ADDENDUM NO.: ONE **DATE OF ADDENDUM: January 11, 2013**

Renovations & Additions to Jenkins-Waggoner Laboratory
CAES, 123 Huntington St, New Haven CT 06511
BI – P – 86

Original Bid Due Date / Time:	**January 16, 2013**	**1:00 PM**
Revised Bid Due Date / Time:	**January 30, 2013**	**1:00 PM**

Previous Addendums: None

TO: Prospective Bid Proposers:
This Addendum forms part of the "Contract Documents" and modifies or clarifies the original "Contract Documents" for this Project dated 09/27/2012. Prospective Bid Proposers shall acknowledge receipt of the total number the Addenda issued for this Project on the space provided on Section 00 41 00 Bid Proposal Form. Failure to do may subject Bid Proposers to disqualification.

The following clarifications are applicable to drawings and specifications for the project referenced above.

Item 1

The bid opening will be changed from (January 16, 2013 at 1:00 PM) to (January 30, 2013 at 1:00 PM).

Item 2

In Section 06 20 23 "Interior Finish Carpentry", Paragraph 1.2.A, add the following:

3. Certificates for Credit MR 7: Chain-of-custody certificates indicating that composite wood products comply with forest certification requirements. Include documentation that manufacturer is certified for chain of custody by an FSC-accredited certification body. Include statement indicating cost for each certified wood product.

In Section 06 20 23 "Interior Finish Carpentry", Paragraph 2.2, add the following:

B. Certified Wood: Lumber trim shall be produced from wood obtained from forests certified by an FSC-accredited certification body to comply with FSC STD-01-001, "FSC Principles and Criteria for Forest Stewardship".

Item 3

In Section 08 71 00

DELETE: Paragraph 2.4

SUBSTITUTE: Revised Paragraph 2.4:

2.4 KEYING

A. Provide a key system to match the Owner's existing Yale mastery key system. conforming to the following requirements:

1. Provide construction cores with construction master keying for use during construction. The Owner or Owner's security agent shall install permanent keyed cores upon completion of the project. The temporary construction cores are to be returned to the hardware supplier or the manufacturer.

2. Provide permanent restricted and patented cores furnished and keyed by the factory to the Owner, per Owner's keying requirements and instructions.

3. The hardware supplier, accompanied by a qualified factory representative for the manufacturer of the cores and cylinders, shall meet with Owner and Architect to review keying requirements and lock functions prior to ordering finish hardware.
4. Provide keys as follows

    a. Three change key per lock and/or cylinder.
    b. Two construction core control keys
    c. Six construction master keys for each type (Contractor is to provide one set of construction keys to Architect)

5. Deliver all key blanks from the factory or authorized distributor directly to the Owner in sealed containers, return receipt requested. Failure to comply with these requirements may be cause to require replacement of all or any part of the keying system that was compromised at no additional cost to the Owner.
6. Approved products: Assa Abloy Yale.

Item 4

In Section 07 42 43 "Aluminum-Faced Composite Wall Panels", Paragraph 2.4.A.1, add the following:

d. Alucoil North America, LLC.

Item 5

In Section 07 72 33 "Roof Hatches"

DELETE: Paragraph 2.3.B.2

SUBSTITUTE: Revised Paragraph 2.3.B.2:

2. Type and Size: Single leaf lid, 30 by 36 inches.

Item 6

In Section 11 53 13 "Laboratory Fume Hoods"

DELETE: Paragraph 2.3.A

SUBSTITUTE: Revised Paragraph 2.3.A:

2.3 FUME HOOD VENILATION

A. Variable-Air-Volume Control: Specified in a Division 23 Section; field installed.

Item 7

In Section 11 53 13 "Laboratory Fume Hoods"

DELETE: Paragraph 2.8

SUBSTITUTE: Revised Paragraph 2.8:

2.8 AIR FLOW INDICATOR AND ALARM

A. Air Flow Indicator and Alarm: Specified in a Division 23 Section; field installed.

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Item 8

In Section 01 23 13 "Supplemental Bids"

DELETE: Paragraph 3.1.D

SUBSTITUTE: Revised Paragraph 3.1.D:

D. Supplemental Bid No. 4: Requires the provision of Entrance Canopy as shown on Sheet A-804 and illuminated glass panel sign as shown on Sheet A-805 and specified in Section 10 14 23 "Panel Signage".

Item 9

NEW SECTION: Add new Section 03 54 19 "Portland Cement-Based Lightweight Fill".

Item 10

NEW SECTION: Add new Section 04 22 00 "Concrete Unit Masonry".

Item 11

NEW SECTION: Add new Section 10 14 23 "Panel Signage".

Item 12

NEW SECTION: Add new Section 11 53 13.29 "Ductless Fume Hoods".

Item 13

Table of Contents: Revised to show new Sections added by Addendum.

Item 14

Bid Phase Meeting Attendance Log: Attached to this Addendum

Item 15

REPLACED SECTION: Replace new section 01 91 00 Commissioning

Item 16

In Section 01 91 00 "Commissioning"

ADD: "Commissioning Construction Checklist"

Item 17

NEW SECTION: Add new section 22 08 00 Commissioning of Plumbing

Item 18

REPLACED SECTION: Replace new section 23 08 00 Commissioning of HVAC

Item 19

NEW SECTION: Add new section 23 90 10 Commissioning of Building Automation System

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Item 20

NEW SECTION: Add new section 26 08 00 Commissioning of Electrical

Item 21

In Section 10 44 00 "Signage and Graphics – Interior Signage Program"

ADD: Sign Type N-16. See sketches AG-001 and AG-002

Item 22

Drawing S-001, Structural General Notes, **REVISE** Design Note 1. Live Loads, Existing Building Floor as follows:

- Labs 60 PSF
- Offices 60 PSF

Item 23

Drawing S-200, Added existing slab openings and section marks. Refer to attached Sketches SKS- 001 and SKS-002

Item 24

Drawing S-200, Added new CMU wall and section mark. Refer to attached Sketch SKS-003

Item 25

Drawing S-200, First Floor Framing Plan Notes, **DELETE** Note 22 and **REPLACE** with:

"22. ALLOWABLE CONSTRUCTION LOADING ON ALL EXISTING SUPPORTED SLABS AND NEW INFILLS WITHIN THE EXISTING BUILDING SHALL BE LIMITED TO 35 PSF AND LIMITED TO 25 PSF ON EXISTING ROOF SLABS. ADDITIONALLY, THE DEFLECTION OF ALL SUPPORTED SLABS IN THE EXISTING STRUCTURE SHALL BE LIMITED TO ½" UNDER CONSTRUCTION LOADING. THE MORE STRINGENT OF THE LOADING OR DEFLECTION CRITERIA SHALL GOVERN. CONTRACTOR TO MONITOR DEFLECTIONS OF SLABS SUBJECTED TO CONSTRUCTION LOADING AND MAINTAIN A DAILY LOG. **CONTRACTOR'S SHALL PROVIDE SHORING OF THE SLABS TO SUPPORT HIGHER CONSTRUCTION LOADS. SHORING SHALL EXTEND TO THE SLAB-ON-GRADE AND BE DESIGNED BY A LICENSED CT PE.** SEE GENERAL NOTES FOR ADDITION INFORMATION AND REQUIREMENTS."

Item 26

Drawing S-201, Added existing slab openings and section marks. Refer to attached Sketches SKS- 004 and SKS-005.

Item 27

Drawing S-201, Added new CMU wall and section mark. Refer to attached SketchSKS-006.

Item 28

Drawing S-202, Added existing slab openings and section marks. Refer to attached Sketches SKS- 007 and SKS-008.

Item 29

Drawing S-401, Added new sections 10/S-401 & 11/S-401. Refer to attached Sketches SKS- 009 and SKS-010.

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Item 30

Drawing S-402, Added new section 4/S-402. Refer to attached Sketch SKS-011.

Item 31

Drawing S-700, Added new section 6/S-700. Refer to attached Sketch SKS-012.

Item 32

Drawing SU-100, **ADD** drawing note #7 as follows: "7. SEE DRAWINGS MEP-100 AND MEP-101 FOR ADDITIONAL INFORMATION".

Item 33

Drawing MEP-301, Air Handling Unit Schedule, **REVISE** Note #4 to: "DUEL FANS CONTROLLED BY SEPARATE VFD, WITH BYPASS".

Item34

Drawings MEPD-100 and MEPD-101, **REVISE** General MEP Demolition Note 1 as follows: "….RECONSTRUCTION SCOPE OF WORK SHALL BE DETERMINED BY THE PROJECT CONTRACT DOCUMENTS AND THE MANDATORY PRE-BID WALKTHROUGH HELD ON 01/03/13. REFER TO THE EXISTING……..".

Item 35

Drawings MEPD-100 and MEPD-101, **DELETE** General MEP Demolition Note 7 and **REPLACE** with:

" 7. SOME OF THE DEMOLITION WORK INSIDE THE BUILDING NOTED ON THIS DRAWING HAS BEEN PERFORMED BY THE OWNER. IT IS THE CONTRACTOR'S RESPONSIBILITY TO DETERMINE THE EXTENT OF THE REMAINING DEMOLITION WORK REQUIRED TO BE COMPLETED PRIOR TO SUBMISSION OF THEIR BID. THIS WORK INCLUDES, BUT NOT LIMITED TO, SANITARY/STORM PIPING, VENT PIPING, ELECTRICAL EQUIPMENT AND FEEDERS, WATER METER AND ASSOCIATED PIPING, AND DEMOLITION WORK ON THE BUILDING EXTERIOR. ACCESS TO THE BUILDING IS AVAILABLE TO ALL CONTRACTORS DURING THE BIDDING PERIOD, COORDINATE WITH DCS.".

Item 36

Drawing P-101, Revised size of cold water piping and Added connection to existing greenhouse boiler feed system. Refer to attached Sketch SKP- 001.

Item 37

Drawing E-801, Revised hood power requirements. Refer to attached Sketch SKE- 001.

Item 38

Drawing E-801, Branch Panel:SL-EM, **REVISE** CKT #3 Load Name to: "FUME HOOD".

Item 39

Not used

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Item 40

Section 236426 Rotary-Screw Water Chillers, **DELETE** Section in its entirety and **REPLACE** with new Section. Refer to attached Section 236426 Rotary-Screw Water Chillers.

Item 41

Section 237313 Modular Indoor Central-Station Air-Handling Units, **DELETE** Section in its entirety and **REPLACE** with new Section. Refer to attached Section 237313 Modular Indoor Central-Station Air-Handling Units.

Item 42

CONTRACTOR QUESTION:
"Are we responsible for insuring the existing building? If yes, what is the value?"

ANSWER:
Yes. See Division 00 PROCUREMENT AND CONTRACTING REQUIREMENTS and Division 01 GENERAL REQUIREMENTS for protection of property requirements.

Item 43

CONTRACTOR QUESTION:
"On A-301/3, Column Line C states to remove all wood windows and replace with aluminum. On A-301/2 states Windows to Remain Scrape and Restore. What is the extent of windows to remain or replace?

ANSWER:
The existing building windows shown on A-201, A-202 and A-302 shall all be replaced with new Aluminum Clad Window except for the existing windows that become part of the interior of the new addition. This includes providing new windows at blocked up existing windows. See ASK-AD100a, ASK-A301a & ASK-A301b.

Item 44

CONTRACTOR QUESTION:
"Please provide updated drawings to the extent of Demolition required. At the Pre-Bid Meeting/Walkthrough a majority of the demolition seems to have taken place."

ANSWER:
The Contractor is responsible for all demolition shown on bid documents and BID should reflect that most of demolition is complete including the existing greenhouse has been removed. The purpose of the walkthrough and the additional day for follow-up site visit, was for the Contractors to observe what has already been removed and prepare a BID based on that.

Item 45

CONTRACTOR QUESTION:
Please advise where the picture referenced on Drawing A-201 Detail 1 Photos B1, DI1, L1 and L2.

ANSWER:
This question appears inaccurate.

Item 46

CONTRACTOR QUESTION:
Reference drawing CD-100. Temporary fence is noted at 8' tall with slats. Specification section 015000 calls for 6' tall with no slats. Which is correct?

ANSWER:
Drawing CD-100 is correct. Provide 8' tall fence with slats.

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Item 47

CONTRACTOR QUESTION:
Will the architect be providing:

- A window schedule with masonry opening sizes?
- Head, jam and sill details showing the profile of the existing exterior trim needed to match and the depth of the extension jambs that need to be provided?
- A clear list of which existing windows are to remain and be refurbished?

ANSWER:
Existing masonry openings will not be provided. The contractor will need to verify masonry openings as part of window demolition. See attached sketches ASK-A521a, ASK-A521b, ASK-A521c, ASK-A521d & ASK-A521e for typical head, jamb and sill details. Contractor will need to verify existing exterior trim conditions and dimensions in order to match. See **Item 43** above for extent of existing windows to remain.

Item 48

Drawing – G003. Refer to attached Sketches ASK-G003a, ASK-G003b, ASK-G003c

Item 49

Drawing AD-100. Refer to attached Sketches ASK-AD100a, ASK-AD100b,

Item 50

Drawing AD-101, Refer to attached Sketch ASK-AD101

Item 51

Drawing AD-102, Refer to attached Sketch ASK-AD102

Item 52

Drawing A-101, Refer to attached Sketch ASK-A101a, ASK-A101b

Item 53

Drawing A-102, Refer to attached Sketch ASK-A102a, ASK-A102b

Item 54

Drawing A-103, Refer to attached Sketch ASK-A103a, ASK-A103b, ASK-A103c, ASK-A103d

Item 55

Drawing A-104, Refer to attached Sketch ASK-A104a, ASK-A104b, ASK-A104c, ASK-A104d, ASK_A104e

Item 56

Drawing A-105, Refer to attached Sketch ASK-A105a, ASK-A105b, ASK-A105c

Item 57

Drawing A-121 and A-122, Refer to attached Sketch ASK-A121

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Item 58

Drawing A-301, Refer to attached Sketch ASK-A301a, ASK-A301b

Item 59

Drawing A-313, Refer to attached Sketch ASK-A313

Item 60

Drawing A-412, Refer to attached Sketch ASK-A412a, ASK-A412b

Item 61

Drawing A-516, Refer to attached Sketch ASK-A516

Item 62

Drawing A-542, Refer to attached Sketch ASK-A542a, ASK-A542b

Item 63

Drawing A-550, Refer to attached Sketch ASK-A550a, ASK-A550b

Item 64

Drawing A-601, Refer to attached Sketch ASK-A601

Item 65

Drawing A-611, Refer to attached Sketch ASK-A611a, ASK-A611b

Item 66

Drawing A-801, Refer to attached Sketch ASK-A801

Item 67

Drawing A-802, Refer to attached Sketch ASK-A802a, ASK-A802b, ASK-A802c, ASK-A802d

Item 68

Drawing A-804, Refer to attached Sketch ASK-A804a, ASK-804b. Associated electrical sketches have not been included however contractor shall provided wire, boxes, conduit and switches as required for complete installation of exterior fixtures.

Item 69

Drawing A-805, Refer to attached Sketch ASK-A805a, ASK-A805b, ASK-A805c, ASK-A805d
Associated electrical sketches have not been included however contractor shall provided wire, boxes, conduit and switches as required for complete installation of exterior illuminated sign.

Item 70

NEW SECTION: Add new Section 00 31 19.26 “Existing Condition Survey”.

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Item 71

In Section 06 45 20, Paragraph 1.3 – References Standards, add the following:

(B. Forest Stewardship Council (FSC): Promotes environmentally sound, socially beneficial and economically prosperous management of the world's forests.)

Item 72

In Section 06 45 20, Paragraph 1.6 – Submittals, add the following:

(D. Submit Chain-of-Custody certification indicating wood products FSC certified.)

Item 73

In Section 06 45 20, Paragraph 1.7 – Quality Assurance, add the following:

B. All wood siding, louvers and trim shall be manufactured using wood products that are certified by the Forest Stewardship Council (FSC).)

Item 74
In Section 08 52 13, Paragraph 1.3 – References, add the following:

(H. Forest Stewardship Council (FSC): Promotes environmentally sound, socially beneficial and economically prosperous management of the world's forests.)

Item 75
In Section 08 52 13, Paragraph 1.5 – Submittals, add the following:

(E. Submit Chain-of-Custody certification indicating wood products used in the manufacturing of window units are FSC certified.)

Item 76
In Section 08 52 13, Paragraph 1.6 – Quality Assurance, add the following:

(G. All window units shall be manufactured using wood products that are certified by the Forest Stewardship Council (FSC).)

Item 77
Drawing A-521, Refer to attached Sketch ASK-A521a, ASK-A521b, ASK-A521c, ASK-A521d & ASK-A521e

Item 78
See attachment to this Addendum ONE for use with above items.

All questions must be in writing (not phone or e-mail) and must be forwarded to the consulting Architect/Engineer (David Halpern, Flad Architects, fax 212-213-8250) with copies sent to the CT DCS Project Manager (Michael Rice, DCS, fax 860-713-7261).

End of Addendum

David Busanet, Bidding & Contracts Supervisor
Department of Administrative Services
On Behalf of the Department of Construction Services

SECTION 03 54 19

PORTLAND CEMENT-BASED LIGHTWEIGHT FILL

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes:

1. Portland-cement-based, lightweight fill.
2. Portland-cement-based, self-leveling underlayment.

B. Lightweight fill and self-leveling underlayment are intended for the following applications:

1. Filling depressed areas in existing concrete slabs.
2. Leveling existing concrete slabs before the installation of finish flooring.

C. Survey of Existing Slab Conditions: Perform survey of condition of existing concrete slabs to identify areas where fill is required and where leveling is necessary before the installation of finish flooring. Indicate surface preparation required for fill and leveling materials. Submit survey as written report including survey drawings of existing conditions.

1.2 SUBMITTALS

A. Product Data: For each type of product indicated.

B. LEED Submittals:

1. Product Data for Credit IEQ 4.2: For priming and sealing coatings, documentation including printed statement of VOC content.

C. Survey Drawings of Existing Slab Conditions: Include plans indicating the following:

1. Areas requiring lightweight fill topped with self-leveling underlayment.
2. Areas requiring only self-leveling underlayment.
3. Include required depths of light-weight fill and self-leveling underlayment.
4. Indicate tolerances of floor slabs after application of self-leveling underlayment using the measure of a 10-ft long straightedge and the gap between high spots.
5. Indicate surface preparation required for the application of lightweight fill and self-leveling underlayment.

D. Qualification Data: For qualified Installer.

E. Product Certificates: Signed by manufacturers of underlayment and floor-covering systems certifying that products are compatible.

1.3 QUALITY ASSURANCE

A. Installer Qualifications: Installer who is approved by manufacturer for application of underlayment products required for this Project.

B. Product Compatibility: Manufacturers of underlayment and floor-covering systems certify in writing that products are compatible.

C. Preinstallation Conference: Conduct conference at Project site.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Store materials to comply with manufacturer's written instructions to prevent deterioration from moisture or other detrimental effects.

1.5 PROJECT CONDITIONS

A. Environmental Limitations: Comply with manufacturer's written instructions for substrate temperature, ventilation, ambient temperature and humidity, and other conditions affecting underlayment performance.

1. Place lightweight fill and self-leveling underlayment only when ambient temperature and temperature of substrates are between 50 and 80 deg F.

1.6 COORDINATION

A. Coordinate application of self-leveling underlayment with requirements of floor-covering products and adhesives, to ensure compatibility of products.

PART 2 - PRODUCTS

2.1 PORTLAND-CEMENT-BASED LIGHTWEIGHT FILL

A. Portland-Cement-Based Lightweight Fill: Portland-cement-based, lightweight fill product that can be applied in minimum uniform thickness of ¾-inch, with no limit on maximum thickness.

1. Basis-of-Design Product: LT-65 Lite-Tech; Ardex. Provide the basis-of-design product or a comparable product of one of the following:

a. CMP Specialty Products, Inc.
b. Hacker Industries, Inc.

2. Cement Binder: Portland cement as defined by ASTM C 150.
3. Compressive Strength: Not less than 4000 psi at 28 days when tested according to ASTM C 109/C 109M.
4. Aggregate: Expanded polystyrene beads.

B. Water: Potable and at a temperature of not more than 70 deg F.

C. Primer: Product of underlayment manufacturer recommended in writing for substrate, conditions, and application indicated.

1. Primer shall have a VOC content of 200 g/L or less when calculated according to 40 CFR 59, Subpart D.

2.2 PORTLAND-CEMENT-BASED SELF-LEVELING UNDERLAYMENTS

A. Application of Self-Leveling Underlayments: Used as smoothing course over lightweight fill and for leveling large expanses of irregular existing concrete substrates prior to installation of finish flooring.

B. Underlayment: Portland-cement-based, self-leveling product that can be applied in minimum uniform thickness of 1/8 inch and that can be feathered at edges to match adjacent floor elevations.

1. Basis-of-Design Product: K-15; Ardex. Provide the basis-of-design product or a comparable product of one of the following:

a. CMP Specialty Products, Inc.
b. Hacker Industries, Inc.

2. Cement Binder: Portland cement as defined by ASTM C 150.
3. Compressive Strength: Not less than 4000 psi at 28 days when tested according to ASTM C 109/C 109M.
4. Underlayment Additive: Resilient-emulsion product of underlayment manufacturer, formulated for use with underlayment when applied to substrate and conditions indicated.

C. Water: Potable and at a temperature of not more than 70 deg F.

D. Primer: Product of underlayment manufacturer recommended in writing for substrate, conditions, and application indicated.

1. Primer shall have a VOC content of 200 g/L or less when calculated according to 40 CFR 59, Subpart D.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, with Installer present, for conditions affecting performance.

1. Proceed with application only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. General: Prepare and clean substrate according to manufacturer's written instructions.

1. Treat nonmoving substrate cracks according to manufacturer's written instructions to prevent cracks from telegraphing (reflecting) through underlayment.

2. Fill substrate voids to prevent underlayment from leaking.

B. Concrete Substrates: Provide sound concrete surfaces free of laitance, glaze, efflorescence, curing compounds, form-release agents, dust, dirt, grease, oil, and other contaminants incompatible with resinous flooring.

1. Roughen concrete substrates by shot-blasting with an apparatus that abrades the concrete surface, contains the dispensed shot within the apparatus, and recirculates the shot by vacuum pickup.

3.3 APPLICATION

A. General: Mix and apply lightweight fill and self-leveling underlayment components according to manufacturer's written instructions.

1. Close areas to traffic during application and for time period after application recommended in writing by manufacturer.
2. Coordinate application of components to provide optimum lightweight fill-to-substrate and intercoat adhesion.
3. At substrate expansion, isolation, and other moving joints, allow joint of same width to continue through underlayment.

B. Apply primer over prepared substrate at manufacturer's recommended spreading rate.

C. Apply self-leveling underlayment to produce uniform, level surface.

1. Feather edges to match adjacent floor elevations.

D. Cure self-leveling underlayment according to manufacturer's written instructions. Prevent contamination during application and curing processes.

E. Do not install floor coverings over self-leveling underlayment until after time period recommended in writing by underlayment manufacturer.

F. Remove and replace lightweight fill and self-leveling underlayment areas that evidence lack of bond with substrate, including areas that emit a "hollow" sound when tapped.

3.4 PROTECTION

A. Protect self-leveling underlayment from concentrated and rolling loads for remainder of construction period.

END OF SECTION

SECTION 04 22 00

CONCRETE UNIT MASONRY

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes unit masonry assemblies consisting of the following:

1. Concrete masonry units (CMUs).
2. Mortar and grout.
3. Masonry joint reinforcement.
4. Miscellaneous masonry accessories.
5. Reinforced unit masonry.

B. Related Sections include the following:

1. Division 07 Section "Joint Sealants" for sealing control joints in concrete unit masonry.

1.2 DEFINITIONS

A. Reinforced Masonry: Masonry containing reinforcing steel in grouted cells.

1.3 PERFORMANCE REQUIREMENTS

A. Provide unit masonry that develops net-area compressive strengths at 28 days.

1. Determine net-area compressive strength of masonry from average net-area compressive strengths of masonry units and mortar types (unit-strength method) according to Tables 1 and 2 in ACI 530.1/ASCE 6/TMS 602.

a. Compressive Strength: Minimum 1900 psi.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: For the following:

1. Reinforcing Steel: Detail bending and placement of unit masonry reinforcing bars. Comply with ACI 315, "Details and Detailing of Concrete Reinforcement." Show elevations of reinforced walls.
2. Control Joints: Detail control joints and show locations on wall elevations.

C. Material Certificates: Include statements of material properties indicating compliance with requirements including compliance with standards and type designations within standards. Provide for each type and size of the following:

1. Masonry units.
2. Cementitious materials. Include brand, type, and name of manufacturer.
3. Preblended, dry mortar mixes. Include description of type and proportions of ingredients.
4. Grout mixes. Include description of type and proportions of ingredients.
5. Reinforcing bars.
6. Joint reinforcement.

D. Mix Designs: For each type of mortar and grout. Include description of type and proportions of ingredients.

1. Include test reports, per ASTM C 780, for mortar mixes required to comply with property specification.
2. Include test reports, per ASTM C 1019, for grout mixes required to comply with compressive strength requirement.

E. LEED Submittals:

1. MR Credit 4: Product Data and certification letter indicating percentages by weight of post-consumer and pre-consumer recycled content for products having recycled content.

   a. Installed Product: CMU; steel reinforcing.
   b. Include statement indicating costs for each product having recycled content.

2. Product Certificates for MR Credit 5: For products and materials required to comply with requirements for regional materials indicating location and distance from Project of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include statement indicating cost for each regional material and the fraction by weight that is considered regional.

1.5 QUALITY ASSURANCE

A. Source Limitations for Masonry Units: Obtain exposed masonry units of a uniform texture and color, or a uniform blend within the ranges accepted for these characteristics, through one source from a single manufacturer for each product required.

B. Source Limitations for Mortar Materials: Obtain mortar ingredients of a uniform quality, including color for exposed masonry, from a single manufacturer for each cementitious component and from one source or producer for each aggregate.

C. Fire-Resistance Ratings: Where indicated, provide materials and construction identical to those of assemblies with fire-resistance ratings determined per ASTM E 119 by a testing and inspecting agency, by equivalent concrete masonry thickness, or by other means, as acceptable to authorities having jurisdiction.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Store masonry units on elevated platforms in a dry location. If units are not stored in an enclosed location, cover tops and sides of stacks with waterproof sheeting, securely tied. If units become wet, do not install until they are dry.

B. Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.

C. Store aggregates where grading and other required characteristics can be maintained and contamination avoided.

D. Deliver preblended, dry mortar mix in moisture-resistant containers designed for lifting and emptying into dispensing silo. Store preblended, dry mortar mix in delivery containers on elevated platforms, under cover, and in a dry location or in a metal dispensing silo with weatherproof cover.

E. Store masonry accessories, including metal items, to prevent corrosion and accumulation of dirt and oil.

1.7 PROJECT CONDITIONS

A. Protection of Masonry: During construction, cover tops of walls, projections, and sills with sheeting at end of each day's work. Cover partially completed masonry when construction is not in progress.

1. Extend cover a minimum of 24 inches down both sides and hold cover securely in place.

B. Do not apply uniform loads for at least 12 hours and concentrated loads for at least 3 days after building masonry walls or columns.

C. Stain Prevention: Prevent grout, mortar, and soil from staining the face of masonry to be left exposed or painted. Immediately remove grout, mortar, and soil that come in contact with such masonry.

1. Protect sills, ledges, and projections from mortar droppings.
2. Protect surfaces of window and door frames, as well as similar products with painted and integral finishes, from mortar droppings.

PART 2 - PRODUCTS

2.1 MASONRY UNITS, GENERAL

A. Defective Units: Referenced masonry unit standards may allow a certain percentage of units to exceed tolerances and to contain chips, cracks, or other defects exceeding limits stated in the standard. Do not uses units where such defects, including dimensions that vary from specified dimensions by more than stated tolerances, will be exposed in the completed Work or will impair the quality of completed masonry.

2.2 CONCRETE MASONRY UNITS (CMUs)

A. Shapes: Provide shapes indicated and as follows:

1. Provide special shapes for lintels, corners, jambs, movement joints, headers, bonding, and other special conditions.
2. Provide square-edged units for outside corners, unless otherwise indicated.

B. Concrete Masonry Units: ASTM C 90.

1. Density Classification: Normal weight.
2. Size (Width): Manufactured to dimensions 3/8 inch less than nominal dimensions.

2.3 MASONRY LINTELS

A. Masonry Lintels: Prefabricated or built-in-place masonry lintels made from bond beam concrete masonry units with reinforcing bars placed as indicated and filled with coarse grout. Cure precast lintels before handling and installing. Temporarily support built-in-place lintels until cured.

2.4 MORTAR AND GROUT MATERIALS

A. Portland Cement: ASTM C 150, Type I or II; natural color.

B. Hydrated Lime: ASTM C 207, Type S.

C. Portland Cement-Lime Mix: Packaged blend of portland cement complying with ASTM C 150, Type I or Type III, and hydrated lime complying with ASTM C 207, Type S.

D. Aggregate for Mortar: ASTM C 144.

1. For mortar that is exposed to view, use washed aggregate consisting of natural sand or crushed stone.

E. Aggregate for Grout: ASTM C 404.

F. Water: Potable.

2.5 REINFORCEMENT

A. Recycled Content of Steel Materials: Provide steel materials manufactured to contain the maximum possible amount of postconsumer and preconsumer recycled steel content.

B. Uncoated Steel Reinforcing Bars: ASTM A 615/A 615M or ASTM A 996/A 996M, Grade 60.

C. Masonry Joint Reinforcement, General: ASTM A 951.

1. Interior Walls: Hot-dip galvanized, carbon steel.
2. Wire Size for Side Rods: W1.7 or 0.148-inch diameter.
3. Wire Size for Cross Rods: W1.7 or 0.148-inch diameter.
4. Spacing of Cross Rods, Tabs, and Cross Ties: Not more than 16 inches o.c.
5. Provide in lengths of not less than 10 feet, with prefabricated corner and tee units.

D. Masonry Joint Reinforcement for Single-Wythe Masonry: Ladder type with single pair of side rods.

2.6 MISCELLANEOUS MASONRY ACCESSORIES

A. Bond-Breaker Strips: Asphalt-saturated, organic roofing felt complying with ASTM D 226, Type I (No. 15 asphalt felt).

B. Preformed Control-Joint Gaskets: Made from styrene-butadiene-rubber compound, complying with ASTM D 2000, Designation M2AA-805 or PVC, complying with ASTM D 2287, Type PVC-65406 and designed to fit standard sash block and to maintain lateral stability in masonry wall; size and configuration as indicated.

C. Reinforcing Bar Positioners: Wire units designed to fit into mortar bed joints spanning masonry unit cells with loops for holding reinforcing bars in center of cells. Units are formed from 0.142-inch steel wire, hot-dip galvanized after fabrication. Provide units with either two loops or four loops as needed for number of bars indicated.

1. Products: Subject to compliance with requirements, provide one of the following products:

a. Dayton Superior Corporation, Dur-O-Wal Division; D/A 810, D/A 812 or D/A 817.
b. Heckmann Building Products Inc.; No. 376 Rebar Positioner.
c. Hohmann & Barnard, Inc.; #RB or #RB-Twin Rebar Positioner.
d. Wire-Bond; O-Ring or Double O-Ring Rebar Positioner.

2.7 MORTAR AND GROUT MIXES

A. General: Do not use admixtures, including pigments, air-entraining agents, accelerators, retarders, water-repellent agents, antifreeze compounds, or other admixtures, unless otherwise indicated.

1. Do not use calcium chloride in mortar or grout.
2. Limit cementitious materials in mortar to portland cement and lime.

B. Preblended, Dry Mortar Mix: Furnish dry mortar ingredients in form of a preblended mix. Measure quantities by weight to ensure accurate proportions, and thoroughly blend ingredients before delivering to Project site.

C. Mortar for Unit Masonry: Comply with ASTM C 270, Proportion Specification. Provide the following types of mortar for applications stated unless another type is indicated or needed to provide required compressive strength of masonry.

1. For reinforced masonry, use Type S.
2. For un-reinforced masonry, use Type N.

D. Grout for Unit Masonry: Comply with ASTM C 476.

1. Use grout of type indicated, of type (fine or coarse) that will comply with Table 1.15.1 in ACI 530.1/ASCE 6/TMS 602 for dimensions of grout spaces and pour height.
2. Proportion grout in accordance with ASTM C 476, paragraph 4.2.2 for specified 28-day compressive strength indicated, but not less than 2000 psi.
3. Provide grout with a slump of 8 to 11 inches as measured according to ASTM C 143/C 143M.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of work.

1. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of work.
2. Verify that foundations are within tolerances specified.
3. Verify that reinforcing steel is properly placed.

B. Before installation, examine rough-in and built-in construction for piping systems to verify actual locations of piping connections.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

A. Thickness: Build single-wythe walls to actual widths of masonry units, using units of widths indicated.

B. Build chases and recesses to accommodate items specified in this and other Sections.

C. Leave openings for equipment to be installed before completing masonry. After installing equipment, complete masonry to match the construction immediately adjacent to opening.

D. Use full-size units without cutting if possible. If cutting is required to provide a continuous pattern or to fit adjoining construction, cut units with motor-driven saws; provide clean, sharp, unchipped edges. Allow units to dry before laying unless wetting of units is specified. Install cut units with cut surfaces and, where possible, cut edges concealed.

E. Comply with construction tolerances in ACI 530.1/ASCE 6/TMS 602 and with the following:

1. For conspicuous vertical lines, such as external corners, door jambs, reveals, and expansion and control joints, do not vary from plumb by more than 1/8 inch in 10 feet, 1/4 inch in 20 feet, or 1/2 inch maximum.
2. For vertical alignment of exposed head joints, do not vary from plumb by more than 1/4 inch in 10 feet, or 1/2 inch maximum.
3. For conspicuous horizontal lines, such as lintels, sills, parapets, and reveals, do not vary from level by more than 1/8 inch in 10 feet, 1/4 inch in 20 feet, or 1/2 inch maximum.
4. For exposed bed joints, do not vary from thickness indicated by more than plus or minus 1/8 inch, with a maximum thickness limited to 1/2 inch. Do not vary from bed-joint thickness of adjacent courses by more than 1/8 inch.
5. For exposed head joints, do not vary from thickness indicated by more than plus or minus 1/8 inch. Do not vary from adjacent bed-joint and head-joint thicknesses by more than 1/8 inch.
6. For faces of adjacent exposed masonry units, do not vary from flush alignment by more than 1/16 inch except due to warpage of masonry units within tolerances specified for warpage of units.
7. For exposed bed joints and head joints of stacked bond, do not vary from a straight line by more than 1/16 inch from one masonry unit to the next.

3.3 LAYING MASONRY WALLS

A. Lay out walls in advance for accurate spacing of surface bond patterns with uniform joint thicknesses and for accurate location of openings, movement-type joints, returns, and offsets. Avoid using less-than-half-size units, particularly at corners, jambs, and, where possible, at other locations.

B. Bond Pattern for Exposed Masonry: Unless otherwise indicated, lay exposed masonry in running bond; do not use units with less than nominal 4-inch horizontal face dimensions at corners or jambs.

C. Stopping and Resuming Work: Stop work by racking back units in each course from those in course below; do not tooth. When resuming work, clean masonry surfaces that are to receive mortar, remove loose masonry units and mortar, if required before laying fresh masonry.

D. Built-in Work: As construction progresses, build in items specified in this and other Sections. Fill in solidly with masonry around built-in items.

3.4 MORTAR BEDDING AND JOINTING

A. Lay hollow concrete masonry units as follows:

1. With face shells fully bedded in mortar and with head joints of depth equal to bed joints.
2. With webs fully bedded in mortar in grouted masonry, including starting course on footings.

B. Lay solid masonry units with completely filled bed and head joints; butter ends with sufficient mortar to fill head joints and shove into place. Do not deeply furrow bed joints or slush head joints.

C. Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than joint thickness, unless otherwise indicated.

3.5 MASONRY JOINT REINFORCEMENT

A. General: Install entire length of longitudinal side rods in mortar with a minimum cover of 1/2 inch. Lap reinforcement a minimum of 6 inches.

1. Space reinforcement not more than 16 inches o.c.
2. Provide reinforcement not more than 8 inches above and below wall openings and extending 12 inches beyond openings.

    a. Reinforcement above is in addition to continuous reinforcement.

B. Interrupt joint reinforcement at control joints, unless otherwise indicated.

C. Provide continuity at wall intersections by using prefabricated T-shaped units.

D. Provide continuity at corners by using prefabricated L-shaped units.

3.6 CONTROL JOINTS

A. General: Install control joint materials in unit masonry as masonry progresses. Do not allow materials to span control joints without provision to allow for in-plane wall or partition movement.

B. Spacing of Control Joints: Not to exceed 25 ft., unless indicated otherwise on Drawings.

C. Form control joints in concrete masonry by installing temporary foam-plastic filler in head joints and removing filler when unit masonry is complete for application of sealant.

3.7 LINTELS

A. Provide masonry lintels where shown and where openings of more than 24 inches for block-size units are shown without structural steel or other supporting lintels.

B. Provide minimum bearing of 8 inches at each jamb, unless otherwise indicated.

3.8 REINFORCED UNIT MASONRY INSTALLATION

A. Temporary Formwork and Shores: Construct formwork and shores as needed to support reinforced masonry elements during construction.

1. Construct formwork to provide shape, line, and dimensions of completed masonry as indicated. Make forms sufficiently tight to prevent leakage of mortar and grout. Brace, tie, and support forms to maintain position and shape during construction and curing of reinforced masonry.
2. Do not remove forms and shores until reinforced masonry members have hardened sufficiently to carry their own weight and other temporary loads that may be placed on them during construction.

B. Placing Reinforcement: Comply with requirements in ACI 530.1/ASCE 6/TMS 602.

C. Grouting: Do not place grout until entire height of masonry to be grouted has attained enough strength to resist grout pressure.

1. Comply with requirements in ACI 530.1/ASCE 6/TMS 602 for cleanouts and for grout placement, including minimum grout space and maximum pour height.
2. Limit height of vertical grout pours to not more than 60 inches.

3.9 REPAIRING, POINTING, AND CLEANING

A. Remove and replace masonry units that are loose, chipped, broken, stained, or otherwise damaged or that do not match adjoining units. Install new units to match adjoining units; install in fresh mortar, pointed to eliminate evidence of replacement.

B. Pointing: During the tooling of joints, enlarge voids and holes, except weep holes, and completely fill with mortar. Point up joints, including corners, openings, and adjacent construction, to provide a neat, uniform appearance. Prepare joints for sealant application, where indicated.

C. In-Progress Cleaning: Clean unit masonry as work progresses by dry brushing to remove mortar fins and smears before tooling joints.

D. Final Cleaning: After mortar is thoroughly set and cured, clean exposed masonry as follows:

1. Remove large mortar particles by hand with wooden paddles and nonmetallic scrape hoes or chisels.
2. Protect adjacent nonmasonry surfaces from contact with cleaner by covering them with liquid strippable masking agent or polyethylene film and waterproof masking tape.
3. Wet wall surfaces with water before applying cleaners; remove cleaners promptly by rinsing surfaces thoroughly with clear water.
4. Clean concrete masonry by cleaning method indicated in NCMA TEK 8-2A applicable to type of stain on exposed surfaces.

3.10 MASONRY WASTE DISPOSAL

A. Salvageable Materials: Unless otherwise indicated, excess masonry materials are Contractor's property. At completion of unit masonry work, remove from Project site.

B. Excess Masonry Waste: Remove excess clean masonry waste and legally dispose of off Owner's property.

END OF SECTION

SECTION 10 14 23

PANEL SIGNAGE

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Illuminated glass panel sign.

B. Related Requirements:

1. Division 03 Section “Cast-In-Place Concrete” for sign foundation installed by others.
2. Division 26 Electrical Section for wiring and transformers for lighting.

1.2 COORDINATION

A. Furnish templates for placement of sign-anchorage devices embedded in concrete construction by other installers.

B. Furnish templates for placement of electrical service embedded in permanent construction by other installers.

1.3 SUBMITTALS

A. Product Data: For each type of product.

B. LEED Submittals:

1. Product Certificates for Credit MR 5: For products and materials required to comply with requirements for regionally manufactured materials. Include statement indicating cost for each regionally manufactured material.

a. Include statement indicating location of manufacturer and distance to Project for each regionally manufactured material.

C. Shop Drawings: For panel signs.

1. Include fabrication and installation details and attachments to other work.
2. Show sign dimensions and mounting height
3. Show etched lettering.
4. Show locations of electrical service connections.
5. Include diagrams for power, signal, and control wiring.

D. Samples for Verification: For each type of sign assembly showing all components and with the required finish(es), in manufacturer's standard size unless otherwise indicated and as follows:

1. Glass Panel: Not less than 16 inches square, with indicated finish and including one letter of the indicated text.
2. Mounting Post and Base Plate: 12-inch high post welded to base plate, in indicated finish. Use full-sized sections.
3. Glass Fasteners: Full-size Sample of fastener used to mount glass on aluminum posts. Include gaskets.
4. LED Strip Lighting: 24-inch length of lighting and aluminum housing.

E. Delegated-Design Submittal: For signs indicated in "Performance Requirements" Article.

1. Include structural analysis calculations for signs indicated to comply with design loads; signed and sealed by the qualified professional engineer responsible for their preparation.

F. Qualification Data: For Installer and fabricator.

G. Sample Warranty: For special warranty.

H. Maintenance Data: For signs to include in maintenance manuals.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: Fabricator of sign.

1.5 FIELD CONDITIONS

A. Field Measurements: Verify locations of anchorage devices and electrical service embedded in permanent construction by other installers by field measurements before fabrication, and indicate measurements on Shop Drawings.

1.6 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of signs that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Deterioration of finishes beyond normal weathering.

2. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PANEL SIGNS, GENERAL

A. Regional Materials: Panel signs shall be manufactured within 500 miles of Project site.

2.2 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer to design sign structure and anchorage of illuminated glass panel sign to withstand design loads as indicated on Drawings.

B. Thermal Movements: For exterior signs, allow for thermal movements from ambient and surface temperature changes.

1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.3 ILLUMNATED GLASS PANEL SIGNS

A. Illuminated Glass Panel Sign: Edge-lit glass panel sign is supported by aluminum post- and base plate- assembly and mounted on concrete foundation.

1. Lighting: LED strip lighting mounted in aluminum housing, including transformers, insulators and other accessories for operability with provision for servicing and concealing connections to building electrical system. Use tight or sealed joint construction to prevent unintentional light leakage. Space lamps apart from each other and away from sign surfaces as needed to illuminate evenly.

a. Power: 120 V, 60 Hz, 1 phase, 15 A.
b. Weeps: Provide weep holes in aluminum housing to drain water at lowest part of exterior signs. Equip weeps with permanent baffles to block light leakage without inhibiting drainage.

2. Glass Panel: Clear glass; fully tempered.

a. Thickness: 1 inch.
b. Edges: Square edges, polished.
c. Text: Acid-etched in sign face.

3. Mounting Assembly: Mounted to concrete foundation with aluminum post- and base-plate welded assembly; with stainless steel anchor rods cast into concrete.

a. Aluminum Finish: 2-coat fluoropolymer.

4. Text and Typeface: Text and typeface as shown on Drawing. Acid-etch characters to contrast with background.

2.4 ACCESSORIES

A. Fasteners and Anchors: As required for secure anchorage of signage, noncorrosive and compatible with each material joined, and complying with the following:

1. Anchors For Mounting Post-and-Base-Plate Assembly: Threaded stainless steel anchor rods cast into concrete foundation; with stainless steel acorn nuts; rods set by other trades.
2. Glass Mounting Fasteners: Stainless steel through fasteners; with type of head indicated, installed in predrilled holes.

B. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.

C. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107/C 1107M. Provide grout specifically recommended by manufacturer for exterior applications.

2.5 FABRICATION

A. General: Provide sign assemblies according to requirements indicated.

1. Preassemble signs and assemblies in the shop to greatest extent possible. Disassemble signs and assemblies only as necessary for shipping and handling limitations. Clearly mark units for reassembly and installation; apply markings in locations concealed from view after final assembly.
2. Mill joints to a tight, hairline fit. Form assemblies and joints exposed to weather to resist water penetration and retention.
3. Comply with AWS for recommended practices in welding and brazing.
4. Clean exposed welded and brazed connections of flux, and dress exposed and contact surfaces.

B. Post-and-Base-Plate Assembly: Finish exposed welds to comply with NOMMA's "Voluntary Joint Finish Standards" for Type 1 welds: no evidence of a welded joint. Refer to image attached to end of this Section.

2.6 ALUMINUM FINISHES

A. General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. High-Performance Organic Finish: Two-coat fluoropolymer finish complying with AAMA 2605 and containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

1. Color and Gloss: Match Centria #9917 Light Gray.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of signage work.

B. Verify that sign-support surfaces are within tolerances to accommodate signs without gaps or irregularities between support surfaces.

C. Verify that anchor inserts are correctly sized and located to accommodate signs.

D. Verify that electrical service is correctly sized and located to accommodate signs.

E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. General: Install signs using mounting methods indicated.

1. Install signs level, plumb, true to line, and at locations and heights indicated, with sign surfaces free of distortion and other defects in appearance.
2. Before installation, verify that sign surfaces are clean and free of materials or debris that would impair installation.
3. Corrosion Protection: Coat concealed surfaces of aluminum in contact with concrete with a heavy coat of bituminous paint.

B. Mounting with Preset Anchor Bolts: Set post-and-base-plate assembly in position over anchor bolts projecting from concrete foundation, shim and support assembly to prevent movement, place washers and nuts, and tighten. Fill shim space with nonshrink, nonmetallic grout, mixed and placed to comply with manufacturer's written instructions.

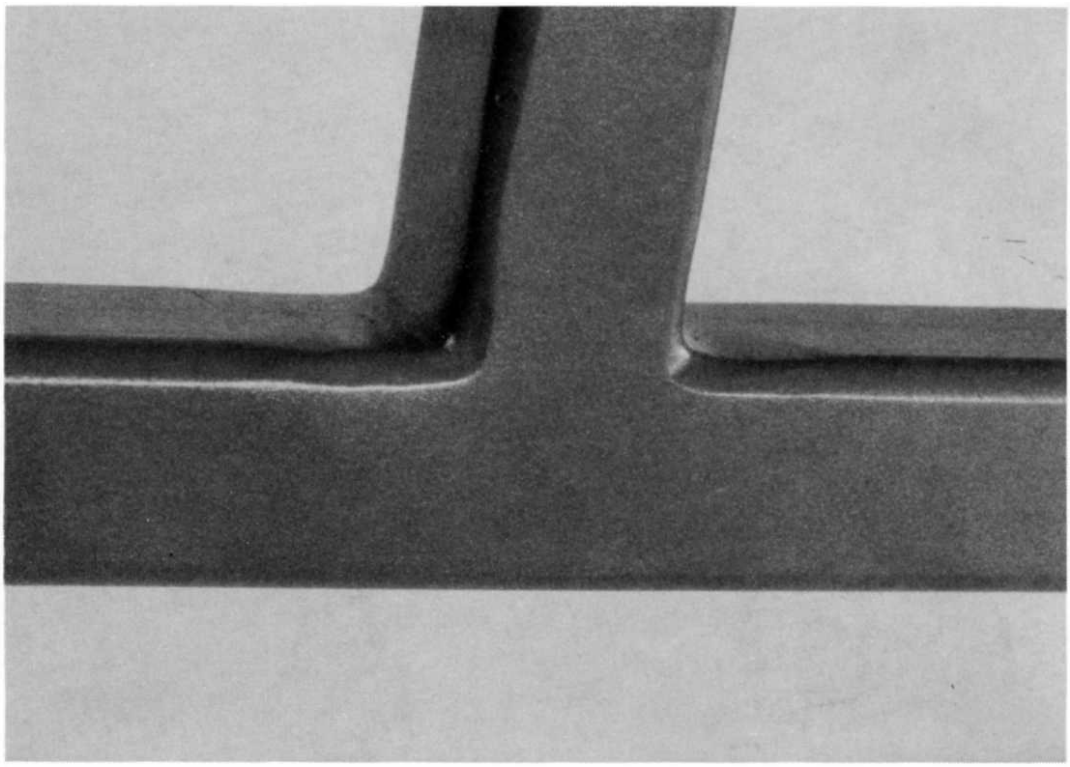
3.3 ADJUSTING AND CLEANING

A. Remove and replace damaged or deformed signs and signs that do not comply with specified requirements. Replace signs with damaged or deteriorated finishes or components that cannot be successfully repaired by finish touchup or similar minor repair procedures.

B. Remove temporary protective coverings and strippable films as signs are installed.

C. On completion of installation, clean exposed surfaces of signs according to manufacturer's written instructions, and touch up minor nicks and abrasions in finish. Maintain signs in a clean condition during construction and protect from damage until acceptance by Architect.

END OF SECTION



Finish #1 - No evidence of a welded joint.

SECTION 11 53 13.29

DUCTLESS FUME HOODS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Bench-mounted self-contained, carbon-filtered and carbon/ HEPA-filtered ductless fume hoods.

B. Related Requirements:

1. Division 12 Section “Metal Laboratory Casework” for work surface and base cabinet for ductless fume hoods.

1.2 SUBMITTALS

A. Product Data: Submit product data for ductless fume hoods, including specifications, dimensions, engineering data, standard details, wiring diagrams, and material thicknesses and finishes.

B. Operation and Maintenance Manual: Bound manual of the type used by service technicians for servicing and repairing ductless fume hoods. Manual shall include the following:

1. Product specifications.
2. Engineering data.
3. Operating instructions.
4. Standard details.
5. Wiring diagrams.
6. Control panel drawings.
7. Fan curves, test designs, performance charts.
8. Parts list for special components.
9. Process descriptions.
10. Recommended spare parts inventory.
11. Print-out of application program and interface graphics screens.

C. Service Technician: Include name, address, and telephone number of the manufacturer's nearest service technician.

D. Certifications: Submit forms indicating compliance with regulatory agencies. Attach certification plates to the equipment.

E. Sample Warranties: Submit sample of special warranty incorporating indicated requirements.

F. Field Certification Report: Submit field certification report for ductless fume hoods.

1.3 QUALITY ASSURANCE

A. Comply with requirements of the following codes and standards except as shown or specified otherwise:

1. ANSI/NFPA 70 - National Electric Code (NEC).
2. IEST-RP-CC-001, Recommended Practice for HEPA Filters.
3. IEST-RP-CC021,Testing HEPA and ULPA Filter Media.
4. Underwriters Laboratories; UL Standard UL 3101-1 (115 volts, 60 Hz models).
5. SEFA 1-2006, Recommended Practices for Laboratory Fume Hoods.
6. ASHRAE 110-95 (Method of Testing Performance of Laboratory Fume Hoods).
7. ANSI/AIHA Z9.5 2012 (Laboratory Ventilation).

B. Manufacturers' Qualifications: Provide equipment produced by manufacturer with not less than 10 years' successful experience in the fabrication of ductless fume hoods of the type and quality indicated.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Deliver units in manufacturer's unopened containers. Comply with manufacturer's instructions for storage and handling. Protect from moisture and damage.

1.5 PROJECT CONDITIONS

A. Do not begin installation of units until the following conditions have been met:

1. Building is enclosed and weathertight.
2. Utilities are installed.
3. Partitions are installed and painted.
4. Finish flooring is installed.
5. HVAC system is operating and maintaining relative humidity and ambient temperature planned for building occupants.

1.6 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of ductless fume hoods that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Three years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 DUCTLESS FUME HOODS

A. Basis of Design Product: Paramount Ductless Enclosure, Labconco. Provide the basis-of-design product or an equivalent product of one of the following:

1. AirClean Systems, Inc.

2. Erlab, Inc.

B. Ductless Fume Hoods: Bench-mounted, self-contained work stations that protect operators from organic solvents, formaldehyde, acid gases, ammonia, radioisotopes, particulates, and powders released in the work area through the use of carbon filters and/ or HEPA filters. Vapors and particulates are contained inside enclosure and then filtered. Purified air is drawn from the filters and returned to room. Vapors are adsorbed on activated carbon filters or impregnated carbon filters and particulates/powders are filtered by the HEPA filter.

C. Air Flow:

1. Air foil allows air to sweep work surface for maximum containment. Side-entry air foils are located on both sides of sash opening to direct room air along sides of the ductless enclosure.
2. Upper dilution air supply allows air into ductless enclosure from above work area which bathes back of sash with room air and directs concentrations away from sash opening.
3. Upper containment sash foil allows room air to bleed in between sash and handle to reduce turbulence and direct concentrations away from operating breathing zone.
4. Zone-perforated rear baffle contains three zoned sections of perforations to direct air in a non-turbulent laminar air stream across interior of the enclosure.
5. Ductless enclosure control has air monitor to maintain constant face velocity.

D. Air Flow Velocity: Standard operating velocity is 75-80 fpm.

1. Velocity can be reset by Owner's safety officer or certification technician through password protected menu.

E. Dimensions:

1. Height: 53 inches.
2. Width: 48 inches.
3. Depth: 29 inches.

F. Cabinet Construction: Factory-assembled and pre-wired.

1. Frame: Aluminum with powder-coated epoxy finish.
2. Side Walls: ¼-inch thick clear tempered glass.
3. Plenums and Baffle: Steel with powder-coated epoxy finish.
4. Work Surface: Specified in Division 12 Section "Metal Laboratory Casework".
5. Sash: Hinged to pivot upward, locks to loading height of 19 inches.

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a. Working Opening Height: 12 inches.
b. Angle of Window: Slanted 10 deg.

G. Base Cabinet: Specified in Division 12 Section "Metal Laboratory Casework".

H. Lighting: Fluorescent lighting provides 45 to 60 foot-candles on work surface; replaceable from front of enclosure.

I. Electrical: 115 VAC, 50 - 60 Hz; nominal 8-foot, 3-wire power cord and plug.

J. Electrical Ports: Located in each bottom corner of rear wall to allow pass-through of electrical cords.

K. Motor: Non-sparking, ECM type, delivers air volume for programmed face velocity; automatically adjusts as filters load. Sparkless motorized impellers are constructed of backward curved centrifugal fans highly resistant to particles; with maintenance-free ball bearings and runs over 50,000 hours.

L. Blower: Located behind front panel, serviceable from outside the enclosure.

M. Vapor Sensor: Provides for detection of filter saturation for organic solvent, ammonia, or formaldehyde concentrations in exhaust stream, with optimum detection at 1-10 parts per million, and upon detection, to activate audible/visual alarm:

1. Redundant sensor provides secondary monitoring.

N. Control Panel: LCD display with touch-pad controls. For alternate display of filter types and filter time elapsed. Two timers are user programmable: to alarm at user-determined intervals to check filter; and to alarm at user-determined time so filter is changed. Menu, Filter, Up/Down, and Enter programming buttons allow operator to reset elapsed time display and alarm time when new filter is installed. Security password code is required to change filter alarm time. Control panel displays following:

1. Filter types installed.
2. Filter status.
3. Face velocity.
4. Alarm conditions for filter and airflow.
5. Filter life remaining bar graph.
6. Timer.

O. Audible/ Visual Alarms: Audible/visual alarms remind operator to check filters with sampling tubes or replace the filter. Filter replacement alarms occur in audible/visual modes for both filter saturation activated by the vapor sensor or final filter elapsed time. Low airflow alarm occurs when face velocity drops below programmed levels.

P. Filters:

1. Carbon-based filters provide minimum of 7.5 lbs. of activated or 10.0 lbs. of treated carbon per filter. Clamping mechanism is gas-assist type.
2. Optional HEPA filters are 99.99% efficient for removing 0.3 micron particulates or larger.

PART 3 - EXECUTION

3.1 PREPARATION

A. Rough-In Work: Examine roughed-in electrical services and other conditions affecting installation of ductless fume hoods.

B. Verify dimensions and locations of services and substrates before fabricating work. Notify Contractor of unsatisfactory conditions preventing proper installation of cabinets.

C. Do not proceed with installation until unsatisfactory conditions have been corrected in manner satisfactory to Architect.

3.2 INSTALLATION

A. General: Set each unit securely in place; level, and adjust to correct height. Anchor to supporting substrate where indicated and where required for proper operation. Conceal anchorages where possible.

B. Accessory Installation: Install accessories and fittings in accordance with manufacturer's recommendations.

C. Adjusting: Adjust sash, fixtures, accessories and other moving or operating parts to function smoothly.

3.3 FIELD CERTIFICATION

A. Ductless fume hood manufacturer’s technical representative shall test ductless fume hood after building HVAC system has been commissioned and required exhaust and room supply air is available.

B. Testing: Perform the following tests to demonstrate ductless fume hood can provide protection for personnel and products

1. Inflow velocity test.
2. Airflow smoke pattern tests.
3. Alarm function verification.

C. Adjust ductless fume hood and make other corrections until tested ductless fume hood performs as specified. After making corrections, retest unit. Replace unit if after adjustments and corrections unit fails to achieve safe operating status.

D. Provide written report on testing.

3.4 CLEANING

A. Remove protective coverings and clean and sanitize equipment, internally and externally. Restore exposed and semi-exposed finishes; remove abrasions and other damage, polish bare metal surfaces and touch-up painted surfaces.

B. Touch-up minor abrasions and imperfections in painted finishes with coating which matches factory-applied finish.

C. Cover equipment for protection against soiling and deterioration during remainder of construction period.

D. Repair or replace deteriorated or defective equipment to a condition free of damage and deterioration at time of Substantial Completion.

3.5 DEMONSTRATION AND TRAINING

A. Provide services of manufacturer's technical representative to instruct Owner's personnel in operation and maintenance of ductless fume hoods.

B. Schedule training with Owner and provide at least 7-day notice to Contractor and Architect of training date.

1. Provide not less than 4 hours of training.

END OF SECTION

VOLUME 1 of 2

DIVISION 00 PROCUREMENT AND CONTRACTING REQUIREMENTS

TECHNICAL SPECIFICATIONS

VOLUME 2 of 2

END OF TABLE OF CONTENTS

Connecticut

Department of Construction Services

6020
Bid Phase Meeting Attendance Log

CTDCS Project No.: BI-P-86
Date: January 3, 2013
Meeting Start Time: 10:00 AM
Meeting Location: 123 Huntington St New Haven CT

Meeting Purpose:
- ☒ Pre-Bid Meeting
- ☐ Post Bid Review Meeting
- ☐ Other:

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Name: Scott Tracey	Title: Estimator
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Company/Department:	E-mail:
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City/State/Zip	FAX:

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Name: Heinz P. Stock	Title: V.P. Engineering
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Company/Department:	E-mail:
Street:	Phone:
City/State/Zip	FAX:

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Street:	Phone:
City/State/Zip	FAX:

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Company/Department:	E-mail:
Street:	Phone:
City/State/Zip	FAX:

Name:	Title:
Company/Department:	E-mail:
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Name: Carlo Salvator	Title:
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PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 specification sections, apply to this section.

1.2 SUMMARY

A. This Section includes equipment and system commissioning, including the following:

1. Completion of commissioning procedures on specific equipment and systems as indicated under "Related Sections" below.

2. Verification of operational and functional performance of specific equipment and systems for compliance with the “Design Intent” as described in the "Related Sections" indicated below.

B. **Related Sections**: The following Sections contain requirements that relate to this Section:

1. Section 01 31 00 “Project Management and Coordination” specifies procedures for coordinating the Commissioning Process.

2. Division 01 Section 01 33 00 "Submittal Procedures" specifies procedures for submittal of Product Data and Quality Assurance Submittals.

3. Division 01 Section 01 77 00 "Closeout Procedures" specifies general closeout requirements.

4. Division 22 Section 22 08 00 "Commissioning of Plumbing" specifies closeout and/or commissioning related requirements for specific pieces of equipment or building operating systems.

7. Division 23 Section 23 08 00 "Commissioning of HVAC" specifies closeout and/or commissioning related requirements for specific pieces of HVAC equipment and systems.

8. Division 23 Section 23 90 10 "Commissioning of Building Automation System" specifies closeout and/or commissioning related requirements for the building automation system.

9. Division 26 Section 26 08 00 "Commissioning of Electrical Systems" specifies closeout and/or commissioning related requirements for specific pieces of equipment or building operating systems.

1.3 DEFINITIONS

A. **Basis of Design (BOD):** A document that records the concepts, calculations, decisions, and product selections used to meet the Owner’s Project Requirements and to satisfy applicable regulatory requirements, standards, and guidelines. The document includes both narrative descriptions and lists of individual items that support the design process.

B. **Commissioning Agent (CxA):** An entity identified by the Owner who leads, plans, schedules, and coordinates the commissioning team to implement the Commissioning Process.

C. **Commissioning (Cx) Plan:** A plan that includes a list of all equipment to be commissioned, delineation of roles for each of the primary commissioning participants, and details on the scope, timeline, and deliverables throughout the commissioning process.”

C. **Deficiencies and Resolutions List:** List of noted deficiencies discovered as result of commissioning process.

E. **Final Commissioning Report:** Overall final commissioning document (see 1.6, I(2) below), prepared by the Commissioning Agent, which details the actual commissioning procedures performed, inspection and testing results, and the final version of the deficiencies and resolutions list indicating that all issues discovered through the commissioning process have been verified as resolved.

F. **Functional Completion:** Functional Completion is when all remaining TAB (Testing, Adjusting, Balancing) and commissioning responsibilities of the Contractor and their subcontractor’s (except for seasonal or approved deferred testing and controls training), have been functionally certified as complete by the Owner’s Commissioning Agent (CxA) and the Certificate of Functional Completion has been issued.

G. **Functional Performance Testing Process:** Documented testing of system parameters, under actual or simulated operating conditions. Functional testing is the dynamic testing of systems (rather than just components).

H. **Pre-Commissioning Checklists:** Installation and start-up items to be completed by the appropriate party prior to operational verification through Functional Testing.

I. **Physical Inspection Process:** On-site inspection and review of related system components for conformance to the specifications.

J. **Seasonal Commissioning Tests:** Functional Tests that are deferred until the system(s) will experience conditions closer to their intended design conditions.

K. **Trending:** Monitoring using the building control system.

1.4 COORDINATION

A. **Commissioning Team:** The members of the commissioning team consist of the Commissioning Agent (CxA), the CT DCS Project Manager (PM), the Construction Administrator (CA), the Contractor, the Architect and Design engineers (particularly the mechanical engineer), the mechanical subcontractor, the electrical subcontractor, the TAB representative, the controls subcontractor, any other installing subcontractors or suppliers of equipment. If known, the Agency's building or plant operator/engineer is also a member of the Commissioning team.

B. **Management:** The CxA is hired by the Owner. The CxA directs and coordinates the commissioning activities and the reports to the CA. All members of the Commissioning Team work together to fulfill their contracted responsibilities and meet the objectives of the Contract Documents. Refer to Section 01 91 00 Part 1.6 and 1.7 for additional management details.

C. **Scheduling.** The CxA will work with the CA and Contractor according to established protocols to schedule the commissioning activities. The CxA will provide sufficient notice to the CA and Contractor for scheduling commissioning activities. The Contractor will integrate all commissioning activities into their master CPM schedule. All parties will address scheduling problems and make necessary notifications in a timely manner in order to expedite the commissioning process.

1. The CxA will provide the initial schedule of primary commissioning events at the commissioning scoping meeting. The Commissioning Plan—Construction Phase provides a format for this schedule. As construction progresses more detailed schedules are developed by the CxA. The Commissioning Plan also provides a format for detailed schedules.

1.5 DESCRIPTION OF CONSTRUCTION PHASE COMMISSIONING PROCESS

A. As soon as practicable after the "Contract Start Date" the Commissioning Agent (CxA) will conduct a pre-installation commissioning "kick-off" meeting with the subcontractors. Parties directly affected by the commissioning work will be required to attend. The CxA will explain the commissioning process in detail, and identify specific commissioning related responsibilities of the various parties.

B. Commissioning status meetings will be scheduled to occur during construction to monitor progress and to help facilitate the commissioning process. Contractor representatives will be required to attend these meetings.

C. Once subcontractors have provided the CxA with written verification indicating completion of installation and startup procedures, the CxA will conduct an on-site physical inspection of the specific systems and equipment.

D. Upon confirmation of system readiness, the CxA will schedule with the subcontractors to perform functional compliance with the project specifications and drawings. The CxA will oversee the process and will provide the format and documentation for these tests.

E. Deficiencies noted during these tests will be documented on the Deficiencies and Resolutions list. When corrected, issues will be resolved at the time of discovery. The responsible Contractor will resolve all other issues at a later date. All deficiencies will be noted by the CxA as either resolved or pending resolution.

F. The construction commissioning process will be complete when all noted deficiencies have been corrected, proved to be compliance with the project specifications or otherwise resolved to the satisfaction of the Owner and when the CxA has issued the Certificate of Functional Completion

1.6 COMMISSIONING AGENT'S (CxA's) DUTIES AND RESPONSIBILITIES

A. Meet and communicate with the Owner's representatives, Contractor, Construction Administrator, subcontractors, equipment manufacturers' representatives, Architect, and others as needed, to facilitate the commissioning process.

B. Review commissioning related specifications, submittals and construction documents. Communicate noted deficiencies and concerns to the Owner, and Architect.

C. Develop detailed and specific Functional Testing procedures for equipment and systems to be commissioned.

D. Develop testing, adjusting and balancing (TAB) specifications. Oversee the TAB process.

E. Perform site inspections and verify Contractor's subcontractor readiness for the Functional Testing process. Document deficiencies for future resolution.

F. Witness Contractor performed Functional Testing process as appropriate to verify contractor compliance with the functional testing procedures. Document deficiencies for future resolution.

G. Provide the Owner, Contractor Construction Administrator, and Architect with a Final Commissioning Report to document the commissioning process and to verify that the commissioning process is complete.

H. Verify that the Contractor O&M documentation is complete.

I. Commissioning Record in O&M Manuals.

1. The CxA is responsible to compile, organize and index the following commissioning data by equipment into labeled, indexed and tabbed, three-ring binders and deliver it to the Contractor, to be included with the O&M manuals. Three copies of the manuals will be provided. The format of the manuals shall be:

1.1 **Tab I-1:** Commissioning Plan;
1.2 **Tab I-2:** Final Commissioning Report (see (2) below)
1.3 **Tab 01***:* System Type 1 (chiller system, packaged unit, boiler system, etc.);
1.3.1 **Sub-Tab A:** Design narrative and criteria, sequences, approvals for equipment in System Type 1;
1.3.2 **Sub-Tab B:** Startup plan and report, approvals, corrections, blank Precommissioning Checklists;

.1 **Colored Separator Sheets**—for each equipment type (fans, pumps, chiller, etc.);

1.3.3 **Sub-Tab C:** Functional tests (completed), trending and analysis, approvals and corrections, training plan, record and approvals, blank functional test forms and a recommended recommissioning schedule.

1.4 **Tab 02:** System Type 2.....repeat as per above requirements for System 1.

2. **Final Report Commissioning Report Details.** The final commissioning report shall include an executive summary, list of participants and roles, brief building description, overview of commissioning and testing scope and a general description of testing and verification methods. For each piece of commissioned equipment, the report should contain the disposition of the commissioning authority regarding the adequacy of the equipment, documentation and training meeting the contract documents in the following areas:
2.1 Equipment meeting the equipment specifications;
2.2 Equipment installation,
2.3 Functional performance and efficiency;
2.4 Equipment documentation and design intent; and
2.5 Operator training. All outstanding non-compliance items shall be specifically listed. Recommendations for improvement to equipment or operations, future actions, commissioning process changes, etc. shall also be listed. Each non-compliance issue shall be referenced to the specific functional test, inspection, trend log, etc. where the deficiency is documented. The functional performance and efficiency section for each piece of equipment shall include a brief description of the verification method used (manual testing, BAS trend logs, data loggers, etc.) and include observations and conclusions from the testing.

2.6 **Pre-Occupancy Commissioning (Cx) Report:**
A Pre-occupancy Commissioning (Cx) Report shall be prepared by the Commissioning Agent (CxA**)** that demonstrates that the project has met all of the requirements spelled out in the following Table:

Twelve (12) Mandatory Requirements [16a-38k-3] Summary Table:		
	Regulation	**Summary Description**
1.	16a-38k-3(a)	Building Commissioning:
2.	16a-38 -3(b)	Integrated Design Process:

3.	16a-38k-3(d)	ENERGY STAR Products:
4.	16a-38k-3(c)	Energy Performance:
5.	16a-38k-3(e)	Indoor Air Quality Management Plan:
6.	16a-38k-3(f)	Water Usage:
7.	16a-38k-3(g)	Recycling of Materials:
8.	16a-38k-3(h)	Erosion and Sedimentation Control:
9.	16a-38k-3(i)	No Smoking Policy:
10.	16a-38k-3(j)	Integrated Pest Management Plan:
11.	16a-38k-3(k)	Chlorofluorocarbon (CFC)-Based Refrigerants:
12.	16a-38k-3(l)	Minimum Ventilation Requirement:

2.7 Post-Occupancy Commissioning (Cx) Report:
A Post-Occupancy Commissioning (Cx) Report shall be prepared by the Commissioning Agent (CxA) and submitted to the CT DCS PM for review and approval. The approved Report shall be submitted by the State Agency that is responsible for the ongoing care, operation, and maintenance of the building to the CT OPM Secretary and the CT DCS Commissioner within one hundred eighty (180) days after one year of occupancy Date of CT DCS Acceptance of the Work. The Report shall include results of any post-occupancy survey of building occupants, a description of any adjustments made to equipment or building operation and the reasons for which the changes were made, and one year of all energy usage by source and water usage.

3. Other documentation will be retained by the CxA.

1.7 DUTIES AND RESPONSIBILITIES OF OTHERS FOR COMMISSIONING

A. The commissioning process will require the active participation of persons qualified to represent the Owner, mechanical engineer, electrical engineer, Contractor, equipment manufacturers' representatives, mechanical subcontractor, HVAC subcontractor, controls subcontractor, TAB subcontractor, electrical subcontractor, and other specific subcontractors, as deemed appropriate. The CxA will witness the final functional performance commissioning process. Participants shall include in their contracts all costs necessary to participate in and complete the commissioning process.

B. The Contractor will assure the participation and co-operation of the subcontractors, as required to complete the commissioning process.

C. The Owner will assure the participation of their chosen representatives as required to complete the commissioning process.

D. The Architect will assure the participation of necessary representatives from the design team as required to complete the commissioning process. Design team members will provide prompt replies to requests for information issued during the commissioning process.

E. It is the Contractor's specific responsibility to complete their respective start-up and checkout procedures, and to insure the complete readiness of equipment and systems, prior to the start of the functional performance testing phase. The CxA shall request written confirmation of system readiness for performance testing, from the appropriate Contractor or subcontractor. Once the CxA is provided with confirmation of all related systems completion, the actual date and times for the functional performance testing process will be confirmed. Contractor and subcontractors shall provide sufficient time, and qualified representatives, to complete this process at no additional cost to the State.

F. After a second failure of a system to successfully meet the criteria as set forth in the functional performance testing process, the Contractor shall reimburse the Owner for all costs associated with any additional re-testing efforts made necessary due to remaining Contractor related system deficiencies previously reported by the Contractor as corrected. These costs shall also include the costs (where applicable) for the CxA.

G. Training on related systems and equipment operation and maintenance shall only be scheduled to commence after final performance commissioning is satisfactorily completed, and systems are verified to be 100 percent complete and functional.

1.8 SUBMITTALS

A. Refer to Section 01 33 00 Submittal Procedures.

B. **Pre-Commissioning Checklist Forms:** Submit two (2) signed copies of the checklist forms to the CxA upon completion of all listed items.

C. **Equipment Manufacturer's Startup Forms:** Submit two (2) completed copies of the installation and startup checklists provided by the equipment manufacturers to the CxA.

D. **Test Reports:** Submit two (2) copies of test reports for equipment and systems to the CxA.

E. **Control Schematics:** Submit two (2) copies of the control schematics for equipment, systems, and subsystems to the CxA.

F. **Inspection Records:** Submit two (2) copies of the records of inspections for code compliance, and approved permits and licenses to operate the equipment and systems to the CxA.

G. **Operating Data:** Submit two (2) copies of equipment and system operating data including all necessary instructions to facilitate operation to specified performance standards to the Owner.

H. **Maintenance Data:** Submit two (2) copies of equipment and system maintenance data including all necessary information required to maintain the equipment and systems in continuous operation, such as the testing, balancing and adjusting report and the as-built drawings.

1.9 TRAINING OF OWNER PERSONNEL

A. The Contractor shall be responsible for training coordination and scheduling and ultimately for ensuring that training is completed.

B. The CxA shall be responsible for overseeing and approving the content and adequacy of the training of Agency's personnel for commissioned equipment.

1. The CxA shall interview the Agency's facility manager and lead engineer to determine the special needs and areas where training will be most valuable. The Construction Administrator, Agency's facility manager, and CxA shall decide how rigorous the training should be for each piece of commissioned equipment. The CxA shall communicate the results to the Contractor of subcontractors and vendors who have training responsibilities.

2. In addition to these general requirements, the specific training requirements of Owner personnel by subcontractor and vendors are specified in Divisions 21, 22, 23, 25, 26, and 27.

3. The Contractor shall require each subcontractor and vendor responsible for training to submit a written training plan to the CxA for review and approval prior to training. The plan will cover the following elements:
- **3.1** Equipment (included in training);
- **3.2** Intended audience;
- **3.3** Location of training;
- **3.4** Objectives;
- **3.5** Subjects covered (description, duration of discussion, special methods, etc.);
- **3.6** Duration of training on each subject;
- **3.7** Instructor for each subject;
- **3.8** Methods (classroom lecture, video, site walk-through, actual operational demonstrations, written handouts, etc.);
- **3.9** Instructor and qualifications.

4. For the primary HVAC equipment, the controls contractor shall provide a short discussion of the control of the equipment during the mechanical or electrical training conducted by others.

5. The CxA shall develop an overall training plan and coordinate and schedule, with the CA, Agency Representative, and Contractor, the overall training for the commissioned systems. The CxA shall develop criteria for determining that the training was satisfactorily completed, including attending some of the training, etc. The CxA shall recommend approval of the training to the CA using a standard form for submittal to the Contractor. The CA also shall sign the approval form.

6. At one of the training sessions, the CxA shall present a **one (1)** hour presentation discussing the use of the blank functional test forms for re-commissioning equipment.

7. Video recording of the training sessions shall be provided by Contractor. The Contractor shall provide the CA, with video disks cataloged by Contractor, and added to the O&M manuals.

8. The HVAC design engineer shall at the first training session present the overall system design concept and the design concept of each equipment section. This presentation shall be **two (2)** hours in length and include a review of all systems using the simplified system schematics (one-line drawings) including chilled water systems, condenser water or heat rejection systems, heating systems, fuel oil and gas supply systems, supply air systems, exhaust system and outside air strategies.

1.10 DEFERRED TESTING

A. Unforeseen Deferred Tests. If the Contractor determines that any check or test cannot be completed due to the building structure, required occupancy condition or other deficiency, execution of checklists and Functional Testing may be delayed upon approval of the CT DCS PM. These tests will be conducted in the same manner as the seasonal tests as soon as possible. Services of necessary parties will be negotiated.

B. Seasonal Testing. During the warranty period, seasonal testing (tests delayed until weather conditions are closer to the system's design intent) as specified in Division 23 shall be completed as part of this contract. The CxA shall coordinate this activity. Tests will be executed, documented and deficiencies corrected by the appropriate subcontractors, with the Agency facilities staff and the CxA witnessing. Any final adjustments to the O&M manuals and as-built drawings due to the testing will be made.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

END OF SECTION 01 91 00

Construction Checklist

Hallam-ICS COMMISSIONING

Equipment Tag: «F2»
Equipment Name: «Equipment_Descriptions»
Equipment Location: «F3»

Jenkins-Waggoner Labs
New Haven, CT
Project No. BI-P-86

MECHANICAL INSTALLATION VERIFICATION

INSTALLATION VERIFICATION:
Verify the following installation & startup items. Document the completion of each task by initialing in the spaces below. If a row is not applicable to the installation, note with "N/A" in the Comments column.

Mechanical Installation	Contractor Initials	Comments
INSTALLED MODEL #		
INSTALLED SERIAL #		
Equipment is installed undamaged		
Equipment is Anchored w/ applicable vibration isolation		
Seismic bracing installed (per applicable code)		
Equipment is cleaned/purged and clear of construction debris		
Access doors operate freely and are accessible		
Pressure Tank has correct air pressure		
Refrigerant Relief Valve Installed		
Piping is insulated (as applicable)		
Automated Control Devices installed, labeled and tested		
Gauges and Manual Valves installed and working properly		
Pressure / Temperature Test ports & gauges installed as specified		
Chemical Treatment Plan is Approved		
Equipment is free of Air / Water Leaks.		
Strainers Checked and Clean		
Balance Valves installed and Water Balance complete		
System is properly labeled		
OEM Vendor Start-up Complete (Attach copy of report)		
Contractor has tested and verified that the equipment control sequence is functioning according to the Sequence of Operation		
Equipment operation is ready to be demonstrated to the owner or an owner's representative.		
MSDS's are on-site and easily accessible, clearly marked		

ADDITIONAL NOTES OR COMMENTS:

«F15»

CHECKLIST SIGN-OFF:
Signoff of this form constitutes approval from the Contractor and Construction Manager that the equipment has been properly installed, started up, contractor tested and is fully ready for functional demonstration as specified in the project specifications and submittals. The Contractor and Construction Manager accept responsibility for retesting if the systems are found to be incomplete. The signoff MUST be completed prior to the functional testing phase of commissioning.

Company	Contact Name	Contact Signature	Date
Contractor			
Construction Manager			

Equipment Tag: «F2»
Equipment Name: «Equipment_Descriptions»
Equipment Location: «F3»

Jenkins-Waggoner Labs
New Haven, CT
Project No. BI-P-86

ELECTRICAL INSTALLATION VERIFICATION

INSTALLATION VERIFICATION:
Verify the following installation & startup items. Document the completion of each task by initialing in the spaces below. If a row is not applicable to the installation, note with "N/A" in the Comments column.

Electrical Installation	Contractor Initials	Comments
Equipment is installed undamaged		
Equipment is cleaned/purged and clear of construction debris		
Proper code required clearances maintained		
Access doors operate freely		
Holes and Knock-outs are sealed		
Disconnect Switch Tested		
Equipment is properly grounded		
Equipment is properly labeled (panel schedules updated)		
Install meets code and intent of the design		
Motor rotation correct		
OEM Vendor start-up Complete (Attach copy of report)		
Equipment is energized and operating amperages & voltages are measured & recorded **(Phase to Phase)** **Phase A-B: Voltage_____ Amps_____** **Phase B-C: Voltage_____ Amps_____** **Phase C-A: Voltage_____ Amps_____**		
If Neutral is installed, also check **(Phase to Neutral)** **Phase A-N: Voltage_____ Amps_____** **Phase B-N: Voltage_____ Amps_____** **Phase C-N: Voltage_____ Amps_____**		

ADDITIONAL NOTES OR COMMENTS:

CHECKLIST SIGN-OFF:
Signoff of this form constitutes approval from the Contractor and Construction Manager that the equipment has been properly installed, started up, contractor tested and is fully ready for functional demonstration as specified in the project specifications and submittals. The Contractor and Construction Manager accept responsibility for retesting if the systems are found to be incomplete. The signoff MUST be completed prior to the functional testing phase of commissioning.

Company	Contact Name	Contact Signature	Date
Contractor			
Construction Manager			

Equipment Tag: «F2»
Equipment Name: «Equipment_Descriptions»
Equipment Location: «F3»

Jenkins-Waggoner Labs
New Haven, CT
Project No. BI-P-86

CONTROL DEVICE INSTALLATION VERIFICATION

INSTALLATION VERIFICATION:
Verify the following installation & startup items. Document the completion of each task by initialing in the spaces below. If a row is not applicable to the installation, note with "N/A" in the Comments column.

	Controls Installation	Contractor Initials	Comments
	Devices are installed undamaged		
	Devices are wired and complete		
	Devices actuate clear of any obstruction and in full range of motion		
	Devices have been calibrated to their min / max position		
	Access doors operate freely		
	Holes and Knock-outs are sealed		
	Wiring has proper strain relief		
	Devices are labeled according to the design documents		
	Labels are clearly visible		
	Devices maintains the correct fail-safe steady state		
	Each Alarm condition has been triggered and tested to BAS.		
	Devices have been programmed to operate according to the Sequence of Operation.		
	Devices have been visualized on the Graphic User Interface		
	Contractor has verified that the Equipment control sequence is functioning according to the Sequence of Operation		

ADDITIONAL NOTES OR COMMENTS:

CHECKLIST SIGN-OFF:
Signoff of this form constitutes approval from the Contractor and Construction Manager that the equipment has been properly installed, started up, contractor tested and is fully ready for functional demonstration as specified in the project specifications and submittals. The Contractor and Construction Manager accept responsibility for retesting if the systems are found to be incomplete. The signoff MUST be completed prior to the functional testing phase of commissioning.

Company	Contact Name	Contact Signature	Date
Contractor			
Construction Manager			

SECTION 22 08 00

COMMISSIONING OF PLUMBING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this section.

B. In addition to the drawings and general provisions of the contract, commissioning requirements are defined in the following sections:

1. Section 019100 – Commissioning
2. Section 230800 – Commissioning of HVAC
3. Section 260800 – Commissioning of Electrical

1.2 SUMMARY

A. This section includes commissioning process requirements for Plumbing systems, assemblies, and equipment.

B. General commissioning requirements are described in Division 01 Section 019100 and are therefore not repeated in this Section.

1.3 SYSTEMS TO BE COMMISSIONED

A. Commissioning of the plumbing systems shall include:

1. The incoming domestic water service, including backflow preventers and meters
2. Domestic water recirculating pumps
3. Fuel-fired domestic storage-type water heaters and expansion tanks
4. Sample testing of plumbing fixtures
5. Laboratory Service Water
6. Laboratory Acid Waste and Treatment
7. Controls associated with the above systems

1.4 SUBMITTALS

A. Refer to Division 01 Section 013300 “Submittal Procedures” for specific requirements.

B. In addition, provide the following:

1. Certificates of readiness
2. Certificates of completion of installation, prestart, and startup activities.
3. O&M manuals
4. Contractor and equipment startup and test reports
5. Completed construction checklists

PART 2 - PRODUCTS

2.1 TEST EQUIPMENT

A. The Contractor shall furnish all standard testing equipment required to perform startup, initial checkout and functional performance testing for the equipment being tested. For example, the plumbing contractor of Division 22 shall ultimately be responsible for all standard testing equipment for the plumbing system in Division 22, except for equipment specific to and used by TAB in their commissioning responsibilities. A sufficient quantity of two-way radios shall be provided by each subcontractor.

B. Refer to Division 01 Section 019100 “Commissioning” for a detailed description of test equipment requirements.

PART 3 - EXECUTION

3.1 GENERAL DOCUMENTATION REQUIREMENTS

A. With assistance from the installing contractors, the CxA will prepare Construction Checklists for all commissioned components, equipment, and systems.

B. Red-lined and As-Built Drawings

1. The contractor shall verify all equipment, systems, instrumentation, wiring and components are shown correctly on red-lined drawings.

2. Preliminary red-lined drawings must be made available to the Commissioning Team for use prior to the start of Functional Performance Testing.

3. Changes, as a result of Functional Testing, must be incorporated into the final as-built drawings, which will be created from the red-lined drawings.

4. The contracted party, as defined in the Contract Documents shall create the as-built drawings.

5. All red-lined drawings are to be available on-site for review by the Owner and the CxA.

3.2 COMMISSIONING TEAM RESPONSIBILITIES

A. Refer to Division 01 Section 019100 “Commissioning” for commissioning team member roles and responsibilities.

3.3 TESTING PREPARATION

A. Certify in writing to the CxA that plumbing systems, subsystems, and equipment have been installed, calibrated, and started and are operating according to the Contract Documents.

B. Certify in writing to the CxA that Plumbing instrumentation and control systems have been completed and calibrated, that they are operating according to the Contract Documents, and that pretest set points have been recorded.

C. Certify in writing that balancing procedures have been completed and that testing, adjusting, and balancing reports have been submitted, discrepancies corrected, and corrective work approved.

D. Set systems, subsystems, and equipment into operating mode to be tested (e.g., normal shutdown, normal auto position, normal manual position, unoccupied cycle, emergency power, and alarm conditions).

E. Inspect and verify the position of each device and interlock identified on checklists.

F. Check safety cutouts, alarms, and interlocks with smoke control and life-safety systems during each mode of operation.

G. If the failure rate of a similar family of equipment or devices is greater than 10%, then the Owner shall be notified. The matter shall be addressed by the Owner, CM, CxA, and other applicable parties. The failure issue shall be resolved to the Owner’s satisfaction.

3.4 DOMESTIC WATER BALANCING VERIFICATION

A. Prior to performance of Domestic Water Balancing work, provide copies of reports, sample forms, checklists, and certificates to the CxA.

B. Notify the CxA at least ten (10) days in advance of testing and balancing Work, and provide access for the CxA to witness balancing Work.

3.5 GENERAL TESTING REQUIREMENTS

A. Provide technicians, instrumentation, and tools to perform commissioning test at the direction of the CxA.

B. Scope of Plumbing testing shall include entire Plumbing installation. Testing shall include measuring capacities and effectiveness of operational and control functions.

C. Test all operating modes, interlocks, control responses, and responses to abnormal or emergency conditions, and verify proper response of building automation system controllers and sensors.

D. The CxA and the Plumbing and Balancing contractors shall prepare detailed testing plans, procedures, and checklists for Plumbing systems, subsystems, and equipment.

E. Tests shall be performed using design conditions whenever possible.

F. Simulated conditions may need to be imposed using an artificial load when it is not practical to test under design conditions. Before simulating conditions, calibrate testing instruments. Provide equipment to simulate loads. Set simulated conditions as directed by the CxA and document simulated conditions and methods of simulation. After tests, return settings to normal operating conditions.

G. The CxA may direct that set points be altered when simulating conditions is not practical.

H. The CxA may direct that sensor values be altered with a signal generator when design or simulating conditions and altering set points are not practical.

I. If tests cannot be completed because of a deficiency outside the scope of the Plumbing system, document the deficiency and report it to the Owner. After deficiencies are resolved, reschedule tests.

J. If the testing plan indicates specific seasonal testing, complete appropriate initial performance tests and documentation and schedule seasonal tests.

3.6 TESTING PROCEDURES

A. General

1. Refer to individual Division 22 sections for testing and acceptance procedure requirements. Provide the CxA with submittals, test data, inspector records, and certifications.

2. Provide technicians, instrumentation, tools, and equipment to test performance of air, fuel gas, sanitary waste and vent piping, storm drainage piping, sprinkler and domestic water distribution systems.

B. Plumbing Contractor shall prepare and execute a pipe system cleaning, flushing, and hydrostatic testing plan for all distribution systems. Plans shall include the following:

1. Sequence of testing and testing procedures for each section of pipe to be tested, identified by pipe zone or sector identification marker. Markers shall be keyed to Drawings for each pipe sector, showing the physical location of each designated

pipe test section. Drawings keyed to pipe zones or sectors shall be formatted to allow each section of piping to be physically located and identified when referred to in pipe system cleaning, flushing, hydrostatic testing, and chemical treatment plan.

2. Description of equipment for flushing operations.
3. Minimum flushing water velocity.
4. Tracking checklist for managing and ensuring that all pipe sections have been cleaned, flushed, hydrostatically tested, and chemically treated.

C. The Plumbing Contractor shall plan and execute performance testing of vibration isolation and seismic controls. Furnish technicians, instrumentation, tools, and equipment to test performance.

3.7 DEFICIENCIES

A. Refer to Division 01 Section “Commissioning” for requirements pertaining to deficiencies, non-conformances, cost of retesting, or failures due to manufacturer defects.

3.8 APPROVALS

A. Refer to Division 01 Section “Commissioning” for approval procedures.

3.9 DEFERRED TESTING

A. Refer to Division 01 Section “Commissioning” for requirements pertaining to deferred testing.

3.10 OPERATION AND MAINTENANCE MANUALS

A. Refer to Division 01 Section 019100 “Commissioning” for requirements pertaining to operation and maintenance manuals.

3.11 TRAINING OF OWNER PERSONNEL

A. Refer to Division 01 Section “Commissioning” for requirements pertaining to training.

B. The contractor shall provide designated Owner personnel with comprehensive orientation and training in the understanding of the systems and the operation and maintenance of each piece of Plumbing equipment.

1. During any demonstration, should the system fail to perform in accordance with the requirements of the O&M manual or sequence of operations, the Contractor shall repair or adjust the system as necessary and the demonstration repeated.

2. The Contractor shall provide one or more qualified instructors as appropriate to the equipment or systems. The instructor may be the start-up technician for the piece of equipment, the installing contractor or manufacturer's representative. The instructor shall possess practical expertise and in-depth knowledge of all modes of operation for each specific piece of equipment.
3. The training sessions shall follow the outline in the Table of Contents of the operation and maintenance manual and illustrate whenever possible the use of the O&M manuals for reference.
4. Hands-on training shall include start-up, operation in all modes possible, including manual, shut-down and any emergency procedures and preventative maintenance for all pieces of equipment.
5. The plumbing contractor shall fully explain and demonstrate the operation, function and overrides of any local packaged controls.
6. Training shall occur after functional testing is complete, unless approved otherwise by the Owner.

END OF SECTION

SECTION 230800

COMMISSIONING OF HVAC

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Specification Sections, apply to this commissioning requirement.

B. In addition to the drawings and general provisions of the contract, commissioning requirements are defined in the following sections:

1. Section 019100 – Commissioning
2. Section 220800 – Commissioning of Plumbing
3. Section 239010 – Commissioning of Building Automation System
4. Section 260800 – Commissioning of Electrical

1.2 SUMMARY

A. This section defines commissioning requirements for HVAC&R (Heating, Ventilation, Air-conditioning and Refrigeration) systems, assemblies, and equipment.

B. General commissioning requirements are described in Division 01 Section 019100 and are therefore not repeated in this Section.

1.3 SYSTEMS TO BE COMMISSIONED

A. Commissioning of the HVAC&R systems shall include all equipment and components associated with the Heating, Ventilation, Air-Conditioning and Refrigeration systems. These shall include:

1. Air Handling Units
2. Split System Air Conditioning
3. Shutoff VAV Terminal Boxes
4. Heating Hot Water Boilers
5. Heating Hot Water Coils
6. Airflow Control Valves
7. Dampers, Ductwork, Diffusers and Filters.
8. Laboratory Exhaust Ductwork Systems,Hoods and Fans
9. General Duty and Environmental Air Exhaust Fans

10. Pumps, Piping, Valves and Strainers
11. Glycol Makeup Units
12. Unit Heaters
13. Expansion Tanks and Air Separators
14. Energy Recovery Systems including Pumps and Heat Exchangers
15. Condensing Boilers
16. Air-Cooled Chillers
17. All controls, including operator stations, displays, alarms, sensors and control systems programming.

1.4 SUBMITTALS

A. Refer to Division 01 Section 013300 “Submittal Procedures” for specific requirements.

B. In addition, provide the following:

1. Certificates of readiness
2. Certificates of completion of installation, prestart, and startup activities.
3. O&M manuals
4. Contractor and equipment vendor startup and test reports
5. Completed construction checklists

C. Control Drawings Submittals

1. The control drawings shall have a key to all abbreviations.
2. The control drawings shall contain graphic schematic depictions of the systems and each component.
3. The diagrams shall include the system and component layout of any equipment that the control system monitors, enables or controls, even if the equipment is primarily controlled by packaged or integral controls.
4. Provide a full points list with at least the following included for each point:

    a. Controlled system
    b. Point abbreviation
    c. Point description
    d. Display unit

PART 2 - PRODUCTS

2.1 TEST EQUIPMENT

A. The Contractor shall furnish all standard testing equipment required to perform startup, initial checkout and functional performance testing for the equipment being tested. For example, the mechanical contractor of Division 23 shall ultimately be responsible for all standard testing equipment for the HVAC&R system and controls system in Division

23, except for equipment specific to and used by TAB in their commissioning responsibilities. A sufficient quantity of two-way radios shall be provided by each subcontractor.

B. Refer to Division 01 Section 019100 “Commissioning” for a detailed description of test equipment requirements.

PART 3 - EXECUTION

3.1 GENERAL DOCUMENTATION REQUIREMENTS

A. With assistance from the installing contractors, the CxA will prepare Construction Checklists for all commissioned components, equipment, and systems

1. The CxA will develop checklists CxA and provide to the contractors.
2. Contractors shall complete the construction checklists and provide completed copies to the CxA prior to beginning system functional testing

B. Red-lined and As-Built Drawings

1. The contractor shall verify all equipment, systems, instrumentation, wiring and components are shown correctly on red-lined drawings.
2. Preliminary red-lined drawings shall be made available to the Commissioning Team for use prior to the start of Functional Performance Testing.
3. The Contractor shall incorporate changes resulting from Functional Testing into the final as-built drawings, which will be created from the red-lined drawings.
4. The contracted party, as defined in the Contract Documents, shall create the As-Built drawings.
5. All red-lined drawings shall be available for review on-site by the Owner and the CxA.

C. Operation and Maintenance Data

1. Contractor shall provide a copy of O&M literature within 45 days of each submittal acceptance for use during the commissioning process for all commissioned equipment and systems.
2. The CxA will review the O&M literature once for conformance to project requirements.
3. The CxA shall receive a copy of the final approved O&M literature once corrections have been mad by the Contractor.

D. Demonstration and Training

1. Contractor shall provide demonstration and training as required by the specifications.
2. A complete training plan and schedule shall be submitted by the Contractor to the CxA four weeks (4) prior to any training.
3. A training agenda for each training session shall be submitted to the CxA one (1) week prior the training session.
4. The CA shall be notified at least (72) hours in advance of scheduled tests so that testing may be observed by the CA and Owner's representative. A copy of the test record shall be provided to the CA, Owner, and Architect.
5. The contractor shall engage a Factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain specific equipment.
6. Train Owner's maintenance personnel on procedures and schedules for starting and stopping, trouble shooting, servicing, and maintaining equipment.
7. Review data in O&M Manuals.

E. Systems Manual Requirements:

1. The Systems Manual is intended to be a usable information resource containing all of the information related to the systems, assemblies, and Commissioning Process in one place with indexes and cross references.
2. The GC shall include final approved versions of the following information for the Systems Manual:
    a. As-Built System Diagrams
    b. Verified Record Drawings
    c. Test Results not otherwise included in Cx Record
    d. Periodic Maintenance Information for computer maintenance management system
    e. Recommendations for recalibration frequency of sensors and actuators
    f. A list of contractors, subcontractors, suppliers, architects, and engineers involved in the project along with their contact information
    g. Training Records, Information on training provided, attendees list, and any on-going training
3. This information shall be organized and arranged by building system, such as fire alarm, chilled water, heating hot water, etc.
4. Information should be provided in an electronic version to the extent possible. Legible, scanned images are acceptable for non-electronic documentation to facilitate this deliverable.

3.2 COMMISSIONING TEAM RESPONSIBILITIES

A. Refer to Division 01 Section 019100 “Commissioning” for commissioning team member roles and responsibilities.

3.3 TESTING PREPARATION

A. Certify in writing to the CxA that HVAC&R systems, subsystems, and equipment have been installed, calibrated, and started and are operating according to the Contract Documents.

B. Certify in writing to the CxA that HVAC&R instrumentation and control systems have been completed and calibrated, that they are operating according to the Contract Documents, and that pretest set points have been recorded.

C. Certify in writing that testing, adjusting, and balancing procedures have been completed and that testing, adjusting, and balancing reports have been submitted, discrepancies corrected, and corrective work approved.

D. Place systems, subsystems, and equipment into operating mode to be tested, including but not limited to, normal shutdown, normal auto position, normal manual position, unoccupied cycle, emergency power, and alarm conditions.

E. Inspect and verify the position of each device and interlock identified on checklists.

F. Check safety cutouts, alarms, and interlocks with smoke control and life-safety systems during each mode of operation.

G. The contractor shall install testing and measuring instruments and logging devices to record test data as directed by the CxA.

H. If the failure rate of a similar family of equipment or devices is greater than 10%, then the Owner shall be notified. The matter shall be addressed by the Owner, CM, CxA, and other applicable parties. The failure issue shall be resolved to the Owner’s satisfaction.

3.4 TESTING, ADJUSTING AND BALANCING VERIFICATION

A. Prior to performance of Testing, Adjusting and Balancing work, provide copies of reports, sample forms, checklists, and certificates to the CxA.

B. Notify the CxA at least ten (10) days in advance of testing and balancing Work, and provide access for the CxA to witness testing and balancing Work.

C. Provide technicians, instrumentation, and tools to verify testing and balancing of HVAC&R systems at the direction of the CxA.

1. The CxA will notify testing and balancing subcontractor ten (10) days in advance of the date of field verification. Notice will not include data points to be verified.
2. The testing and balancing subcontractor shall use the same instruments by model and serial number that were used when original data were collected.
3. Failure of an item is defined by a deviation of more than 10 percent of any pertinent variable other than sound. Failure of more than 10 percent of selected items shall result in rejection of final testing, adjusting, and balancing report. For sound pressure readings, a deviation of 3 dB shall result in rejection of final testing. Variations in background noise shall be considered.
4. Remedy the deficiency and notify the CxA so verification of failed portions can be performed.

3.5 GENERAL TESTING REQUIREMENTS

A. Provide technicians, instrumentation, and tools to perform commissioning test at the direction of the CxA.

B. Scope of HVAC&R testing shall include entire HVAC&R installation, from central equipment for heat generation and refrigeration through distribution systems to each conditioned space. Testing shall include measuring capacities and effectiveness of operational and control functions.

C. Test all operating modes, interlocks, control responses, and responses to abnormal or emergency conditions, and verify proper response of building automation system controllers and sensors.

D. The CxA along with the HVAC&R contractor, testing and balancing Subcontractor, and HVAC&R Instrumentation and Control Subcontractor shall prepare detailed testing plans, procedures, and checklists for HVAC&R systems, subsystems, and equipment.

E. Tests shall be performed using design conditions whenever possible.

F. Simulated conditions may need to be imposed using an artificial load when it is not practical to test under design conditions. Before simulating conditions, calibrate testing instruments. Provide equipment to simulate loads. Set simulated conditions as directed by the CxA and document simulated conditions and methods of simulation. After tests, return settings to normal operating conditions.

G. The CxA may direct that set points be altered when simulating conditions is not practical.

H. The CxA may direct that sensor values be altered with a signal generator when design or simulating conditions and altering set points are not practical.

I. If tests cannot be completed because of a deficiency outside the scope of the HVAC&R system, document the deficiency and report it to the Owner. After deficiencies are resolved, reschedule tests.

J. If the testing plan indicates specific seasonal testing, complete appropriate initial performance tests and documentation and schedule seasonal tests.

3.6 TESTING PROCEDURES

A. Testing requirements are specified in individual Division 23 sections. Provide the CxA with submittals, test data, inspector records, and certifications as required.

B. Field testing plans and testing requirements for instrumentation and control systems are specified in Division 23 Section 230900 "Building Automation System" and Section 230993 "Sequence of Operations for HVAC Controls." Assist the CxA with preparation of testing plans.

C. Test requirements for pipe system cleaning, flushing, hydrostatic tests, and chemical treatment: are specified in Division 23 piping Sections. HVAC&R Contractor shall prepare a pipe system cleaning, flushing, and hydrostatic testing plan. Provide the CxA with cleaning, flushing, testing, and treating plan and final reports.. Plan shall include the following:

1. Sequence of testing and testing procedures for each section of pipe to be tested, identified by pipe zone or sector identification marker. Markers shall be keyed to Drawings for each pipe sector, showing the physical location of each designated pipe test section. Drawings keyed to pipe zones or sectors shall be formatted to allow each section of piping to be physically located and identified when referred to in pipe system cleaning, flushing, hydrostatic testing, and chemical treatment plan.
2. Description of equipment for flushing operations.
3. Minimum flushing water velocity.
4. Tracking checklist for managing and ensuring that all pipe sections have been cleaned, flushed, hydrostatically tested, and chemically treated.

D. Provide qualified refrigeration system technicians, instrumentation, tools, and equipment to test performance of chillers, condensing sections of all packaged equipment and heat pumps, and other refrigeration systems. The CxA shall determine the sequence of testing and testing procedures for each equipment item and pipe section to be tested.

E. Provide qualified technicians, instrumentation, tools, and equipment to test performance of air and hydronic distribution systems; special exhaust; and other distribution systems, including HVAC&R terminal and unitary equipment.

F. Provide qualified technicians, instrumentation, tools, and equipment to test performance of acoustic, vibration isolation, and seismic controls.

3.7 DEFICIENCIES

A. Refer to Division 01 Section 019100 “General Commissioning Requirements” for requirements pertaining to deficiencies, non-conforming conditions, cost of retesting, or failure due to manufacturing defects.

3.8 APPROVAL

A. Refer to Division 01 Section 019100 “General Commissioning Requirements” for approval procedures.

3.9 DEFERRED TESTING

A. Refer to Division 01 Section 019100 “General Commissioning Requirements” for requirements pertaining to deferred testing.

3.10 OPERATION AND MAINTENANCE MANUALS

A. Refer to Division 01 Section 019100 “General Commissioning Requirements” for operation and maintenance manual requirements.

3.11 TRAINING OF OWNER PERSONNEL

A. Refer to Division 01 Section 019100 “General Commissioning Requirements” for owner training requirements

B. The Mechanical Contractor shall provide designated Owner personnel with comprehensive orientation and training in the understanding of the systems and the operation and maintenance of each piece of mechanical equipment.

1. Provide the CxA with a training plan two weeks before the planned training.
2. Provide designated Owner personnel with comprehensive orientation and training in the understanding of the systems and the operation and maintenance of each piece of HVAC equipment including, but not limited to, pumps, heat exchangers, chillers, heat rejection equipment, air conditioning units, air handling units, fans, terminal units, controls and water treatment systems.
3. Training shall normally start with classroom sessions followed by hands-on training on each piece of equipment, which shall illustrate the various modes of operation, including but not limited to startup, shutdown, fire/smoke alarms, and power failures.
4. During any demonstration, should the system fail to perform in accordance with the requirements of the O&M manual or sequence of operations, the system shall be repaired or adjusted as necessary and the demonstration repeated.

5. The Contractor shall provide one or more qualified instructors as appropriate to the equipment or systems. The instructor may be the start-up technician for the piece of equipment, the installing contractor or manufacturer's representative. The instructor shall possess practical expertise and in-depth knowledge of all modes of operation for each specific piece of equipment.
6. The controls contractor shall attend sessions other than the controls training, as requested, to discuss the interaction of the controls system as it relates to the equipment being discussed.
7. The training sessions shall follow the outline in the Table of Contents of the operation and maintenance manual and illustrate whenever possible the use of the O&M manuals for reference.
8. Training shall include:
    a. Use of the printed installation, operation and maintenance instruction material included in the O&M manuals.
    b. A review of the written O&M instructions emphasizing safe and proper operating requirements, preventative maintenance, special tools needed and spare parts inventory suggestions. The training shall include start-up, operation in all modes possible, shut-down, seasonal changeover and any emergency procedures.
    c. Discussion of relevant health and safety issues and concerns. Include Material Safety Data Sheets as applicable.
    d. Discussion of warranties and guarantees.
    e. Common troubleshooting problems and solutions.
    f. Explanatory information included in the O&M manuals and the location of all plans and manuals in the facility.
    g. Discussion of any peculiarities of equipment installation or operation.
    h. The format and training agenda in The HVAC Commissioning Process, ASHRAE Guideline 1-2007, is recommended.
9. Hands-on training shall include start-up, operation in all modes possible, including manual, shut-down and any emergency procedures and preventive maintenance for all pieces of equipment.
10. The mechanical contractor shall fully explain and demonstrate the operation, function and overrides of any local packaged controls not controlled by the central control system.
11. Training shall occur after functional testing is complete, unless approved otherwise by the Owner.

C. The Controls Contractor shall provide designated Owner personnel with comprehensive orientation and training in the understanding of the systems and the operation and maintenance of each piece of mechanical equipment.

1. Provide the CxA and AE with a training plan four weeks before the planned training.

2. The Controls Contractor shall provide designated Owner personnel training on the control system in this facility. The intent is to instruct the Owner on all the capabilities of the control system clearly and completely.

3. The Instructors shall furnish the standard operating manual for the systems and any special training manuals for each trainee, with three extra copies left for the O&M manuals. In addition, copies of the system technical manual shall be demonstrated during training and three copies submitted with the O&M manuals. Manuals shall include detailed description of the subject matter for each session. The manuals shall cover all control sequences and have a definitions section that fully describes all relevant words and abbreviations used in the manuals and in all software displays. Manuals shall be approved by the CxA and AE. The Contractor shall deliver all copies of audiovisual materials to the Owner.

4. Training sessions shall be tailored to the needs and skill levels of the trainees. Trainers shall be knowledgeable on the system and its use in buildings. The contractor shall employ the most qualified trainers for the on-site sessions. The Owner will approve the instructor prior to scheduling the training.

5. Should the system fail to perform in accordance with the requirements of the O&M manuals or sequences of operations during any demonstration, the system shall be repaired or adjusted as necessary and the demonstration repeated.

D. The TAB contractor shall have the following training responsibilities:

1. TAB shall meet for 4 hours with facility staff after completion of TAB and instruct them on the following:

   a. Review the final TAB report, explaining the layout and meanings of each data type.

   b. Discuss any outstanding deficiencies in control, ductwork, piping or system design that may affect the proper delivery of air or water.

   c. Identify and discuss any terminal units, duct runs, diffusers, coils, fans and pumps that are close to or are not meeting their design capacity.

   d. Discuss any temporary settings and steps to finalize them for any areas that are not finished.

   e. Other salient information that may be useful for facility operations, relative to TAB.

END OF SECTION

SECTION 239010

COMMISSIONING OF BUILDING AUTOMATION SYSTEM

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this section.

B. In addition to the drawings and general provisions of the contract, commissioning requirements are defined in the following sections:

1. Section 019100 – Commissioning
2. Section 220800 – Plumbing System Commissioning Requirements
3. Section 230800 – HVAC&R System Commissioning Requirements
4. Section 260800 – Electrical System Commissioning Requirements

1.2 SUMMARY

A. This section includes commissioning process requirements for the Building Automation System (BAS) assemblies, equipment, software and programming.

B. General commissioning requirements are described in Division 01 Section 019100 and are therefore not repeated in this Section.

1.3 SYSTEMS TO BE COMMISSIONED

A. Commissioning of the building automation and controls systems shall include verification of all systems operation that are controlled or monitored by the building automation system. BAS components include:

1. Control system hardware, wiring, sensors and actuators
2. Operator stations and graphic displays
3. System alarming and annunciation
4. System operating control sequences
5. Data trending and logging
6. User access and password protection
7. Remote system access
8. Door access
9. Control hardware

1.4 SUBMITTALS

A. Refer to Division 01 Section 013300 “Submittal Procedures” for specific requirements.

B. In addition, provide the following:

1. Certificates of readiness
2. Certificates of completion of installation, prestart, and startup activities.
3. Contractor and equipment vendor startup and test reports

C. Control Drawings Submittals

1. The control drawings shall have a key to all abbreviations.
2. The control drawings shall contain graphic depictions of the systems and each component.
3. The diagrams shall include the system and component layout of any equipment that the control system monitors, enables or controls, even if the equipment is primarily controlled by packaged or integral controls.
4. Provide a full points list with at least the following included for each point:

a. Controlled system
b. Point abbreviation
c. Point description
d. Display unit

PART 2 - PRODUCTS

2.1 TEST EQUIPMENT

A. The Contractor shall furnish all standard testing equipment required to perform startup, initial checkout and functional performance testing for the equipment being tested.

B. For example, the Mechanical Contractor shall furnish all standard testing equipment for the BAS system and controls system in Division 23, except for equipment specific to and used by TAB in their commissioning responsibilities. A sufficient quantity of two-way radios shall be provided by each subcontractor.

C. Refer to Division 01 Section 019100 “Commissioning” for a detailed description of test equipment requirements.

PART 3 - EXECUTION

3.1 GENERAL DOCUMENTATION REQUIREMENTS

A. The Controls Contractor shall document all BAS testing and startup activities using his own forms. Completed test and startup forms shall be submitted to the CxA for review.

B. Record Documents

1. Red-lined and As-Built Drawings The contractor shall verify all equipment, systems, instrumentation, wiring and components are shown correctly on red-lined drawings.
2. The Controls Contractor shall furnish the Commissioning Team with preliminary red-lined drawings for use prior to the start of Functional Performance Testing.
3. Changes resulting from Functional Testing shall be incorporated into the final as-built drawings to be created from the red-lined drawings.
4. The contracted party, as defined in the Contract Documents, shall create the as-built drawings.
5. All red-lined drawings shall to be available on-site for review by the Owner and the CxA.

C. Operation and Maintenance Data

1. Contractor shall provide a copy of O&M literature within 45 days of each submittal acceptance for use during the commissioning process for all commissioned equipment and systems.
2. The CxA will review the O&M literature once for conformance to project requirements.
3. The CxA will receive a copy of the final approved O&M literature once corrections have been mad by the Contractor.

D. Demonstration and Training

1. The contractor shall contribute to and review training documentation in O&M Manuals.

E. Systems Manual Requirements

1. The Systems Manual is intended to be a usable information resource containing all of the information related to the systems, assemblies, and Commissioning Process in one place with indexes and cross references.

2. The GC shall include final approved versions of the following information for the Systems Manual:
    a. As-Built System Diagrams
    b. Verified Record Drawings
    c. Test Results (not otherwise included in Cx Record)
    d. Periodic Maintenance Information for computer maintenance management system
    e. Recommendations for recalibration frequency of sensors and actuators
    f. A list of contractors, subcontractors, suppliers, architects, and engineers involved in the project along with their contact information
    g. Training Records, Information on training provided, attendees list, and any on-going training

3. This information shall be organized and arranged by building system, such as fire alarm, chilled water, heating hot water, etc.

4. Information should be provided in an electronic version to the extent possible. Legible, scanned images are acceptable for non-electronic documentation to facilitate this deliverable.

3.2 COMMISSIONING TEAM RESPONSIBILITIES

A. Refer to Division 01 Section 019100 “Commissioning” for commissioning team member roles and responsibilities.

3.3 TESTING PREPARATION

A. Certify in writing to the CxA that BAS systems, subsystems, and equipment have been installed, calibrated, and started and are operating according to the Contract Documents.

B. Certify in writing to the CxA that BAS instrumentation and control systems have been completed and calibrated, that they are operating according to the Contract Documents, and that pretest set points have been recorded.

C. Certify in writing that testing, adjusting, and balancing procedures have been completed and that testing, adjusting, and balancing reports have been submitted, discrepancies corrected, and corrective work approved.

D. Place systems, subsystems, and equipment into operating mode to be tested (e.g., normal shutdown, normal auto position, normal manual position, unoccupied cycle, emergency power, and alarm conditions).

E. Inspect and verify the position of each device and interlock identified on checklists.

F. Check safety cutouts, alarms, and interlocks with smoke control and life-safety systems during each mode of operation.

G. If the failure rate of a similar family of equipment or devices is greater than 10%, then the Owner shall be notified. The matter shall be addressed by the Owner, CM, CxA, and other applicable parties. The failure issue shall be resolved to the Owner's satisfaction.

3.4 TESTING, ADJUSTING AND BALANCING VERIFICATION

A. Provide technicians, instrumentation, and tools to verify testing and balancing of BAS systems at the direction of the TAB Contractor.

3.5 GENERAL TESTING REQUIREMENTS

A. Provide technicians, instrumentation, and tools to perform commissioning test at the direction of the CxA.

B. Scope of BAS testing shall include entire BAS installation, including control system hardware, wiring, sensors, operator terminals, software programming, graphic displays, alarms and data storage. Test all operating modes, interlocks, control responses, and responses to abnormal or emergency conditions, and verify proper response of BAS controllers and sensors.

C. The CxA along with the BAS contractor, testing and balancing Subcontractor, and BAS Instrumentation and Control Subcontractor shall prepare detailed testing plans, procedures, and checklists for BAS systems, subsystems, and equipment.

D. Tests shall be performed using design conditions whenever possible.

E. Simulated conditions may need to be imposed using an artificial load when it is not practical to test under design conditions. Before simulating conditions, calibrate testing instruments. Provide equipment to simulate loads. Set simulated conditions as directed by the CxA and document simulated conditions and methods of simulation. After tests, return settings to normal operating conditions.

F. The CxA may direct that set points be altered when simulating conditions is not practical.

G. The CxA may direct that sensor values be altered with a signal generator when design or simulating conditions and altering set points are not practical.

H. If tests cannot be completed because of a deficiency outside the scope of the BAS system, document the deficiency and report it to the Owner. After deficiencies are resolved, reschedule tests.

I. If the testing plan indicates specific seasonal testing, complete appropriate initial performance tests and documentation and schedule seasonal tests.

3.6 RETESTING, FAILURE DUE TO PRODUCT DEFECTS

A. Refer to Division 01 Section 019100 “Commissioning” for requirements pertaining to deficiencies, non-conforming conditions, cost of retesting, and failures due to product defects.

3.7 APPROVALS

A. Refer to Division 01 Section 019100 “Commissioning” for approval procedures.

3.8 DEFERRED TESTING

A. Refer to Division 01 Section 019100 “Commissioning” for requirements pertaining to deferred testing.

3.9 OPERATION AND MAINTENANCE MANUALS

A. Refer to Division 01 Section 019100 “Commissioning” for requirements pertaining to operation & maintenance manuals.

3.10 TRAINING OF OWNER PERSONNEL

A. Refer to Division 01 Section 019100 “Commissioning” for requirements pertaining to training of owner personnel.

B. The Controls Contractor shall provide designated Owner personnel with comprehensive orientation and training in the understanding, operation and maintenance of the control and building automation systems, and include procedures and schedules for starting and stopping, trouble shooting, servicing, and maintaining equipment. Training is intended to instruct the Owner on all the capabilities of the control system clearly and completely.

1. Provide the CxA and AE with a training plan four (4) weeks before the planned training.

2. The contractor shall submit a training agenda one (1) week prior to each session for review by the CxA.

3. Training manuals. The standard operating manual for the system and any special training manuals shall be provided for each trainee, with three extra copies left for the O&M manuals. In addition, copies of the system technical manual shall be demonstrated during training and three copies submitted with the O&M manuals.

4. Manuals shall include detailed description of the subject matter for each session. Manuals shall cover all control sequences and have a definitions section that fully describes all relevant words and abbreviations used in the manuals and in all

software displays. The CxA and the AE will review and approve all manuals. Copies of audiovisuals shall be delivered to the Owner.

5. Training sessions shall be tailored to the needs and skill-level of the trainees. Trainers shall be knowledgeable on the system and its use in buildings. The contractor shall employ the most qualified trainers for the on-site sessions. The Owner will approve the instructor prior to scheduling the training.

6. Should the system fail to perform in accordance with the requirements of the O&M manual or sequence of operations during any demonstration, the system shall be repaired or adjusted as necessary and the demonstration repeated.

7. The controls contractor shall attend sessions other than the controls training, as requested, to discuss the interaction of the controls system as it relates to the equipment being discussed.

8. Training shall be conducted in (3) phases:

    a. Training Phase I. – Basic Control System Operation. The first training shall consist of general system user training. This training may be held on-site or in the supplier's facility. If held off-site, the training may occur prior to final completion of the system installation. Upon completion, each student, using appropriate documentation, should be able to perform elementary operations and describe general hardware architecture and functionality of the system. If owner personnel are sufficiently competent, the Owner may choose to waive this training phase.

    b. Training Phase II. - Building Control Systems Operation. The second session shall be held on-site for actual hands-on training after the completion of system commissioning. The session shall include instruction on:

        1) Specific hardware configuration of installed systems in this building and specific instruction for operating the installed system, including HVAC systems, lighting controls and any interface with security and communication systems.

        2) Security levels, alarms, system start-up, shut-down, power outage and restart routines, changing set points and alarms and other typical changed parameters, overrides, freeze protection, manual operation of equipment, optional control strategies that can be considered, energy savings strategies and set points that if changed shall adversely affect energy consumption, energy accounting, procedures for obtaining vendor assistance, etc.

        3) All trending and monitoring features, such as values, change of state, and totalization. Instruction in trending shall include setting up, executing, downloading, viewing both tabular and graphically and printing trends. The Contractor shall require trainees to set-up actual trends in the presence of the trainer.

        4) Every screen shall be completely discussed, allowing time for questions.

5) Use of keypad or plug-in laptop computer at the zone level.

6) Use of remote access to the system via phone lines or networks.

7) Setting up and changing an air terminal unit controller.

8) Graphics generation

9) Point database entry and modifications

10) Understanding DDC field panel operating programming (when applicable)

c. Training Phase III. – Building Systems Follow-Up Training. The third training shall be conducted on-site six months after occupancy. The session shall be structured to address specific topics that trainees need to discuss and to answer questions concerning operation of the system.

END OF SECTION

SECTION 260800

COMMISSIONING OF ELECTRICAL

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this section.

B. In addition to the drawings and general provisions of the contract, commissioning requirements are defined in the following sections:

1. Section 019100 – Commissioning
2. Section 220800 – Commissioning of Plumbing
3. Section 230800 – Commissioning of HVAC
4. Section 230910 – Commissioning of Building Automation System

1.2 SUMMARY

A. This section includes commissioning process requirements for Electrical systems, assemblies, and equipment.

B. General commissioning requirements are described in Division 01 Section 019100 and are therefore not repeated in this Section.

1.3 SYSTEMS TO BE COMMISSIONED

A. Commissioning of the electrical systems shall include:
1. Additions to the normal power distribution system, including new switchboards, panelboards, and convenience outlets
2. Modifications to existing normal power distribution switchboards
3. Variable frequency controllers and across-the-line starters at new mechanical and plumbing equipment
4. Renovations and additions to the emergency power distribution system, including replacement of circuit breakers at the existing emergency generator, new automatic transfer switches, and annunciators
5. Normal and emergency lighting and lighting control systems

1.4 SUBMITTALS

A. Refer to Division 01 Section 013300 “Submittal Procedures” for specific requirements.

B. In addition, provide the following:

1. Certificates of readiness
2. Certificates of completion of installation, prestart, and startup activities.
3. O&M manuals
4. Test reports
5. Completed Construction Checklists

PART 2 - PRODUCTS

2.1 TEST EQUIPMENT

A. The Contractor shall furnish all standard testing equipment required to perform startup, initial checkout and functional performance testing for the equipment being tested. For example, the electrical contractor of Division 26 shall ultimately be responsible for all standard testing equipment for the electrical systems and controls systems in Division 26. A sufficient quantity of two-way radios shall be provided by each contractor.

B. Refer to Division 01 Section 019100 “Commissioning” for a detailed description of test equipment requirements.

PART 3 - EXECUTION

3.1 GENERAL DOCUMENTATION REQUIREMENTS

A. With assistance from the installing contractors, the CxA shall prepare Construction Checklists for all commissioned components, equipment, and systems.

B. Red-lined and As-Built Drawings

1. The contractor shall verify all equipment, systems, instrumentation, wiring and components are shown correctly on red-lined drawings.
2. Preliminary red-lined drawings shall be made available to the Commissioning Team for use prior to the start of Functional Performance Testing.
3. The Contractor shall incorporate changes resulting from Functional Testing into the final as-built drawings to be created from the red-lined drawings.
4. The contracted party, as defined in the Contract Documents, shall create the As-Built drawings.
5. All red-lined drawings shall be available on-site for review by the Owner and the CxA.

C. Operation and Maintenance Data

1. Contractor shall provide a copy of O&M literature within 45 days of each submittal acceptance for use during the commissioning process for all commissioned equipment and systems.
2. The CxA will review the O&M literature once for conformance to project requirements.
3. The CxA shall receive a copy of the final approved O&M literature once corrections have been mad by the Contractor.

D. Demonstration and Training

1. Contractor shall provide demonstration and training as required by the specifications.
2. A complete training plan and schedule shall be submitted by the Contractor to the CxA four weeks (4) prior to any training.
3. A training agenda for each training session shall be submitted to the CxA one (1) week prior the training session.
4. The CA shall be notified at least (72) hours in advance of scheduled tests so that testing may be observed by the CA and Owner's representative. A copy of the test record shall be provided to the CA, Owner, and Architect.
5. Engage a Factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain specific equipment.
6. Train Owner's maintenance personnel on procedures and schedules for starting and stopping, trouble shooting, servicing, and maintaining equipment.
7. Review data in O&M Manuals.

E. Systems Manual Requirements:

1. The Systems Manual is intended to be a usable information resource containing all of the information related to the systems, assemblies, and Commissioning Process in one place with indexes and cross references.

2. The GC shall include final approved versions of the following information for the Systems Manual:
    a. As-Built System Diagrams
    b. Verified Record Drawings
    c. Test Results not otherwise included in Cx Record
    d. Periodic Maintenance Information for computer maintenance management system
    e. Recommendations for recalibration frequency of sensors and actuators
    f. A list of contractors, subcontractors, suppliers, architects, and engineers involved in the project along with their contact information
    g. Training Records, Information on training provided, attendees list, and any on-going training

3. This information shall be organized and arranged by building system, such as fire alarm, chilled water, heating hot water, etc.
4. Information should be provided in an electronic version to the extent possible. Legible, scanned images are acceptable for non-electronic documentation to facilitate this deliverable.

3.2 COMMISSIONING TEAM RESPONSIBILITIES

A. Refer to Division 01 Section 019100 “Commissioning” for commissioning team member roles and responsibilities.

3.3 TESTING PREPARATION

A. Certify in writing to the CxA that Electrical systems, subsystems, and equipment have been installed, calibrated, and started and are operating according to the Contract Documents.

B. Certify in writing to the CxA that Electrical instrumentation and control systems have been completed and calibrated, that they are operating according to the Contract Documents, and that pretest set points have been recorded.

C. Certify in writing that testing procedures have been completed and that testing reports have been submitted, discrepancies corrected, and corrective work approved.

D. Place systems, subsystems, and equipment into operating mode to be tested (e.g., normal shutdown, normal auto position, normal manual position, unoccupied cycle, emergency power, and alarm conditions).

E. Inspect and verify the position of each device and interlock identified on checklists.

F. Check safety cutouts, alarms, and interlocks with smoke control and life-safety systems during each mode of operation.

G. Testing Instrumentation: Install measuring instruments and logging devices to record test data as directed by the CxA.

H. If the failure rate of a similar family of equipment or devices is greater than 10%, then the Owner shall be notified. The matter shall be addressed by the Owner, CM, CxA, and other applicable parties. The failure issue shall be resolved to the Owner’s satisfaction.

3.4 GENERAL TESTING REQUIREMENTS

A. Provide technicians, instrumentation, and tools to perform commissioning test at the direction of the CxA.

B. Scope of Electrical testing shall include the entire Electrical installation, from the incoming power equipment throughout the distribution system. Testing shall include measuring, but not limited to resistance, voltage, and amperage of system(s) and devices.

C. Test all operating modes, interlocks, control responses, and responses to abnormal or emergency conditions, and verify proper response of building automation system controllers and sensors.

D. The CxA along with the Electrical contractor and other contracted subcontractors, including the fire alarm Subcontractor shall prepare detailed testing plans, procedures, and checklists for Electrical systems, subsystems, and equipment.

E. Tests shall be performed using design conditions whenever possible.

F. Artificial loads may be required to simulate conditions when it is not practical to test under design conditions. Before simulating conditions, calibrate testing instruments. Provide equipment to simulate loads. Set simulated conditions as directed by the CxA and document simulated conditions and methods of simulation. After tests, return settings to normal operating conditions.

G. The CxA may direct that set points be altered when simulating conditions is not practical.

H. The CxA may direct that sensor values be altered with a signal generator when design or simulating conditions and altering set points are not practical.

I. If tests cannot be completed because of a deficiency outside the scope of the Electrical system, document the deficiency and report it to the Owner. After deficiencies are resolved, reschedule tests.

J. If the testing plan indicates specific seasonal testing, complete appropriate initial performance tests and documentation and schedule seasonal tests.

3.5 TESTING PROCEDURES

A. Equipment Testing and Acceptance requirements are specified in individual Division 26 sections. Provide submittals, test data, inspector record, infrared camera and certifications to the CA.

B. Provide technicians, load banks, infrared cameras, instrumentation, tools and equipment to test performance of designated normal and emergency generator and power systems and devices at the direction of the CxA.

3.6 DEFICIENCIES

A. Refer to Division 01 Section 019100 “Commissioning” for requirements pertaining to deficiencies, non-conforming conditions, costs of retesting, or failures due to product defects.

3.7 APPROVAL

A. Refer to Division 01 Section 019100 “Commissioning” for approval procedures.

3.8 DEFERRED TESTING

A. Refer to Division 01 Section 019100 “Commissioning” for requirements pertaining to deferred testing.

3.9 OPERATION AND MAINTENANCE MANUALS

A. Refer to Division 01 Section 019100 “Commissioning” for requirements pertaining to operation and maintenance manuals.

3.10 TRAINING OF OWNER PERSONNEL

A. Refer to Division 01 Section 019100 “Commissioning” for requirements pertaining to training.

B. The electrical contractor shall have the following training responsibilities:

1. Provide the CA with a training plan two weeks before the planned training.
2. Provide designated Owner personnel with comprehensive training in the understanding of the systems and the operation and maintenance of each major piece of commissioned electrical equipment or system.
3. Training shall start with classroom sessions, if necessary, followed by hands on training on each piece of equipment, which shall illustrate the various modes of operation, including startup, shutdown, fire/smoke alarm, power failure, etc.
4. During any demonstration, should the system fail to perform in accordance with the requirements of the O&M manual or sequence of operations, the system shall be repaired or adjusted as necessary and the demonstration repeated.
5. The appropriate trade or manufacturer's representative shall provide the instructions on each major piece of equipment. This person may be the start-up technician for the piece of equipment, the installing contractor or manufacturer’s representative. Practical building operating expertise as well as in-depth knowledge of all modes of operation of the specific piece of equipment are required. More than one party may be required to execute the training.

6. The training sessions shall follow the outline in the Table of Contents of the operation and maintenance manual and illustrate whenever possible the use of the O&M manuals for reference.
7. Training shall include:
    a. Use the printed installation, operation and maintenance instruction material included in the O&M manuals.
    b. Include a review of the written O&M instructions emphasizing safe and proper operating requirements, preventative maintenance, special tools needed and spare parts inventory suggestions. The training shall include start-up, operation in all modes possible, shut-down, seasonal changeover and any emergency procedures.
    c. Discuss relevant health and safety issues and concerns.
    d. Discuss warranties and guarantees.
    e. Cover common troubleshooting problems and solutions.
    f. Explain information included in the O&M manuals and the location of all plans and manuals in the facility.
    g. Discuss any peculiarities of equipment installation or operation.
8. Hands-on training shall include start-up, operation in all modes possible, including manual, shut-down and any emergency procedures and preventative maintenance of all pieces of equipment.
9. The electrical contractor shall fully explain and demonstrate the operation, function and overrides of any local packaged controls, not controlled by the central control system.
10. Training shall occur after functional testing is complete, unless approved otherwise by the Owner's.

END OF SECTION

1 SIGN TYPE N16- BUILDING PLAQUE
SCALE: 1.5" = 1'-0"

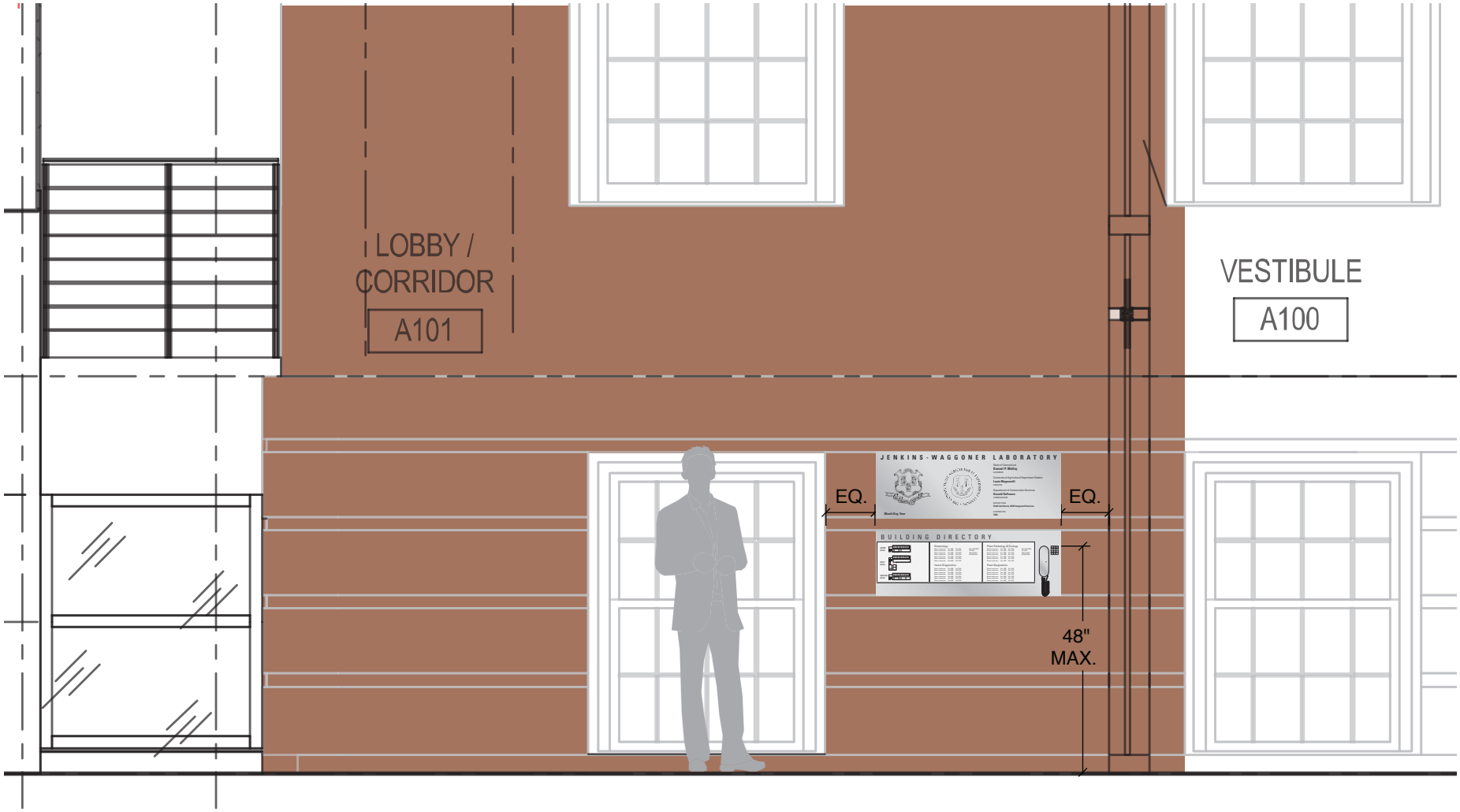
1/4"-THICK ALUMINUM PANEL WITH SATIN FINISH (TO MATCH FINISH OF BUILDING DIRECTORY)

ETCHED AND PAINT-FILLED COPY PER ARTWORK PROVIDED BY DESIGNER (COPY AND COLORS TBD)

PROVIDE CONTINOUS Z-CLIPS TOP AND BOTTOM BEHIND PANEL (AND MOUNTING HARDWARE) OR AS REQUIRED PER WALL CONDITIONS FOR FLUSH-MOUNTING TO WALL

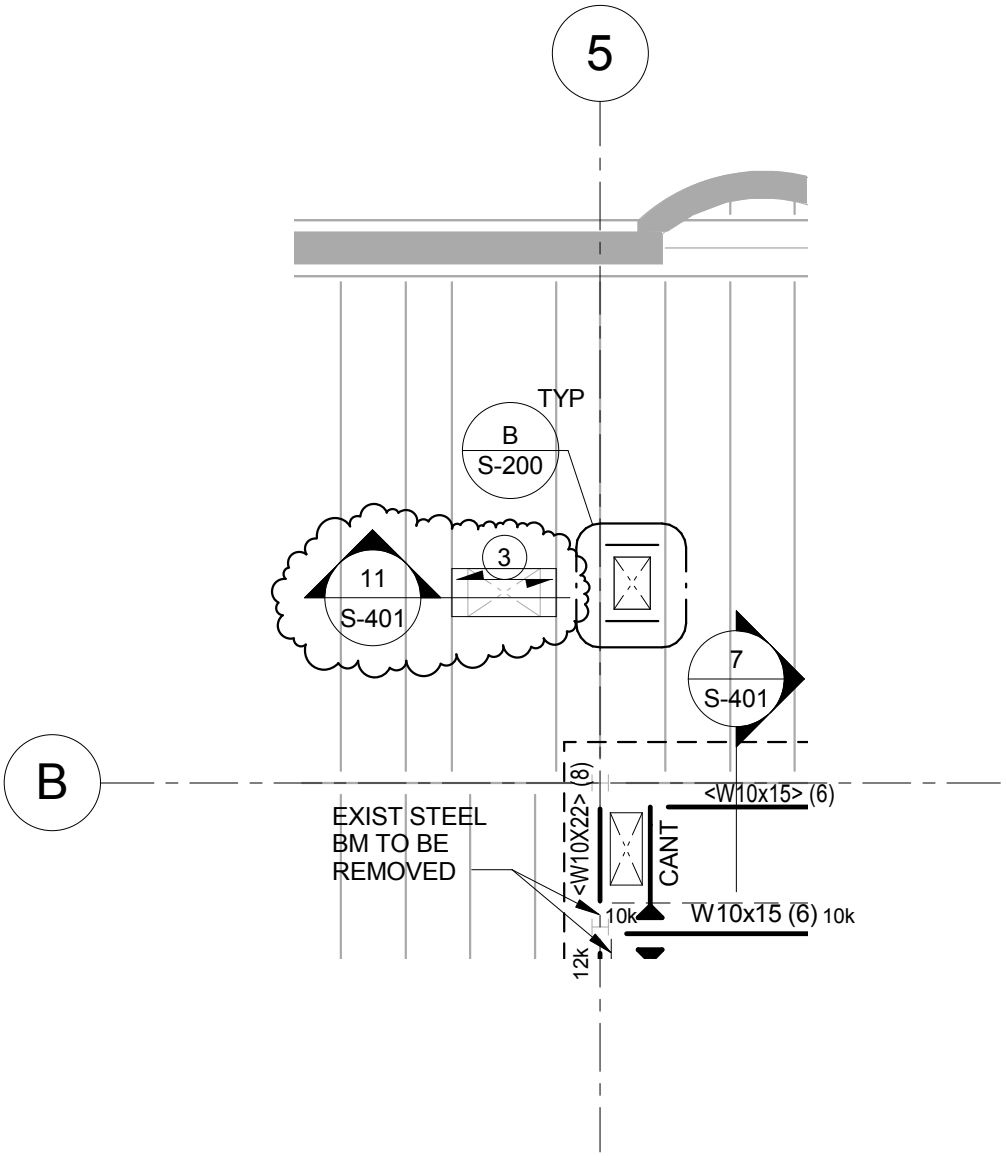
PANEL TO ALIGN WITH REVEALS AND DIRECTORY BELOW (SEE ELEVATION)

Connecticut Department Of Construction Services	Sketch Title: INTERIOR BUILDING PLAQUE			DCS Project Number: BI - P - 86	Sketch Revised
	Project Title: RENOVATIONS and ADDTIONS to JENKINS-WAGGONER LABORATORY			LGD Project Number: 2347	
lebowitz | gould | design 150 west 30th street suite 1202 new york ny 10001 t. 212.695.5700 f. 212.695.1699	Sketch Number: AG-001	RFI Number	Reference Sheet	Revision Number	Sketch Issue Date: 10 January, 2013



1 SIGN TYPE N16 - BUILDING PLAQUE (IN RELATION TO SIGN TYPE N15 - BUILDING DIRECTORY)
SCALE: 3/8" = 1'-0"

Connecticut Department Of Construction Services lebowitz | gould | design 150 west 30th street suite 1202 new york ny 10001 t. 212.695.5700 f. 212.695.1699	Sketch Title: INTERIOR BUILDING PLAQUE Project Title: RENOVATIONS and ADDTIONS to JENKINS-WAGGONER LABORATORY			DCS Project Number: BI - P - 86 LGD Project Number: 2347	Sketch Revised
Sketch Number: AG-002	RFI Number	Reference Sheet	Revision Number	Sketch Issue Date: 10 January, 2013	



FIRST FLOOR FRAMING PLAN

1/8" = 1'-0"

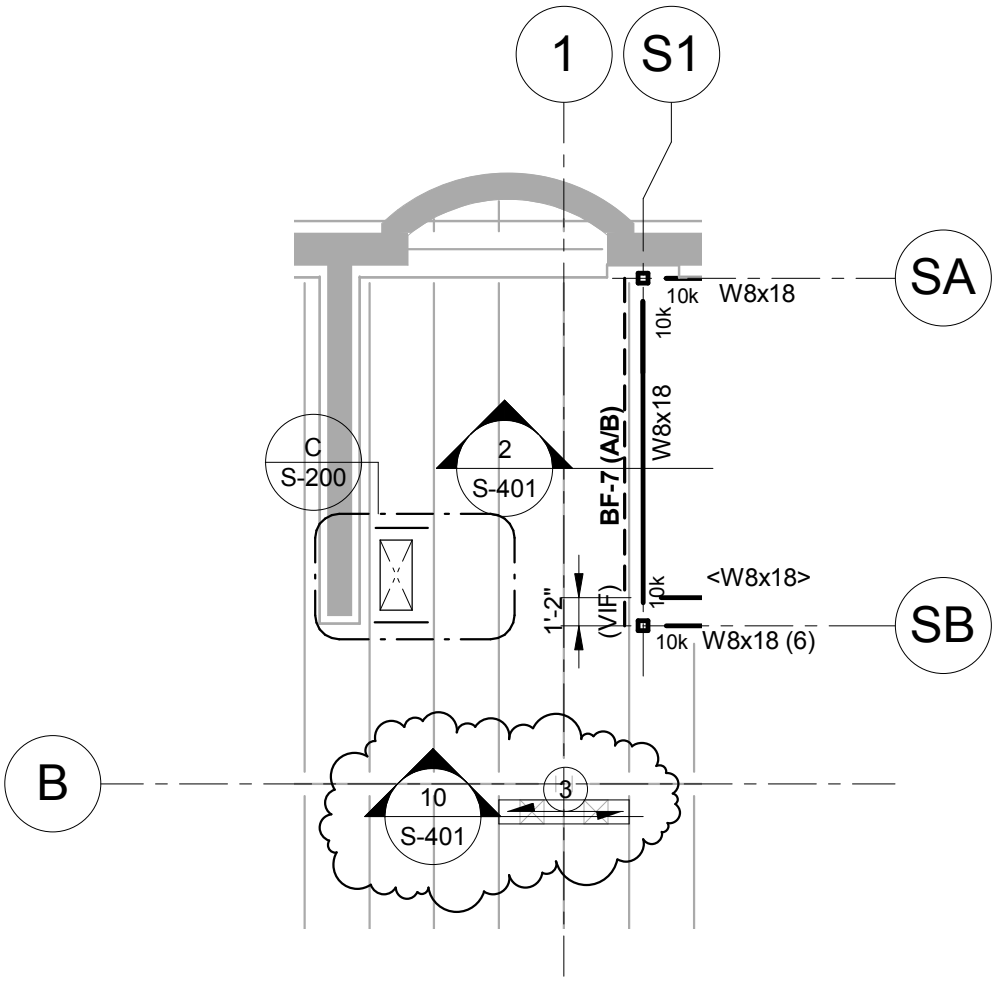
ADDENDUM NO. 1

Connecticut
Department Of
Construction Services

BVH integrated services
STRUCTURAL, MECHANICAL, ELECTRICAL, TECHNOLOGY

50 Griffin Road South
Bloomfield, CT 06002
Tel: (860) 286-9171
www.bvhis.com

Sketch Title			DCS Project Number:	Sketch Revised
FIRST FLOOR FRAMING PLAN			**BI - P - 86**	
Project Title **RENOVATIONS and ADDITIONS to JENKINS-WAGGONER LABORATORY**			BVH Project Number: **2111115**	-
Sketch Number **SKS-001**	RFI Number -	Reference Sheet **S-200**	Revision Number -	Sketch Issue Date **01/10/13**



FIRST FLOOR FRAMING PLAN

1/8" = 1'-0"

ADDENDUM NO. 1

Connecticut
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50 Griffin Road South
Bloomfield, CT 06002
Tel: (860) 286-9171
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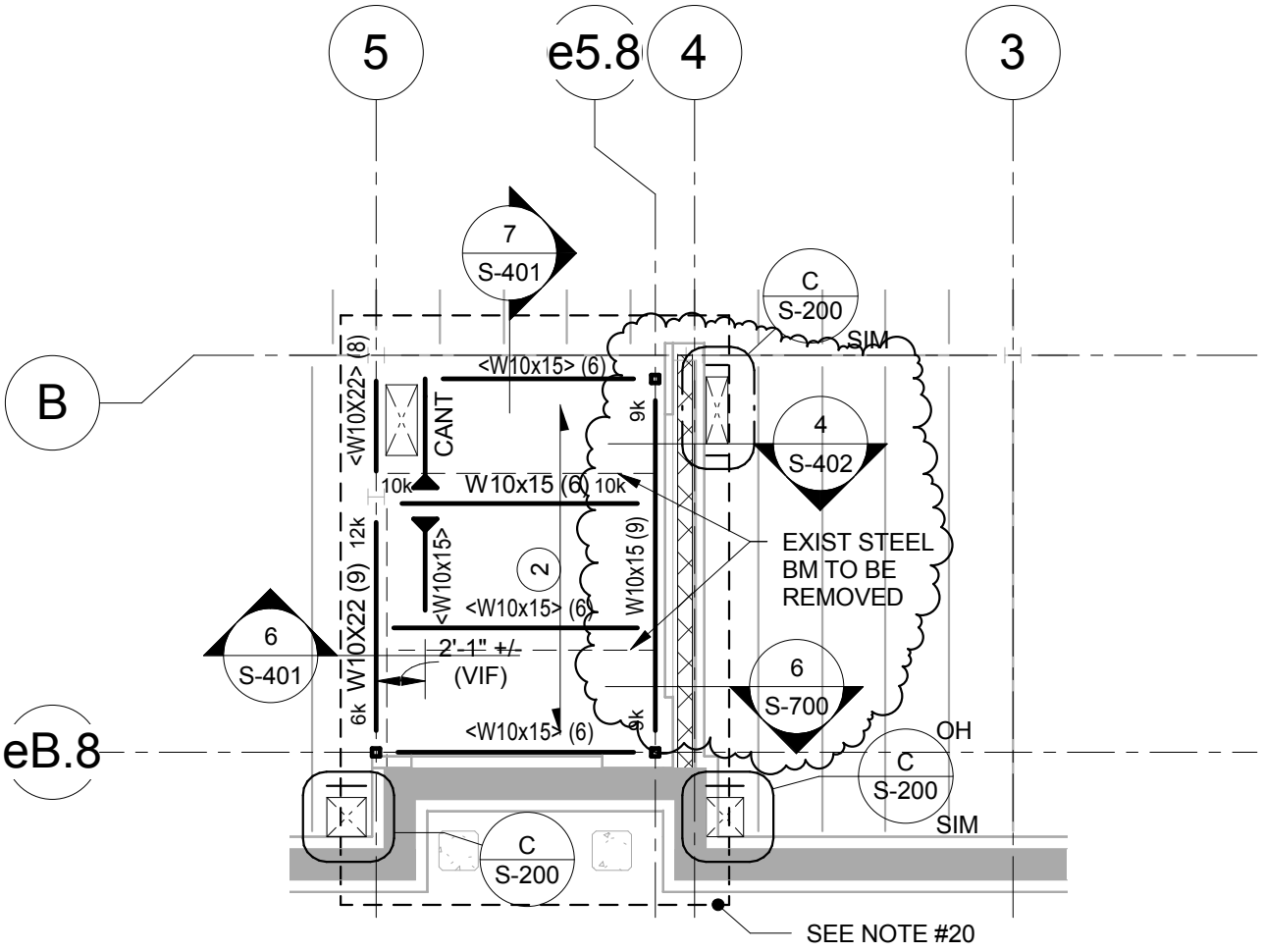
Sketch Title **FIRST FLOOR FRAMING PLAN**				DCS Project Number: **BI - P - 86**	Sketch Revised
Project Title **RENOVATIONS and ADDITIONS to JENKINS-WAGGONER LABORATORY**				BVH Project Number: **2111115**	-
Sketch Number **SKS-002**	RFI Number -	Reference Sheet **S-200**		Revision Number -	Sketch Issue Date **01/10/13**

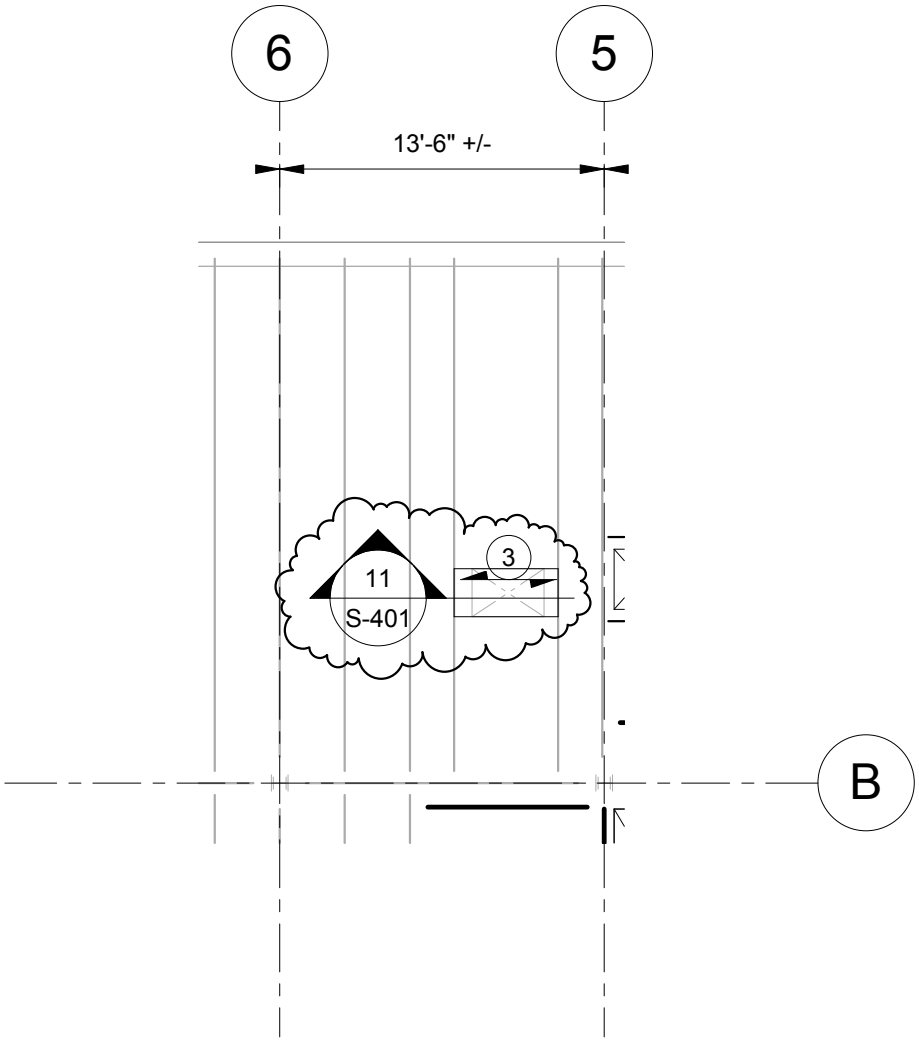


FIRST FLOOR FRAMING PLAN

1/8" = 1'-0"

ADDENDUM NO. 1

Connecticut Department Of Construction Services	Sketch Title **FIRST FLOOR FRAMING PLAN**			DCS Project Number: **BI - P - 86**	Sketch Revised
BVH integrated services 50 Griffin Road South Bloomfield, CT 06002 Tel: (860) 286-9171 www.bvhis.com STRUCTURAL, MECHANICAL, ELECTRICAL, TECHNOLOGY	Project Title **RENOVATIONS and ADDITIONS to JENKINS-WAGGONER LABORATORY**			BVH Project Number: **2111115**	**-**
Sketch Number **SKS-003**	RFI Number **-**	Reference Sheet **S-200**	Revision Number **-**	Sketch Issue Date **01/10/13**	



UPPER FLOOR FRAMING PLAN

1/8" = 1'-0"

ADDENDUM NO. 1

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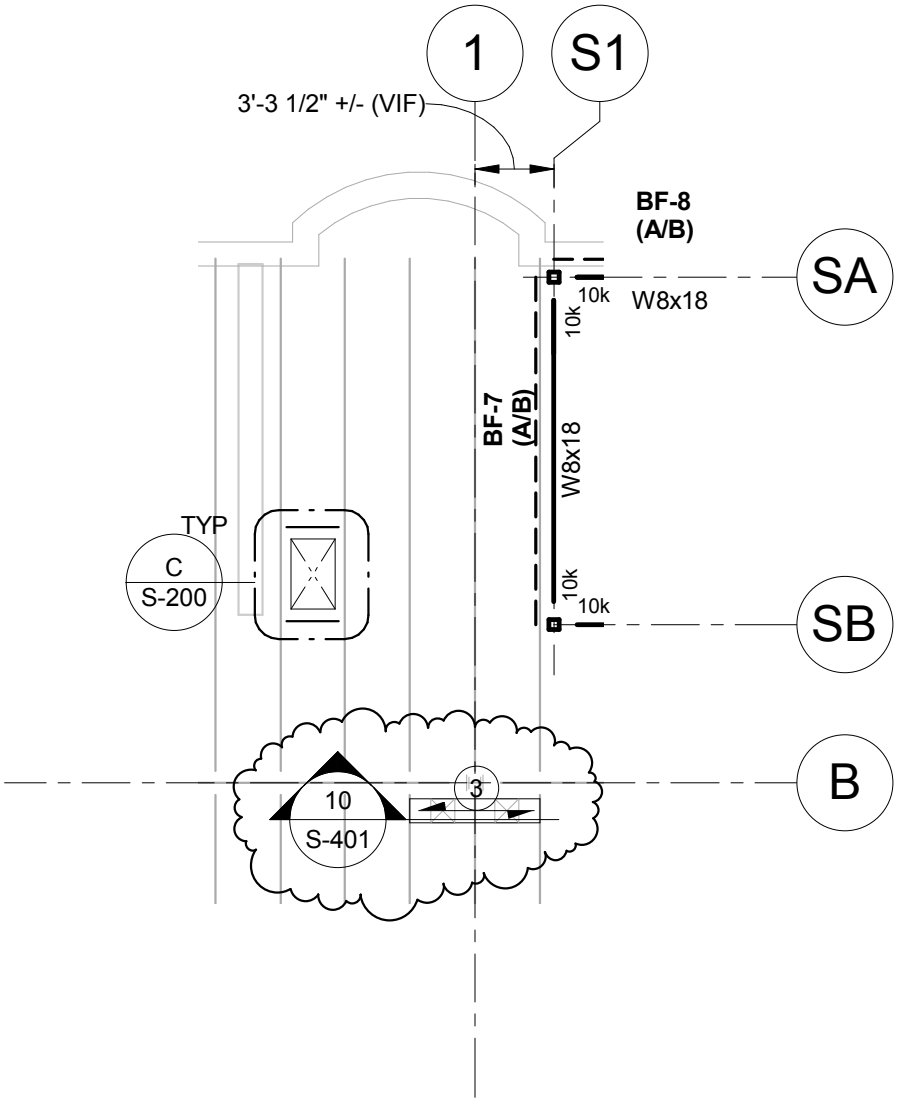
Sketch Title **UPPER FLOOR FRAMING PLAN**				DCS Project Number: **BI - P - 86**	Sketch Revised
Project Title **RENOVATIONS and ADDITIONS to JENKINS-WAGGONER LABORATORY**				BVH Project Number: **2111115**	-
Sketch Number **SKS-004**	RFI Number -	Reference Sheet **S-201**		Revision Number -	Sketch Issue Date **01/10/13**



UPPER FLOOR FRAMING PLAN

1/8" = 1'-0"

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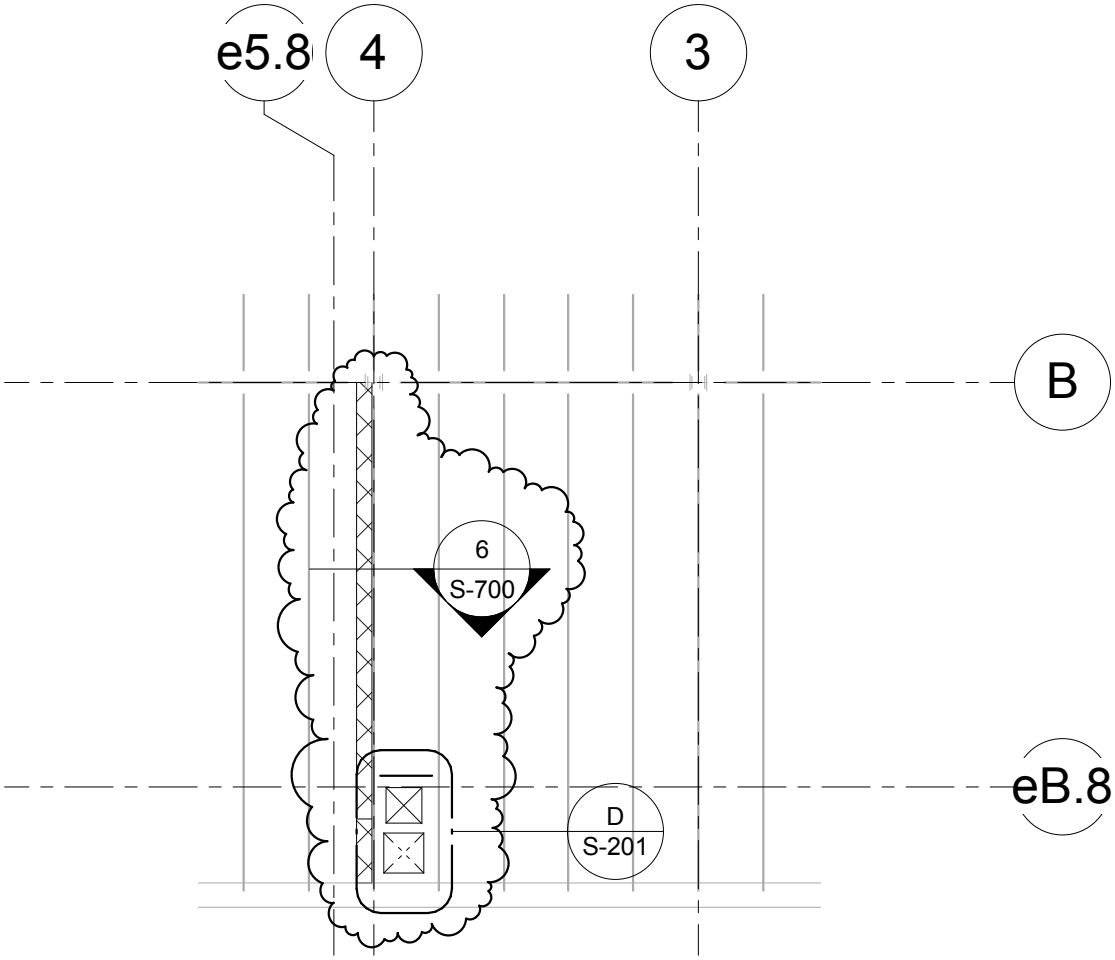
Sketch Title			DCS Project Number:	Sketch Revised
UPPER FLOOR FRAMING PLAN			**BI - P - 86**	
Project Title **RENOVATIONS and ADDITIONS to JENKINS-WAGGONER LABORATORY**			BVH Project Number: **2111115**	**-**
Sketch Number **SKS-005**	RFI Number **-**	Reference Sheet **S-201**	Revision Number **-**	Sketch Issue Date **01/10/13**



UPPER FLOOR FRAMING PLAN

1/8" = 1'-0"

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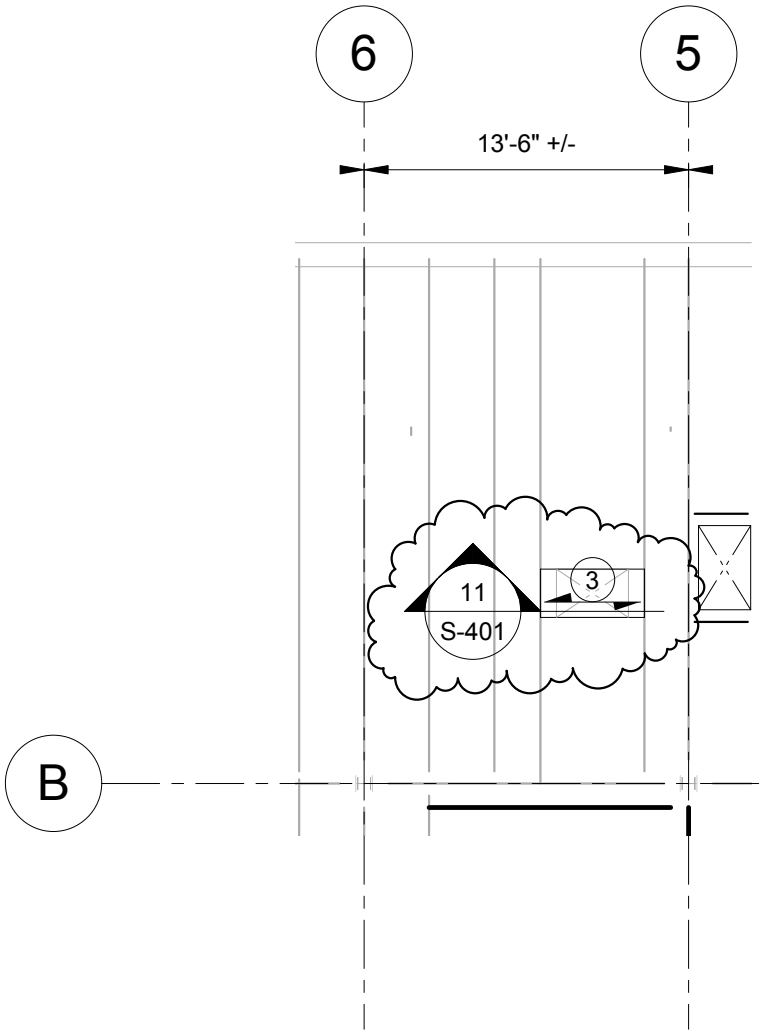
Sketch Title **FIRST FLOOR FRAMING PLAN**				DCS Project Number: **BI - P - 86**	Sketch Revised
Project Title **RENOVATIONS and ADDITIONS to JENKINS-WAGGONER LABORATORY**				BVH Project Number: **2111115**	-
Sketch Number **SKS-006**	RFI Number -	Reference Sheet **S-201**	Revision Number -		Sketch Issue Date **01/10/13**

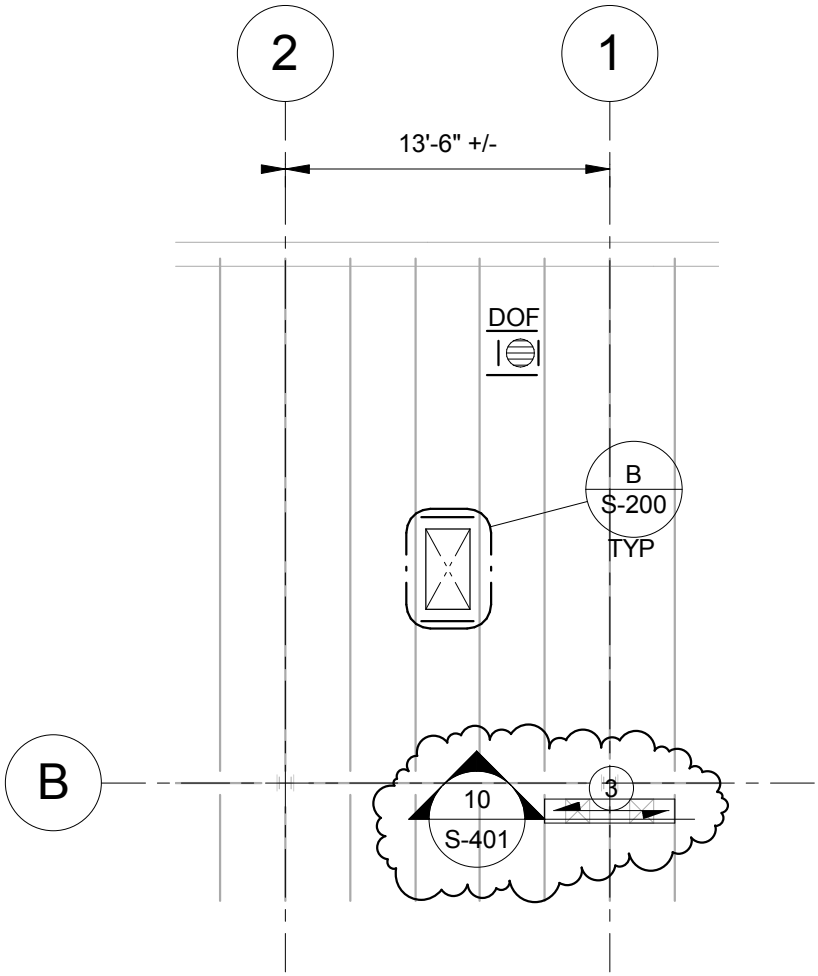


ROOF FRAMING PLAN

1/8" = 1'-0"

ADDENDUM NO. 1

Connecticut Department Of Construction Services	Sketch Title **ROOF FRAMING PLAN**			DCS Project Number: **BI - P - 86**	Sketch Revised
BVH integrated services 50 Griffin Road South Bloomfield, CT 06002 Tel: (860) 286-9171 www.bvhis.com STRUCTURAL, MECHANICAL, ELECTRICAL, TECHNOLOGY	Project Title **RENOVATIONS and ADDITIONS to JENKINS-WAGGONER LABORATORY**			BVH Project Number: **2111115**	**-**
Sketch Number **SKS-007**	RFI Number **-**	Reference Sheet **S-202**	Revision Number **-**	Sketch Issue Date **01/10/13**	

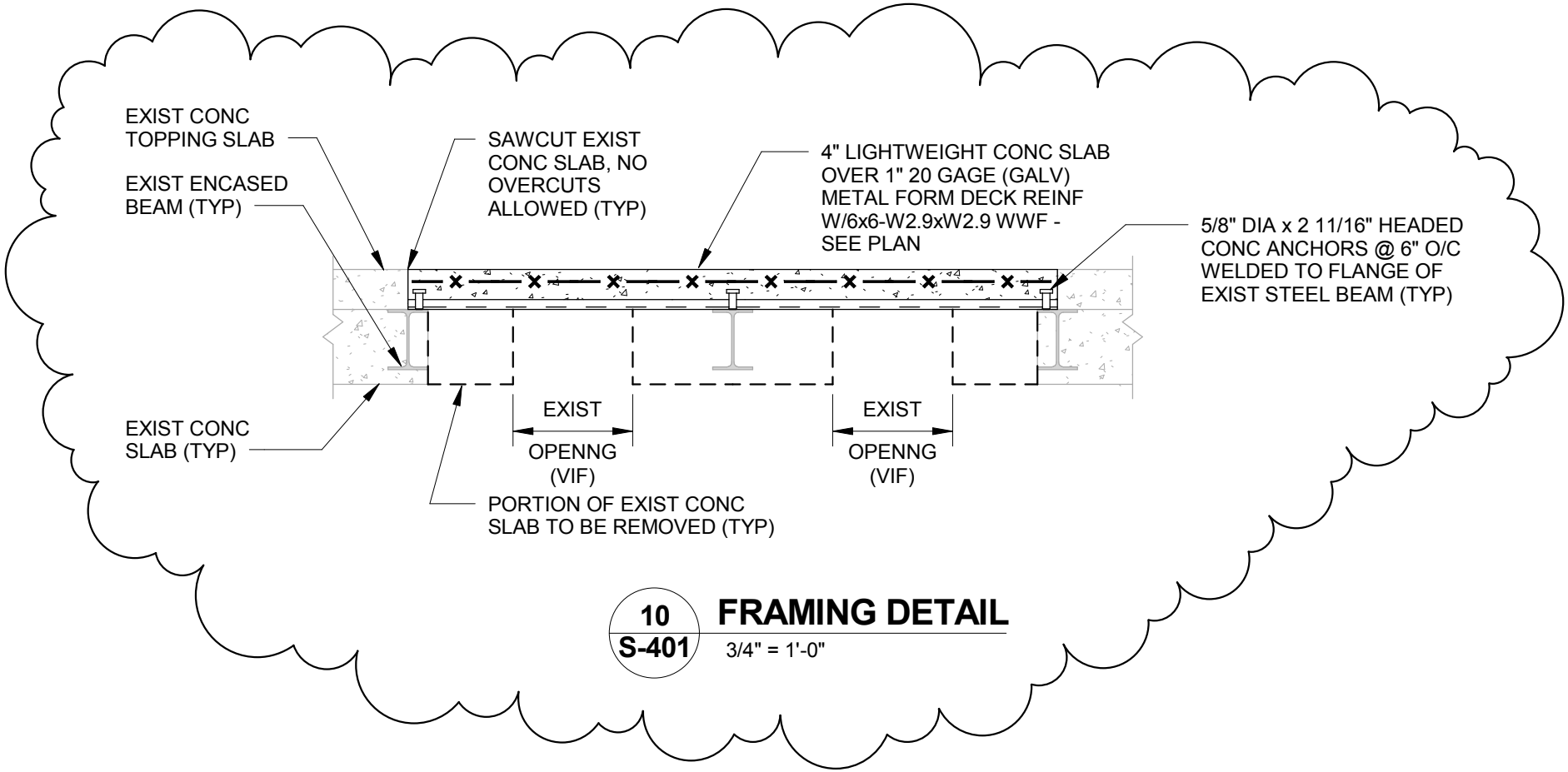


ROOF FRAMING PLAN

1/8" = 1'-0"

ADDENDUM NO. 1

Connecticut Department Of Construction Services	Sketch Title **ROOF FRAMING PLAN**			DCS Project Number: **BI - P - 86**	Sketch Revised
BVH integrated services 50 Griffin Road South Bloomfield, CT 06002 Tel: (860) 286-9171 www.bvhis.com STRUCTURAL, MECHANICAL, ELECTRICAL, TECHNOLOGY	Project Title **RENOVATIONS and ADDITIONS to JENKINS-WAGGONER LABORATORY**			BVH Project Number: **2111115**	**-**
Sketch Number **SKS-008**	RFI Number **-**	Reference Sheet **S-202**	Revision Number **-**	Sketch Issue Date **01/10/13**	



10 / S-401 **FRAMING DETAIL**

3/4" = 1'-0"

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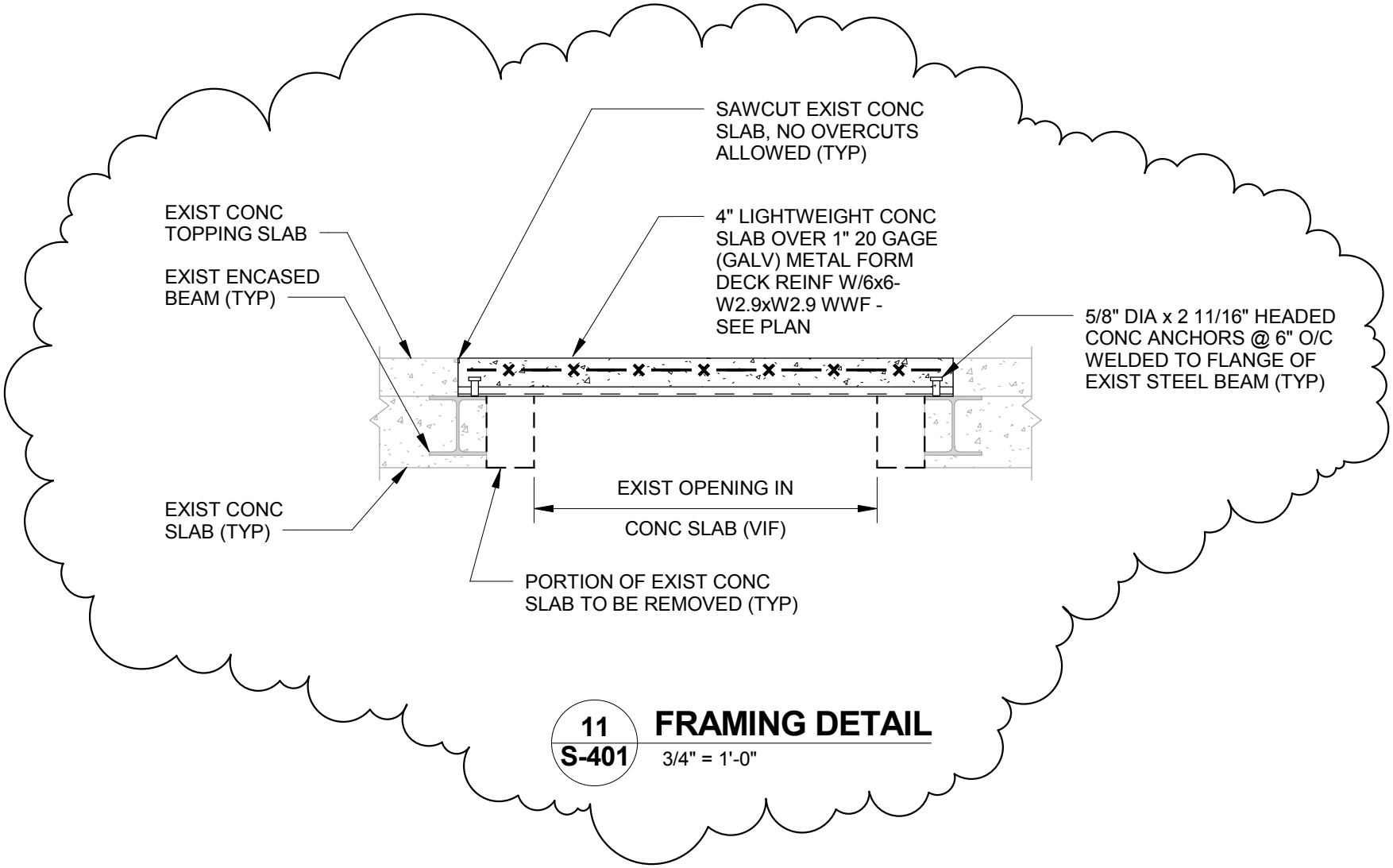
Sketch Title	Project Title	DCS Project Number	Sketch Revised
FRAMING SECTION	**RENOVATIONS and ADDITIONS to JENKINS-WAGGONER LABORATORY**	**BI - P - 86** / BVH Project Number: **2111115**	-

Sketch Number	RFI Number	Reference Sheet	Revision Number	Sketch Issue Date
SKS-009	-	S-401	-	01/10/13



11 / S-401 **FRAMING DETAIL**

3/4" = 1'-0"

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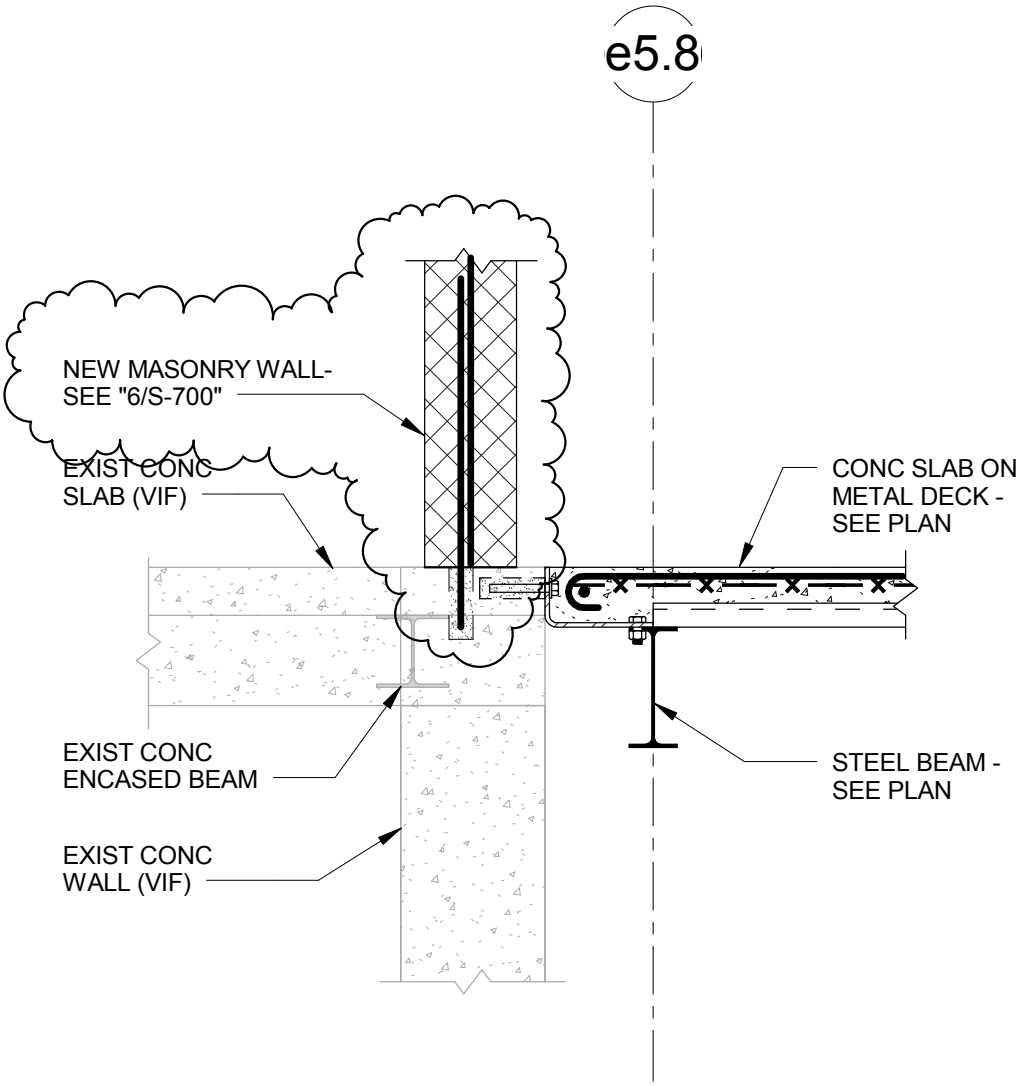
Sketch Title **FRAMING SECTION**				DCS Project Number: **BI - P - 86**	Sketch Revised
Project Title **RENOVATIONS and ADDITIONS to JENKINS-WAGGONER LABORATORY**				BVH Project Number: **2111115**	-
Sketch Number **SKS-010**	RFI Number -	Reference Sheet **S-401**	Revision Number -	Sketch Issue Date **01/10/13**	



4 / S-402 FRAMING DETAIL

3/4" = 1'-0"

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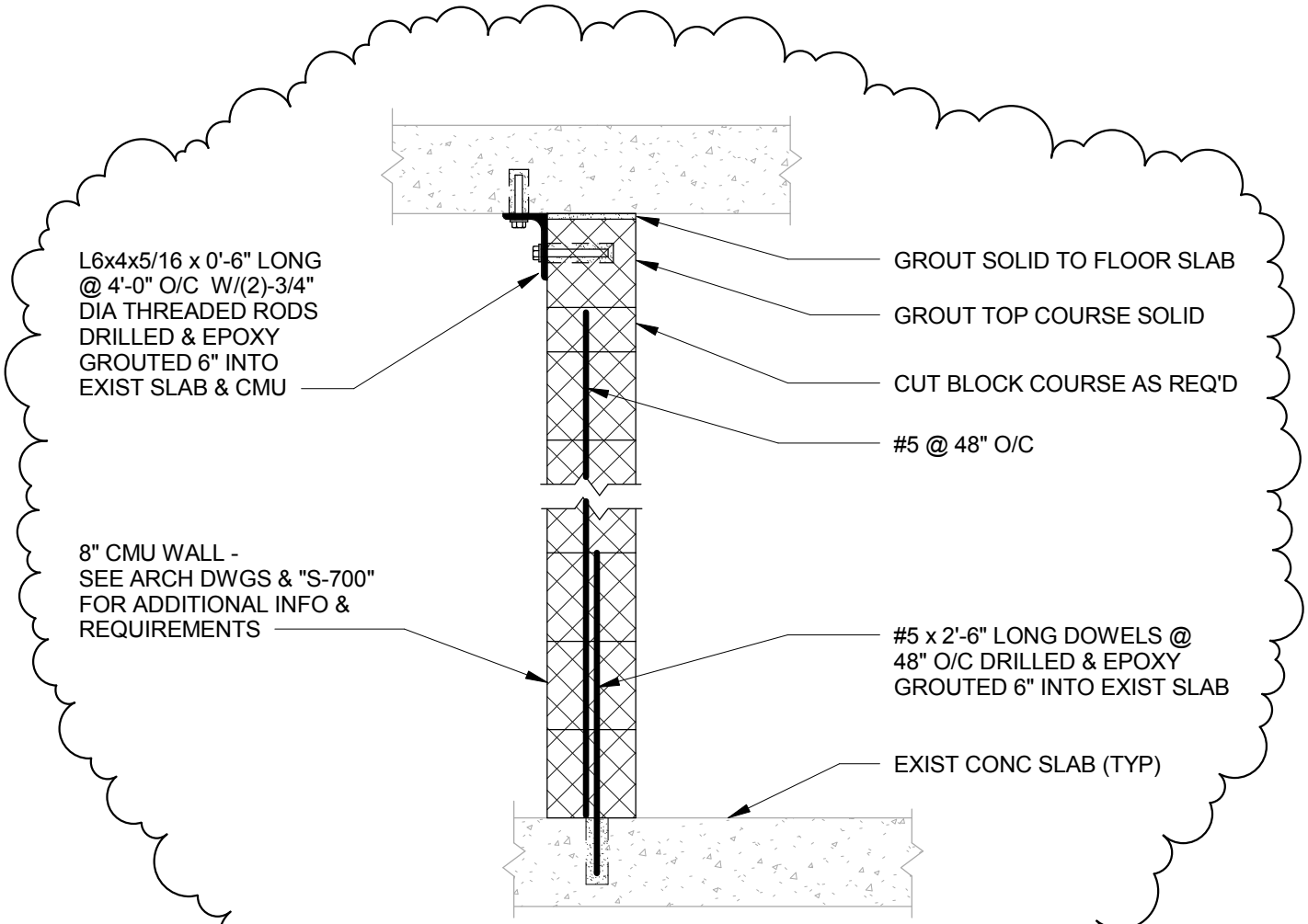
Sketch Title **FRAMING SECTION**				DCS Project Number: **BI - P - 86**	Sketch Revised
Project Title **RENOVATIONS and ADDITIONS to JENKINS-WAGGONER LABORATORY**				BVH Project Number: **2111115**	-
Sketch Number **SKS-011**	RFI Number -	Reference Sheet **S-402**		Revision Number -	Sketch Issue Date **01/10/13**



6
S-700

CMU WALL SECTION

3/4" = 1'-0"

ADDENDUM NO. 1

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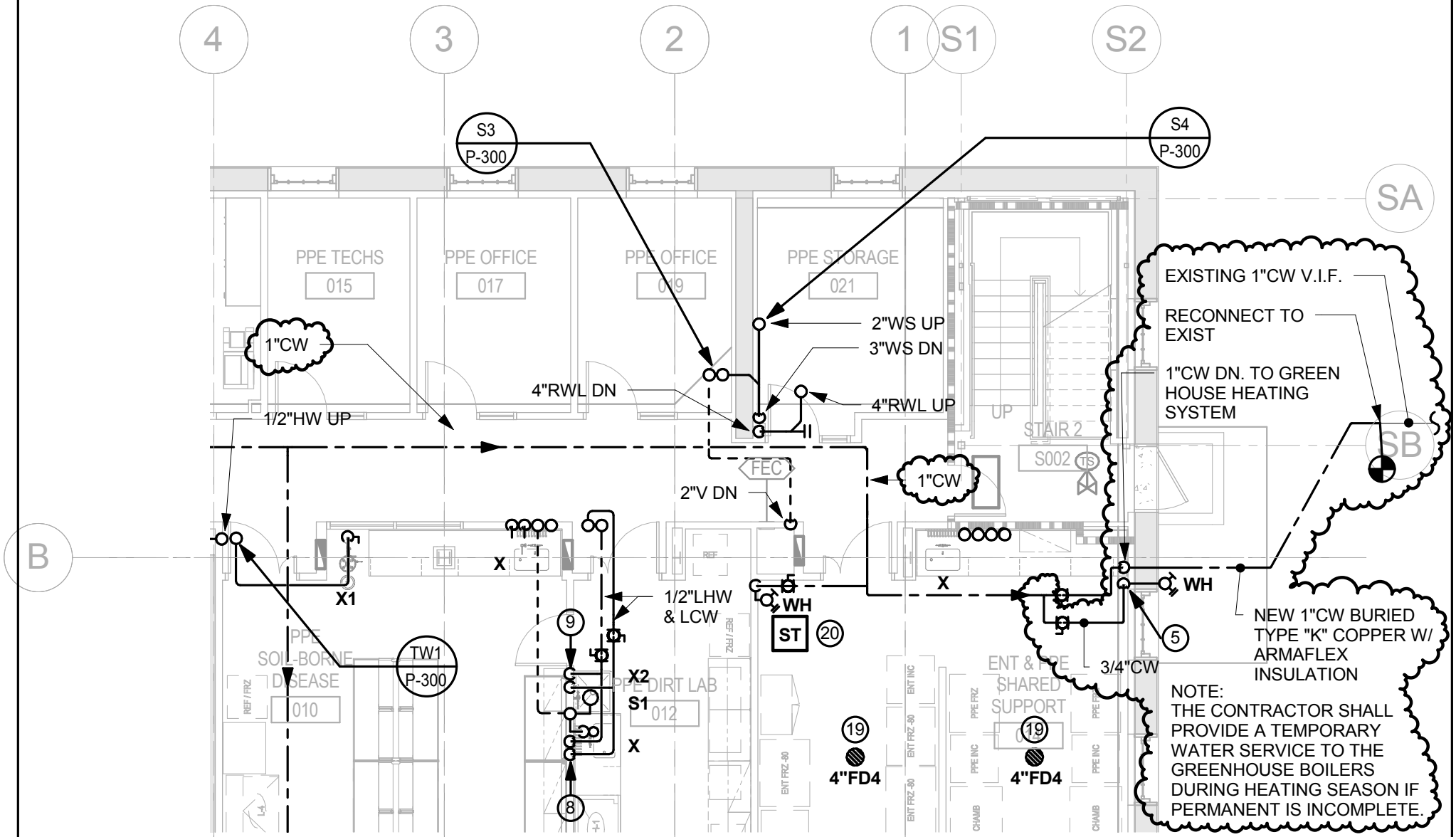
Sketch Title **CMU WALL SECTION**				DCS Project Number: **BI - P - 86**	Sketch Revised
Project Title **RENOVATIONS and ADDITIONS to JENKINS-WAGGONER LABORATORY**				BVH Project Number: **2111115**	**-**
Sketch Number **SKS-012**	RFI Number **-**	Reference Sheet **S-700**		Revision Number **-**	Sketch Issue Date **01/10/13**



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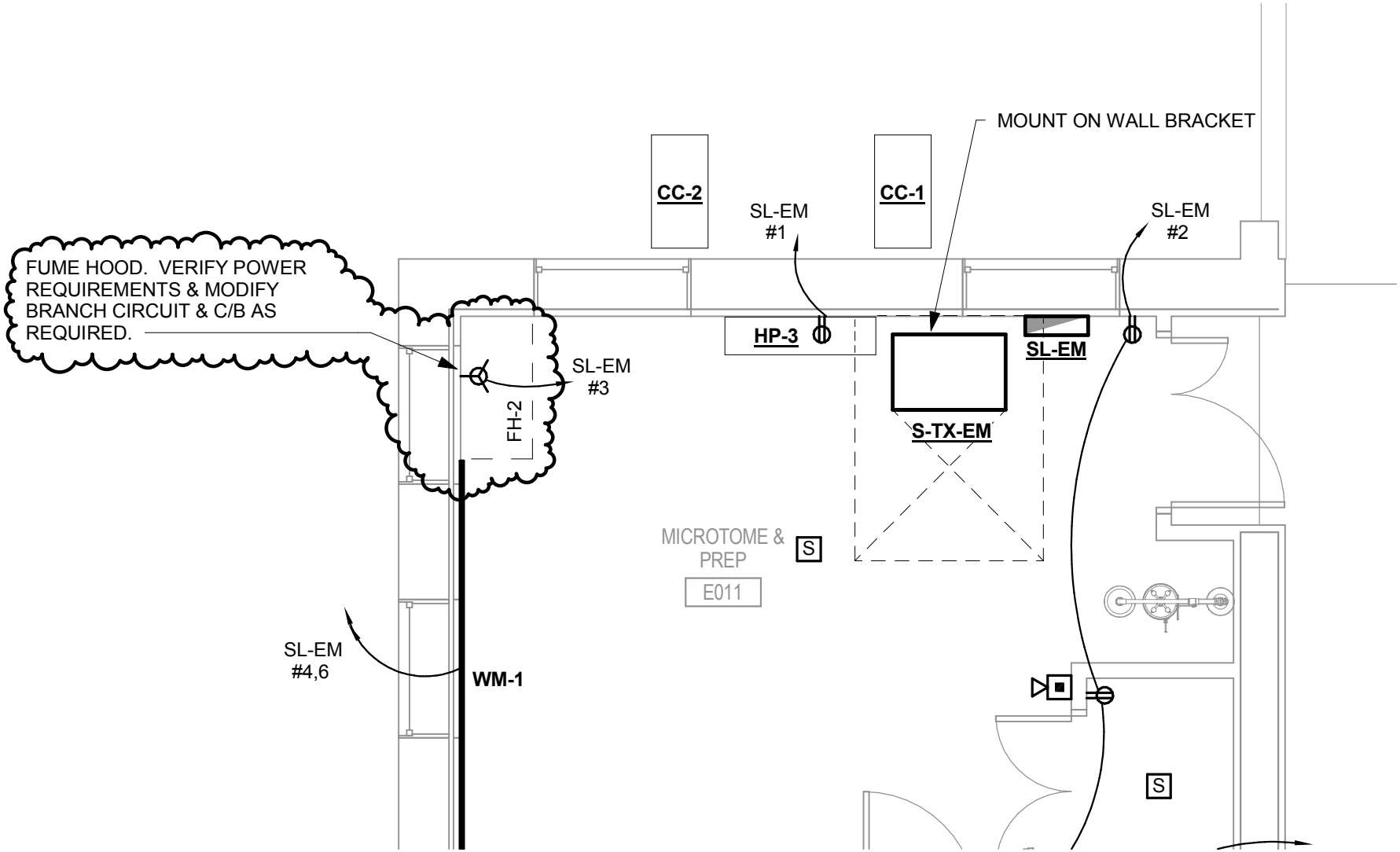
Sketch Title: **PLUMBING LOWER FLOOR PLAN**				DCS Project Number: **BI - P - 86**	Sketch Revised
Project Title: **RENOVATIONS and ADDITIONS to JENKINS-WAGGONER LABORATORY**				BVH Project Number: **2111115**	
Sketch Number **SKP-001**	RFI Number	Reference Sheet **P-101**	Revision Number	Sketch Issue Date **01/10/13**	



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Connecticut Department Of Construction Services; BVH integrated services, 50 Griffin Road South, Bloomfield, CT 06002, Tel: (860) 286-9171, www.bvhis.com, STRUCTURAL, MECHANICAL, ELECTRICAL, TECHNOLOGY	Sketch Title: **ELECTRICAL LOWER & EM SUITE PART PLAN** Project Title: **RENOVATIONS and ADDITIONS to JENKINS-WAGGONER LABORATORY**			DCS Project Number: **BI - P - 86** BVH Project Number: **2111115**	Sketch Revised
Sketch Number **SKE-001**	RFI Number	Reference Sheet **E-801**		Revision Number	Sketch Issue Date **01/10/13**

SECTION 23 64 26

ROTARY-SCREW WATER CHILLERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Packaged, air-cooled chillers.

B. Related Section:

1. Section 20900 "Instrumentation and Controls for HVAC."

1.3 DEFINITIONS

A. BAS: Building automation system.

B. COP: Coefficient of performance. The ratio of the rate of heat removal to the rate of energy input using consistent units for any given set of rating conditions.

C. EER: Energy-efficiency ratio. The ratio of the cooling capacity given in terms of Btu/h to the total power input given in terms of watts at any given set of rating conditions.

D. IPLV: Integrated part-load value. A single-number part-load efficiency figure of merit calculated per the method defined by ARI 550/590 and referenced to ARI standard rating conditions.

E. kW/Ton: The ratio of total power input of the chiller in kilowatts to the net refrigerating capacity in tons at any given set of rating conditions.

F. NPLV: Nonstandard part-load value. A single-number part-load efficiency figure of merit calculated per the method defined by ARI 550/590 and intended for operating conditions other than ARI standard rating conditions.

1.4 PERFORMANCE REQUIREMENTS

A. Seismic Performance: Chillers shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

1. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."

B. Condenser-Fluid Temperature Performance:

1. Startup Condenser-Fluid Temperature: Chiller shall be capable of starting with an entering condenser-fluid temperature of 40 deg F and providing stable operation until the system temperature is elevated to the minimum operating entering condenser-fluid temperature.
2. Minimum Operating Condenser-Fluid Temperature: Chiller shall be capable of continuous operation over the entire capacity range indicated with an entering condenser-fluid temperature of 55 deg F.
3. Make factory modifications to standard chiller design if necessary to comply with performance indicated.

C. Site Altitude: Chiller shall be suitable for altitude in which installed without affecting performance indicated. Make adjustments to affected chiller components to account for site altitude.

D. Performance Tolerance: Comply with ~~the following in lieu of~~ ARI 550/590:

~~1. Allowable Capacity Tolerance: Zero percent.~~
~~2. Allowable IPLV/NPLV Performance Tolerance: Zero percent.~~

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include refrigerant, rated capacities, operating characteristics, sound ratings, furnished specialties, and accessories.

1. Performance at ARI standard conditions and at conditions indicated.
2. Performance at ARI standard unloading conditions.
3. Minimum evaporator flow rate.
4. Refrigerant capacity of chiller.
5. Oil capacity of chiller.
6. Fluid capacity of evaporator.
7. Characteristics of safety relief valves.
8. Fluid capacity of condenser and heat-reclaim condenser.
9. Minimum entering condenser-fluid temperature.
10. Performance at varying capacities with constant-design entering condenser-fluid temperature. Repeat performance at varying capacities for different condenser-fluid temperatures from design to minimum in 5 deg F increments.
11. Minimum entering condenser-air temperature.
12. Maximum entering condenser-air temperature.
13. Performance at varying capacities with constant-design entering condenser-air temperature. Repeat performance at varying capacities for different entering condenser-air temperatures from design to minimum in 10 deg F increments.

B. LEED Submittals:

1. Product Data for Credit EA 4: Documentation indicating that equipment and refrigerants comply.

C. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

1. Detail equipment assemblies and indicate dimensions, weights, load distribution, required clearances, method of field assembly, components, and location and size of each field connection.
2. Wiring Diagrams: For power, signal, and control wiring.

1.6 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Floor plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from Installers of the items involved:

1. Structural supports.
2. Piping roughing-in requirements.
3. Wiring roughing-in requirements, including spaces reserved for electrical equipment.
4. Access requirements, including working clearances for mechanical controls and electrical equipment, and tube pull and service clearances.

B. Certificates: For certification required in "Quality Assurance" Article.

~~C. Seismic Qualification Certificates: For chillers, accessories, and components, from manufacturer.~~

~~1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.~~
~~2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.~~
~~3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.~~

D. Source quality-control reports.

E. Startup service reports.

F. Warranty: Sample of special warranty.

1.7 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For each chiller to include in emergency, operation, and maintenance manuals.

1.8 QUALITY ASSURANCE

A. ARI Certification: Certify chiller according to ARI 550 and ARI 590 certification program(s).

B. ARI Rating: Rate chiller performance according to requirements in ARI 550/590.

C. ASHRAE Compliance:

1. ASHRAE 15 for safety code for mechanical refrigeration.
2. ASHRAE 147 for refrigerant leaks, recovery, and handling and storage requirements.

D. ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1.

E. ASME Compliance: Fabricate and label chiller to comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1, and include an ASME U-stamp and nameplate certifying compliance.

F. Comply with NFPA 70.

G. Comply with requirements of UL and UL Canada and include label by a qualified testing agency showing compliance.

H. ANSI/ASHRAE/IESNA Standard 90.1-2001 Compliance: Equipment shall meet or exceed the minimum efficiency requirements of the Standard. Equipment shall bear a permanent label installed by the manufacturer stating that the equipment complies with the requirements of ASHRAE Standard 90.1.

I. Chiller sound ratings must be equal or below the following project requirements to meet local code requirements:

Chiller Maximum Sound Power (Lw) Levels								
200-Ton Air-Cooled Chiller - Grade-Mounted								
Chiller	63Hz	125Hz	250Hz	500Hz	1 kHz	2 kHz	4 kHz	8 kHz
Sound Power Levels (dB ref 1 pw)	88	98	98	97	93	90	81	79

See Part 2- Products-5.2 Capacities and Characteristics.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Ship chillers from the factory fully charged with refrigerant.

B. Ship each chiller with a full charge of refrigerant. Charge each chiller with nitrogen if refrigerant is shipped in containers separate from chiller.

C. Ship each oil-lubricated chiller with a full charge of oil.

1. Ship oil factory installed in chiller in containers separate from chiller.

D. Package chiller for export shipping in totally enclosed crate and bagging.

1.10 COORDINATION

A. Coordinate sizes and locations of concrete bases with actual equipment provided. Cast anchor-bolt inserts into bases.

B. Coordinate sizes, locations, and anchoring attachments of structural-steel support structures.

C. Coordinate sizes and locations of roof curbs, equipment supports, and roof penetrations with actual equipment provided.

1.11 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of chillers that fail in materials or workmanship within specified warranty period.

1. Extended warranties include, but are not limited to, the following:

a. Complete chiller including refrigerant and oil charge.
b. Complete compressor and drive assembly including refrigerant and oil charge.
c. Refrigerant and oil charge.
d. Parts and labor.
e. Loss of refrigerant charge for any reason.

2. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PACKAGED, AIR-COOLED CHILLERS

A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

1. McQuay International.
2. Trane; a division of American Standard.
3. YORK International Corporation.

B. Description: Factory-assembled and run-tested chiller complete with base and frame, condenser casing, compressors, compressor motors and motor controllers, evaporator, condenser coils, condenser fans and motors, electrical power, controls, and accessories.

C. Fabricate base, frame, and attachment to chiller components strong enough to resist chiller movement during a seismic event when chiller base is anchored to field support structure.

D. Cabinet:

1. Base: Galvanized-steel base extending the perimeter of chiller. Secure frame, compressors, and evaporator to base to provide a single-piece unit.
2. Frame: Rigid galvanized-steel frame secured to base and designed to support cabinet, condenser, control panel, and other chiller components not directly supported by base.
3. Casing: Galvanized steel.
4. Finish: Coat base, frame, and casing with a corrosion-resistant coating capable of withstanding a salt-spray test according to ASTM B 117.
5. Sound-reduction package designed to reduce sound level without affecting performance and consisting of the following: Note: See Quality Assurance 1.8 I for sound level requirements.

a. Acoustic enclosure around compressors.
b. Reduced-speed fans with acoustic treatment.

6. Security Package: Provide removable ~~[**grilles**]~~ ~~[~~**louvered panels**~~]~~ with fasteners for additional protection of compressors, evaporator, and condenser coils without inhibiting service access. Finish to match cabinet.

E. Compressors:

1. Description: Positive displacement, hermetically sealed.
2. Casing: Cast iron, precision machined for minimum clearance about periphery of rotors.
3. Rotors: Manufacturer's standard one- or two-rotor design.
4. Each compressor provided with suction and discharge shutoff valves, crankcase oil heater, and suction strainer.

F. Service: Easily accessible for inspection and service.

G. Capacity Control: On-off compressor cycling and modulating slide-valve assembly or port unloaders combined with hot-gas bypass, if necessary, to achieve performance indicated.

1. Maintain stable operation throughout range of operation. Configure to achieve most energy-efficient operation possible.
2. Operating Range: From 100 to ~~zero~~ **25** percent of ~~design~~ **nominal** capacity.
3. Condenser-Air Unloading Requirements over Operating Range:
4. For units equipped with a variable frequency controller, capacity control shall be both "valveless" and "stepless," requiring no slide valve or capacity-control valve(s) to operate at reduced capacity.

H. Oil Lubrication System: Consisting of pump if required, filtration, heater, cooler, factory-wired power connection, and controls.

1. Provide lubrication to bearings, gears, and other rotating surfaces at all operating, startup, shutdown, and standby conditions including power failure.
2. Thermostatically controlled oil heater properly sized to remove refrigerant from oil.
3. Factory-installed and pressure-tested piping with isolation valves and accessories.
4. Oil compatible with refrigerant and chiller components.
5. Positive visual indication of oil level.

I. Vibration Control:

1. Vibration Balance: Balance chiller compressors and drive assemblies to provide a precision balance that is free of noticeable vibration over the entire operating range.

   a. Overspeed Test: 25 percent above design operating speed.

2. Isolation: Mount individual compressors on vibration isolators.

J. Compressor Motors:

1. Hermetically sealed and cooled by refrigerant suction gas.
2. High-torque, induction type with inherent thermal-overload protection on each phase.

K. Compressor Motor Controllers:

~~1. Across the Line: NEMA ICS 2, Class A, full voltage, nonreversing, or solid state.~~
2. ~~Star~~ **Wye**-Delta, Reduced-Voltage Controller: NEMA ICS 2, closed transition, or solid state.

~~3. Variable Frequency Controller:~~

~~a. Motor controller shall be factory mounted and wired on the chiller to provide a single-point, field-power termination to the chiller and its auxiliaries.~~
~~b. Description: NEMA ICS 2; listed and labeled as a complete unit and arranged to provide variable speed by adjusting output voltage and frequency.~~
~~c. Enclosure: Unit mounted, NEMA 250, Type 3R, with hinged full-front access door with lock and key.~~
~~d. Integral Disconnecting Means: Door-interlocked, NEMA AB 1, instantaneous-trip circuit breaker with lockable handle. Minimum withstand rating shall be as required by electrical power distribution system, but not less than 42,000 A.~~
~~e. Technology: Pulse width modulated (PWM) output suitable for constant or variable torque loads.~~
~~f. Motor current at start shall not exceed the rated load amperes, providing no electrical inrush.~~

L. Refrigerant Circuits:

1. Refrigerant: Type as indicated on Drawings.
2. Refrigerant Type: R-134a. Classified as Safety Group A1 according to ASHRAE 34.
3. Refrigerant Compatibility: Chiller parts exposed to refrigerants shall be fully compatible with refrigerants, and pressure components shall be rated for refrigerant pressures.
4. Refrigerant Circuit: Each shall include a thermal- or electronic-expansion valve, refrigerant charging connections, a hot-gas muffler, compressor suction and discharge shutoff valves, a liquid-line shutoff valve, a replaceable-corefilter-dryer, a sight glass with moisture indicator, a liquid-line solenoid valve, and an insulated suction line.
5. Pressure Relief Device:

    a. Comply with requirements in ASHRAE 15 and in applicable portions of ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.
    b. ASME-rated, spring-loaded pressure relief valve; single- or multiple-reseating type.

M. Evaporator:

1. Description: Shell-and-tube design.

    a. Direct-expansion (DX) type with fluid flowing through the shell, and refrigerant flowing through the tubes within the shell.
    b. Flooded type with fluid flowing through tubes and refrigerant flowing around tubes within the shell.

2. Code Compliance: Tested and stamped according to ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.
3. Shell Material: Carbon steel.
4. Shell Heads: Removable carbon-steel heads located at each end of the tube bundle.
5. Fluid Nozzles: Terminated with flanged end connections for connection to field piping.
6. Tube Construction: Individually replaceable copper tubes with enhanced fin design, expanded into tube sheets.
7. Heater: Factory-installed and -wired electric heater with integral controls designed to protect the evaporator to minus 20 deg F.
8. Remote Mounting: Designed for remote field mounting where indicated. Provide kit for field installation.

N. Air-Cooled Condenser:

1. Plate-fin coil with integral subcooling on each circuit, rated at 450 psig.

    a. Construct coil casing of galvanized or stainless steel.
    b. Construct coils of copper tubes mechanically bonded to aluminum.
    c. Coat coils with a baked-epoxy, corrosion-resistant coating after fabrication.
    d. Hail Protection: Provide condenser coils with louvers, baffles, or hoods to protect against hail damage.

2. Fans: Direct-drive propeller type with statically and dynamically balanced fan blades, arranged for vertical air discharge.
3. Fan Motors: Totally enclosed nonventilating (TENV) or totally enclosed air over (TEAO) enclosure, with permanently lubricated bearings. Equip each motor with overload protection integral to either the motor or chiller controls.
4. Fan Guards: Steel safety guards with corrosion-resistant coating.

O. Electrical Power:

1. Factory-installed and -wired switches, motor controllers, transformers, and other electrical devices necessary shall provide a single-point, field-power connection to chiller.
2. House in a unit-mounted, NEMA 250, Type 3R enclosure with hinged access door with lock and key or padlock and key.
3. Wiring shall be numbered and color-coded to match wiring diagram.
4. Install factory wiring outside of an enclosure in a raceway.
5. Field-power interface shall be to NEMA AB 1, instantaneous-trip circuit breaker with lockable handle.

    a. Disconnect means shall be interlocked with door operation.
    b. Minimum withstand rating shall be as required by electrical power distribution system, but not less than 42,000 A.

6. Provide branch power circuit to each motor and to controls with one of the following disconnecting means:

    a. NEMA KS 1, heavy-duty, fusible switch with rejection-type fuse clips rated for fuses. Select and size fuses to provide Type 2 protection according to IEC 60947-4-1.
    b. NEMA AB 1, motor-circuit protector (circuit breaker) with field-adjustable, short-circuit-trip set point.

7. Provide each motor with overcurrent protection.
8. Overload relay sized according to UL 1995 or an integral component of chiller control microprocessor.
9. Phase-Failure and Undervoltage Relays: Solid-state sensing with adjustable settings.
10. Provide power factor correction capacitors to correct power factor to 0.90 at full load.
11. Control Transformer: Unit-mounted transformer with primary and secondary fuses and sized with enough capacity to operate electrical load plus spare capacity.

    a. Power unit-mounted controls where indicated.
    b. Power unit-mounted, ground fault interrupt (GFI) duplex receptacle.

12. Control Relays: Auxiliary and adjustable time-delay relays.
13. For chiller electrical power supply, indicate the following:

    a. Current and phase to phase for all three phases.

b. Voltage, phase to phase, and phase to neutral for all three phases.
c. Three-phase real power (kilowatts).
d. Three-phase reactive power (kilovolt amperes reactive).
e. Power factor.
f. Running log of total power versus time (kilowatt-hours).
g. Fault log, with time and date of each.

P. Controls:

1. Standalone and microprocessor based.
2. Enclosure: Share enclosure with electrical power devices or provide a separate enclosure for remote mounting in the field.
3. Operator Interface: Multiple-character digital or graphic display with dynamic update of information and with keypad or touch-sensitive display located on front of control enclosure. In either imperial or metric units, display the following information:

a. Date and time.
b. Operating or alarm status.
c. Operating hours.
d. Outdoor-air temperature if required for chilled-water reset.
e. Temperature and pressure of operating set points.
f. Entering and leaving temperatures of chilled water.
g. Refrigerant pressures in evaporator and condenser.
h. Saturation temperature in evaporator and condenser.
i. No cooling load condition.
j. Elapsed time meter (compressor run status).
k. Pump status.
l. Antirecycling timer status.
m. Percent of maximum motor amperage.
n. Current-limit set point.
o. Number of compressor starts.

4. Control Functions:

a. Manual or automatic startup and shutdown time schedule.
b. Entering and leaving chilled-water temperatures, control set points, and motor load limits. Chilled-water leaving temperature shall be reset based on return-water temperature.
c. Current limit and demand limit.
d. External chiller emergency stop.
e. Antirecycling timer.
f. Automatic lead-lag switching.
g. Variable evaporator flow.
h. Thermal storage.

5. Manually Reset Safety Controls: The following conditions shall shut down chiller and require manual reset:

a. Low evaporator pressure or high condenser pressure.
b. Low chilled-water temperature.
c. Refrigerant high pressure.
d. High or low oil pressure.
e. High oil temperature.
f. Loss of chilled-water flow.

g. Control device failure.

6. Trending: Capability to trend analog data of up to five parameters simultaneously over an adjustable period and frequency of polling.
7. Security Access: Provide electronic security access to controls through identification and password with at least three levels of access: view only; view and operate; and view, operate, and service.
8. Control Authority: At least four conditions: Off, local manual control at chiller, local automatic control at chiller, and automatic control through a remote source.
9. BAS Interface: Factory-installed hardware and software to enable the BAS to monitor, control, and display chiller status and alarms.

    a. Hardwired Points:

        1) Monitoring: On-off status, common trouble alarm, electrical power demand (kilowatts), electrical power consumption (kilowatt-hours).
        2) Control: On-off operation, chilled-water, discharge temperature set-point adjustment.

    b. ASHRAE 135 (BACnet) communication interface with the BAS shall enable the BAS operator to remotely control and monitor the chiller from an operator workstation. Control features and monitoring points displayed locally at chiller control panel shall be available through the BAS.

Q. Insulation:

1. Material: Closed-cell, flexible elastomeric, thermal insulation complying with ASTM C 534, Type I for tubular materials and Type II for sheet materials.
2. Thickness: 1-1/2 inches.
3. Factory-applied insulation over cold surfaces of chiller components.

    a. Adhesive: As recommended by insulation manufacturer and applied to 100 percent of insulation contact surface. Seal seams and joints.

4. Apply protective coating to exposed surfaces of insulation to protect insulation from weather.

R. Accessories:

1. Factory-furnished, chilled-water flow switches for field installation.
2. Individual compressor suction and discharge pressure gages with shutoff valves for each refrigerant circuit.
3. Factory-furnished neoprene ~~or spring~~ isolators for field installation.
4. Tool Kit: Chiller manufacturer shall assemble a tool kit specially designed for use in serving the chiller(s) furnished. Include special tools required to service chiller components not readily available to Owner service personnel in performing routine maintenance. Place tools in a lockable case with hinged cover. Provide a list of each tool furnished and attach the list to underside of case cover.

S. Capacities and Characteristics:

1. See Schedule on Drawings for capacities and requirements.

2. Noise Rating: Chiller must comply with or be rated before the following sound levels. Sound power level when measured according to ARI 370. Provide factory-installed sound treatment for compressors and provide low noise fans.

Chiller Maximum Sound Power (Lw) Levels								
200-Ton Air-Cooled Chiller - Grade-Mounted								
Chiller	63Hz	125Hz	250Hz	500Hz	1 kHz	2 kHz	4 kHz	8 kHz
Sound Power Levels (dB ref 1 pw)	88	98	98	97	93	90	81	79

~~2.2 PACKAGED REFRIGERANT RECOVERY UNITS~~

~~A. Packaged portable unit consisting of compressor, air-cooled condenser, recovery system, tank pressure gages, filter-dryer, and valving that allows for switching between liquid and vapor recovery mode. Refrigerant recovery unit shall be factory mounted on an ASME-constructed and -stamped refrigerant storage vessel that is sized to hold the full refrigerant charge of the largest chiller furnished.~~

~~2.3 HEAT-EXCHANGER, BRUSH-CLEANING SYSTEM~~

~~A. Furnish for field installation a brush-cleaning system on each chiller condenser for tube cleaning and improved heat transfer.~~

~~B. System shall maintain tube fouling at or below design conditions without interrupting normal equipment operation.~~

~~C. System shall consist of a brush inserted in each tube and a catch basket attached to each end of the tube. A four-way valve shall operate to reverse the direction of water flow to push the brush through the tube while removing tube deposits. Four-way reversing valve's actuator shall be controlled by a preset time cycle that provides regular tube brushing during equipment operation. Frequency of the brushing cycle shall be set up to match Project requirements.~~

~~D. Components:~~

~~1. Brush: Each brush shall have nylon bristles, titanium wires, and polypropylene tips. Brush interference fit with the ID of the tube shall not exceed 0.025 inch.~~
~~2. Basket: Single-piece polypropylene basket with neck OD to press fit ID of tube. Design shall provide for insertion of eddy current probe or removal of brushes without removing baskets from the valve.~~
~~3. Four-Way Valve:~~

~~a. Construct valve body of carbon steel with internal sealing parts of hard rubber and Type 304 stainless steel.~~
~~b. Configure valve with parallel flow connections to minimize field installation piping.~~
~~c. Construct to comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1, at a system working pressure equal to condenser.~~
~~d. Pipe connections shall be flanged.~~
~~e. Valve manufacturer to test and certify a maximum leakage rate of less than 0.05 percent of the design flow rate at operation conditions of maximum differential pressure.~~
~~f. Hydrostatically test to 1.5 times the design working pressure.~~

g. Design the valve to cause no more than 0.5-psig pressure drop at design flow conditions.
h. Provide valve with valve-mounted indicating/warning light, which shall light before valve begins rotation.
i. Valve Actuator: Mount electric actuator to operate valve.
j. Valve Actuator: Mount pneumatic piston-type actuator to operate valve. Actuator shall be suitable for operation using field-supplied air pressure.
k. Position Switches: Factory mount microswitches on valve to indicate the complete turn of valve in both normal and reverse flow.

4. Control Panel: Factory or field mount a control panel on chiller. Control panel shall include the following features:

a. NEMA 250, Type 4x enclosure.
b. Timer to automatically initiate the cleaning cycle over a 24-hour period.
c. Manual override of preset cleaning cycle.
d. Visual indication of "Power On," "Diverter Position," "Normal Flow," "Reverse Flow," and "Valve Malfunction" indicating a slow turn or incomplete valve turn.
e. For pneumatic actuators, mount four-way solenoid valve for actuator operation in the control panel.
f. Flow switch bypass.
g. Unloading signal to chiller.

2.4 SOURCE QUALITY CONTROL

A. Perform functional tests of chillers before shipping.

B. Factory run test each air-cooled chiller with water flowing through evaporator.

C. Factory performance test air-cooled chillers, before shipping, according to ARI 550/590.

1. Test the following conditions:

a. Design conditions indicated.
b. Reduction in capacity from design to minimum load in steps with condenser air at design conditions.

2. Allow Owner access to place where chillers are being tested. Notify Architect 14 days in advance of testing.
3. Prepare test report indicating test procedures, instrumentation, test conditions, and results. Submit copy of results within one week of test date.

D. Factory sound test air-cooled chillers, before shipping, according to ARI 370.

1. Test the following conditions:

a. Design conditions indicated.
b. Chiller operating at calculated worst-case sound condition.

2. Allow Owner access to place where chillers are being tested. Notify Architect 14 days in advance of testing.
3. Prepare test report indicating test procedures, instrumentation, test conditions, and results. Submit copy of results within one week of test date.

E. Factory test and inspect evaporator and condenser according to ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.

~~F. For chillers located indoors, rate sound power level according to ARI 575.~~

G. For chillers located outdoors, rate sound power level according to ARI 370.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine chillers before installation. Reject chillers that are damaged.

B. Examine roughing-in for equipment support, anchor-bolt sizes and locations, piping, and electrical connections to verify actual locations, sizes, and other conditions affecting chiller performance, maintenance, and operations before equipment installation.

1. Final chiller locations indicated on Drawings are approximate. Determine exact locations before roughing-in for piping and electrical connections.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 CHILLER INSTALLATION

A. Install chillers on support structure indicated.

B. Equipment Mounting: Install chiller on concrete bases. Comply with requirements for vibration isolation devices specified in Section 230548 "Vibration and Seismic Controls for HVAC Piping and Equipment."

1. Minimum Deflection: Per Specification.
2. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around the full perimeter of concrete base.
3. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.
4. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
5. Install anchor bolts to elevations required for proper attachment to supported equipment.

C. Equipment Mounting: Comply with requirements for vibration isolation devices specified in Section 230548 "Vibration and Seismic Controls for HVAC Piping and Equipment."

1. Minimum Deflection: Per Specification.

D. Equipment Mounting: Install chiller on concrete bases.

1. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around the full perimeter of concrete base.

2. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.
3. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
4. Install anchor bolts to elevations required for proper attachment to supported equipment.

E. Maintain manufacturer's recommended clearances for service and maintenance.

F. Charge chiller with refrigerant and fill with oil if not factory installed.

G. Install separate devices furnished by manufacturer and not factory installed.

~~3.3 HEAT-EXCHANGER, BRUSH-CLEANING SYSTEM INSTALLATION~~

~~A. Install brush-cleaning system control panel adjacent to chiller control panel.~~

~~B. Arrange piping to provide service access to four-way valve assembly without affecting access to chiller. Secure valve to prevent lateral movement and vibration during operation.~~

~~C. Provide field electric power, as required, to each system control panel and electric actuated valve.~~

~~D. Provide pneumatic piping with pressure regulator and isolation valve to each pneumatic supply connection. Coordinate field source of air with manufacturer to ensure that requirements are satisfied for proper valve operation.~~

~~E. Interconnect brush-cleaning system controls with chiller controls. Coordinate requirements to ensure safe, trouble-free operation.~~

~~F. Functionally test the entire brush-cleaning system, including the valve, actuator, position indicator, and control panel, with chiller in operation.~~

3.4 CONNECTIONS

A. Comply with requirements for piping specified in Section 232113 "Hydronic Piping," Section 232116 Hydronic Piping Specialties," and Section 232300 "Refrigerant Piping". Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to chiller to allow service and maintenance.

C. Evaporator Fluid Connections: Connect to evaporator inlet with shutoff valve, strainer, flexible connector, thermometer, and plugged tee with pressure gage. Connect to evaporator outlet with shutoff valve, balancing valve, flexible connector, flow switch, thermometer, plugged tee with shutoff valve and pressure gage, flow meter, and drain connection with valve. Make connections to chiller with a flange or mechanical coupling.

D. Condenser Fluid Connections: Connect to condenser inlet with shutoff valve, strainer, flexible connector, thermometer, and plugged tee with pressure gage. Connect to condenser outlet with shutoff valve, balancing valve, flexible connector, flow switch, thermometer, plugged tee with shutoff valve and pressure gage, flow meter, and drain connection with valve. Make connections to chiller with a flange or mechanical coupling.

3.5 STARTUP SERVICE

A. Engage a factory-authorized service representative to perform startup service.

1. Complete installation and startup checks according to manufacturer's written instructions.
2. Verify that refrigerant charge is sufficient and chiller has been leak tested.
3. Verify that pumps are installed and functional.
4. Verify that thermometers and gages are installed.
5. Operate chiller for run-in period.
6. Check bearing lubrication and oil levels.
7. For chillers installed indoors, verify that refrigerant pressure relief device is vented outdoors.
8. Verify proper motor rotation.
9. Verify static deflection of vibration isolators, including deflection during chiller startup and shutdown.
10. Verify and record performance of fluid flow and low-temperature interlocks for evaporator and condenser.
11. Verify and record performance of chiller protection devices.
12. Test and adjust controls and safeties. Replace damaged or malfunctioning controls and equipment.

B. Inspect field-assembled components, equipment installation, and piping and electrical connections for proper assembly, installation, and connection.

C. Prepare test and inspection startup reports.

3.6 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain chillers. Video record the training sessions.

END OF SECTION
09/27/12

SECTION 23 73 13

MODULAR INDOOR CENTRAL-STATION AIR-HANDLING UNITS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Variable-air-volume, single-zone air-handling units.

1.3 PERFORMANCE REQUIREMENTS

A. Delegated Design: Design vibration isolation and seismic-restraint details, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

B. Structural Performance: Casing panels shall be self-supporting and capable of withstanding 133 percent of internal static pressures indicated, without panel joints exceeding a deflection of L/200 where "L" is the unsupported span length within completed casings.

C. Seismic Performance: Air-handling units shall withstand the effects of earthquake motions determined according to SEI/ASCE 7.

1. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."

1.4 SUBMITTALS

A. Product Data: For each air-handling unit indicated.

1. Unit dimensions and weight.
2. Cabinet material, metal thickness, finishes, insulation, and accessories.
3. Fans:

a. Certified fan-performance curves with system operating conditions indicated.
b. Certified fan-sound power ratings.
c. Fan construction and accessories.
d. Motor ratings, electrical characteristics, and motor accessories.

4. Certified coil-performance ratings with system operating conditions indicated.
5. Dampers, including housings, linkages, and operators.
6. Filters with performance characteristics.

B. Delegated-Design Submittal: For vibration isolation and seismic restraints indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1. Vibration Isolation Base Details: Detail fabrication including anchorages and attachments to structure and to supported equipment. Include adjustable motor bases, rails, and frames for equipment mounting.
2. Design Calculations: Calculate requirements for selecting vibration isolators and seismic restraints and for designing vibration isolation bases.

C. Coordination Drawings: Floor plans and other details, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

1. Mechanical-room layout and relationships between components and adjacent structural and mechanical elements.
2. Support location, type, and weight.
3. Field measurements.

D. Seismic Qualification Certificates: For air-handling units, accessories, and components, from manufacturer.

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

E. Source quality-control reports.

F. Field quality-control reports.

G. Operation and Maintenance Data: For air-handling units to include in emergency, operation, and maintenance manuals.

1.5 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. NFPA Compliance: Comply with NFPA 90A for design, fabrication, and installation of air-handling units and components.

C. ARI Certification: Air-handling units and their components shall be factory tested according to ARI 430, "Central-Station Air-Handling Units," and shall be listed and labeled by ARI.

D. Comply with NFPA 70.

1.6 COORDINATION

A. Coordinate sizes and locations of concrete bases with actual equipment provided.

B. Coordinate sizes and locations of structural-steel support members, if any, with actual equipment provided.

1.7 EXTRA MATERIALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Filters: One set for each air-handling unit.
2. Gaskets: One set for each access door.
3. Fan Belts: One set for each air-handling unit fan.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

1. Trane; American Standard Inc.
2. McQuay International.
3. YORK International Corporation.

2.2 UNIT CASINGS

A. General Fabrication Requirements for Casings:

1. Forming: Form walls, roofs, and floors with at least two breaks at each joint.
2. Casing Joints: Sheet metal screws or pop rivets.
3. Sealing: Seal all joints with water-resistant sealant.

B. Cabinet:

1. Outside Casing: Galvanized steel, 0.0396 inch (20 gage) thick.
2. Inside Casing: Galvanized steel, 0.0396 inch (20 gage) thick, solid.
3. Floor Plate: Galvanized steel, 0.1382 inch (10 gage) thick.
4. Base Rail: Full-length, continuous, 12 gage galvanized steel channel, 6 inches high (8 inches high for units larger than 25,000 cfm), with integral lifting lugs.

C. Casing Insulation and Adhesive:

1. Materials: ASTM C 1071, Type II, 2” Insulated Foam, R-13.
2. Location and Application: Factory applied with adhesive and mechanical fasteners to the internal surface of section panels downstream from, and including, the cooling-coil section.

a. Mechanical Fasteners: Galvanized steel, suitable for adhesive attachment, mechanical attachment, or welding attachment to duct without damaging liner when applied as recommended by manufacturer and without causing leakage in cabinet.
b. Liner materials applied in this location shall have air-stream surface coated with a temperature-resistant coating or faced with a plain or coated fibrous mat or fabric depending on service-air velocity.

3. Location and Application: Encased between outside and inside casing.

D. Inspection and Access Panels and Access Doors:

1. Panel and Door Fabrication: Formed and reinforced, double-wall and insulated panels of same materials and thicknesses as casing.
2. Inspection and Access Panels:

a. Fasteners: Two or more camlock type for panel lift-out operation. Arrangement shall allow panels to be opened against air-pressure differential.
b. Gasket: Neoprene, applied around entire perimeters of panel frames.
c. Size: Large enough to allow inspection and maintenance of air-handling unit's internal components.

3. Access Doors:

a. Hinges: A minimum of two ball-bearing hinges and two wedge-lever-type latches, operable from inside and outside. Arrange doors to be opened against air-pressure differential.
b. Gasket: Neoprene, applied around entire perimeters of panel frames.
c. Fabricate windows in doors of double-glazed, wire-reinforced safety glass with an air space between panes and sealed with interior and exterior rubber seals.

4. Locations and Applications:

a. Fan Section: Inspection and access panels.
b. Access Section: Doors.
c. Coil Section: Inspection and access panel.
d. Damper Section: Inspection and access panels.
e. Filter Section: Inspection and access panels large enough to allow periodic removal and installation of filters.

5. Service Light: In units 10,000 cfm and larger,100-W vaporproof marine type fixture in each section accessed with door, with switched junction box located outside adjacent to door.
6. Convenience Outlet: In units 10,000 cfm and larger, in each section accessed with door.

E. Condensate Drain Pans:

1. Fabricated with slopes in at least 2 planes to collect condensate from cooling coils (including coil piping connections, coil headers and return bends, and a minimum of 6 inches downstream from cooling-coil face) and from humidifiers.
2. Formed sections.
3. Double-wall, stainless-steel sheet with space between walls filled with foam insulation and moisture-tight seal.
4. A minimum of 2 inches deep, and complying with requirements in ASHRAE 62.1.

5. Drain Connections: Both ends of pan with NPS 1 threaded nipple.
6. Units with stacked coils or 48 inch coils and higher shall have an intermediate drain pan to collect condensate from top coil with drop tubes to main pan.

F. Air-Handling-Unit Mounting Frame: Formed galvanized-steel channel or structural channel supports, designed for low deflection, welded with integral lifting lugs.

1. Seismic Fabrication Requirements: Fabricate mounting base and attachment to air-handling unit sections, accessories, and components with reinforcement strong enough to withstand seismic forces defined in Division 23 Section "Vibration and Seismic Controls for HVAC Piping and Equipment" when air-handling unit frame is anchored to building structure.

2.3 FAN, DRIVE, AND MOTOR SECTION

A. Fan and Drive Assemblies: Statically and dynamically balanced and designed for continuous operation at maximum-rated fan speed and motor horsepower.

1. Shafts: Designed for continuous operation at maximum-rated fan speed and motor horsepower, and with field-adjustable alignment.

a. Turned, ground, and polished hot-rolled steel with keyway. Ship with a protective coating of lubricating oil.
b. Designed to operate at no more than 70 percent of first critical speed at top of fan's speed range.

B. Plenum fan sections shall be complete with SWSI, arrangement, direct-drive, plenum fans as per the following:

1. Fan unit shall be formed by welding heavy gauge steel inlet plate with spun inlet cones to steel angel frame. A square formed lip shall surround the unit, suitable for attachment of flex connector.
2. Fan wheels shall be non-overloading, airfoil type. Impellers shall be statically and dynamically balanced to a level of G6.3 (per ANSI 2-19) or better. Hubs shall be straight bored, keyed and set screwed to the shaft. Shafts are to be solid steel sized for first critical speed of at least 1.25 times the maximum speed for the class for Class I and II fans and 1.42 times the maximum speed for class for Class III and IV fans.
3. Bearings are to be heavy duty, grease lubricated, anti-friction, self-aligning, pillow block type and selected for minimum average bearing life (AFBMA L-50) in excess of 200,000 hours at the maximum class RPM. All bearings shall be equipped with regreasable Zerk fittings and lubrication lines extended to accessible location on fan housing for easy access lubrication.
4. Fan shall be provided with wire mesh protective wheel enclosure and heavy gauge wire inlet screen.
5. Fan shall be cleaned, prime coated and provided with two coats of enamel final coat.
6. Each fan shall be test run at their operating speed or at the maximum RPM for the particular fan's construction class prior to shipment. The fans are to be balanced and records maintained of the readings in the axial, vertical, and horizontal direction on each of the fan's bearings. Final peak velocity measurements shall not exceed 0.1 in/sec.

C. Internal Vibration Isolation and Seismic Control: Fans shall be factory mounted with manufacturer's standard restrained vibration isolation mounting devices having a minimum static deflection of 2 inches.

1. Seismic Fabrication Requirements: Fabricate fan section, internal mounting frame and attachment to fans, fan housings, motors, casings, accessories, and other fan section components with reinforcement strong enough to withstand seismic forces defined in Division 23 Section "Vibration and Seismic Controls for HVAC Piping and Equipment" when fan-mounting frame and air-handling-unit mounting frame are anchored to building structure.

D. Motor: Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors specified in Division 23 Section "Common Motor Requirements for HVAC Equipment."

1. Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.
2. Controllers, Electrical Devices, and Wiring: Comply with requirements for electrical devices and connections specified in Division 26 Sections.
3. Mount unit-mounted disconnect switches on exterior of unit.

2.4 COIL SECTION

A. General Requirements for Coil Section:

1. Comply with ARI 410.
2. Fabricate coil section to allow removal and replacement of coil for maintenance and to allow in-place access for service and maintenance of coil(s).
3. Coils shall not act as structural component of unit.
4. Seismic Fabrication Requirements: Fabricate coil section, internal mounting frame and attachment to coils, and other coil section components with reinforcement strong enough to withstand seismic forces defined in Division 23 Section "Vibration and Seismic Controls for HVAC Piping and Equipment" when coil-mounting frame and air-handling-unit mounting frame are anchored to building structure.

B. Water Coils: Self-draining coil fabricated according to ARI 410.

1. Arrangement: Horizontal coils.
2. Piping Connections: Threaded, on same end.
3. Tubes: Copper, 0.035 inch wall thickness.
4. Fins: Aluminum with fin spacing as required for scheduled performance.
5. Fin and Tube Joint: Mechanical bond.
6. Headers: Cast iron with cleaning plugs and drain and air vent tappings or seamless copper tube with brazed joints, prime coated.
7. Frames: Galvanized-steel channel frame, 0.0625 inch (16 gage).
8. Ratings: Design tested and rated according to ASHRAE 33 and ARI 410.

    a. Working-Pressure Ratings: 200 psig, 325 deg F.

9. Source Quality Control: Test to 300 psig and to 200 psig underwater.

2.5 AIR FILTRATION SECTION

A. General Requirements for Air Filtration Section:

1. Comply with NFPA 90A.

2. Provide minimum arrestance according to ASHRAE 52.1, and a minimum efficiency reporting value (MERV) according to ASHRAE 52.2.
3. Provide filter holding frames arranged for flat or angular orientation, with access doors on both sides of unit. Filters shall be removable from one side or lifted out from access plenum.

B. Extended-Surface, Disposable Panel Pre-Filters:

1. Factory-fabricated, dry, extended-surface type.
2. Thickness: 2 inches.
3. Initial Resistance: Per ASHRAE 52-76.
4. Arrestance (ASHRAE 52.1): 90.
5. Merv (ASHRAE 52.2): 8.
6. Media: Fibrous material formed into deep-V-shaped pleats with antimicrobial agent and held by self-supporting wire grid.
7. Media-Grid Frame: Nonflammable cardboard.
8. Mounting Frames: Welded, galvanized steel, with gaskets and fasteners, suitable for bolting together into built-up filter banks.

C. Extended-Surface, Disposable Panel Filters:

1. Factory-fabricated, dry, extended-surface type.
2. Thickness: 12 inches.
3. Initial Resistance: Per ASHRAE 52-76.
4. Arrestance (ASHRAE 52.1): >95.
5. MERV (ASHRAE 52.2): 15.
6. Media: Cartridge.
7. Media-Grid Frame: Galvanized steel.
8. Mounting Frames: Welded, galvanized steel, with gaskets and fasteners, suitable for bolting together into built-up filter banks.

2.6 DAMPERS

A. Retain this article to require that dampers be provided by air-handling unit manufacturer; delete if dampers are specified in Division 23 Section "Instrumentation and Control for HVAC."General Requirements for Dampers: Leakage rate, according to AMCA 500, "Laboratory Methods for Testing Dampers for Rating," shall not exceed 2 percent of air quantity at 2000-fpm face velocity through damper and 4-inch wg pressure differential.

B. Damper Operators: Comply with requirements in Division 23 Section "Instrumentation and Control for HVAC."

C. Outdoor- and Return-Air Dampers: Low-leakage, double-skin, airfoil-blade, extruded-aluminum dampers with compressible jamb seals and extruded-vinyl blade edge seals in parallel-blade arrangement with cadmium-plated steel operating rods rotating in stainless-steel sleeve bearings mounted in a single aluminum frame, and with operating rods connected with a common linkage. Leakage rate shall not exceed 5 cfm/sq. ft. at 1-inch wg and 9 cfm/sq. ft. at 4-inch wg.

D. Mixing Section: Multiple-blade, air-mixer assembly located immediately downstream of mixing section. Dampers of different applications (i.e., outdoor, return, relief) shall be independently linked and controlled.

E. Combination Filter and Mixing Section:

1. Cabinet support members shall hold 2-inch- thick, pleated, flat, permanent or throwaway filters.
2. Multiple-blade, air-mixer assembly shall mix air to prevent stratification, located immediately downstream of mixing box.
3. Dampers of different applications (i.e., outdoor, return, relief) shall be independently linked and controlled.

2.7 HUMIDIFIER SECTION

A. Humidifier Section: Supply with a full width, sloped drain pan that extends downstream of the coil to provide sufficient amount of space to contain possible moisture carryover.

1. Drain Pan Construction: Double wall with a stainless steel liner.
2. Drain Pan Insulation: Minimum 2-inches thick.

2.8 BLENDER SECTION

A. Blender Section: Provide a static air mixer in the air blender section of rotary turbulating design consisting radially extending blades, with no moving parts.

1. All welded construction of 0.80-inch-thick aluminum (0.125-inch-thikc on mixers larger than 96 inches).
2. When multiple static mixers are used, configure assembly to impart a counter rotational mixing of the air streams relative to each other.

B. Performance: Install with proper distances such that the mixer shall be capable of providing a minimum mixing effectiveness of:

1. Seventy-five percent and +/-6 deg F standard deviation when mixing 50 percent outdoor air with 50 percent return air at 50 deg F inlet temperature differential.
2. Eighty percent and +/-5 deg F standard deviation when mixing 30 percent outdoor air with 70 percent return air at 50 deg F inlet temperature differential.
3. Fan Velocity: From 500 fpm through 2,500 fpm with no loss in mixing performance.
4. Size blenders to operate effectively at the specified heating minimum airflow for the unit.

2.9 SOURCE QUALITY CONTROL

A. Fan Sound-Power Level Ratings: Comply with AMCA 301, "Methods for Calculating Fan Sound Ratings from Laboratory Test Data." Test fans according to AMCA 300, "Reverberant Room Method for Sound Testing of Fans." Fans shall bear AMCA-certified sound ratings seal.

B. Fan Performance Rating: Factory test fan performance for airflow, pressure, power, air density, rotation speed, and efficiency. Rate performance according to AMCA 210, "Laboratory Methods of Testing Fans for Aerodynamic Performance Rating."

C. Water Coils: Factory tested to 300 psig according to ARI 410 and ASHRAE 33.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Examine casing insulation materials and filter media before air-handling unit installation. Reject insulation materials and filter media that are wet, moisture damaged, or mold damaged.

C. Examine roughing-in for steam, hydronic, and condensate drainage piping systems and electrical services to verify actual locations of connections before installation.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Equipment Mounting: Install air-handling units on concrete bases. Secure units to anchor bolts installed in concrete bases. Comply with requirements for concrete bases specified in Division 03 Section "Cast-in-Place Concrete." Comply with requirements for vibration isolation devices specified in Division 23 Section "Vibration and Seismic Controls for HVAC Piping and Equipment."

B. Equipment Mounting: Install air-handling unit with vibration isolation devices. Comply with requirements for vibration isolation devices specified in Division 23 Section "Vibration and Seismic Controls for HVAC Piping and Equipment."

C. Suspended Units: Suspend and brace units from structural-steel support frame using threaded steel rods and spring hangers. Comply with requirements for vibration isolation devices specified in Division 23 Section "Vibration and Seismic Controls for HVAC Piping and Equipment."

D. Arrange installation of units to provide access space around air-handling units for service and maintenance.

E. Do not operate fan system until filters (temporary or permanent) are in place. Replace temporary filters used during construction and testing, with new, clean filters.

F. Install filter-gage, static-pressure taps upstream and downstream of filters. Mount filter gages on outside of filter housing or filter plenum in accessible position. Provide filter gages on filter banks, installed with separate static-pressure taps upstream and downstream of filters.

3.3 CONNECTIONS

A. Comply with requirements for piping specified in other Division 23 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to air-handling unit to allow service and maintenance.

C. Connect piping to air-handling units mounted on vibration isolators with flexible connectors.

D. Connect condensate drain pans with condensate drain piping. Extend to nearest equipment or floor drain. Construct deep trap at connection to drain pan and install cleanouts at changes in direction.

E. Hot- and Chilled-Water Piping: Comply with applicable requirements in Division 23 Section "Hydronic Piping." Install shutoff valve and union or flange at each coil supply connection. Install balancing valve and union or flange at each coil return connection.

F. Connect duct to air-handling units with flexible connections. Comply with requirements in Division 23 Section "Air Duct Accessories."

3.4 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.

B. Perform tests and inspections.

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

C. Tests and Inspections:

1. Leak Test: After installation, fill water and steam coils with water, and test coils and connections for leaks.
2. Charge refrigerant coils with refrigerant and test for leaks.
3. Fan Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
4. HEPA-Filter Operational Test: Pressurize housing to a minimum of 3-inch wg or to designed operating pressure, whichever is higher; test housing joints, door seals, and sealing edges of filter with soapy water to check for air leaks.
5. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

D. Air-handling unit or components will be considered defective if unit or components do not pass tests and inspections.

E. Prepare test and inspection reports.

3.5 STARTUP SERVICE

A. Engage a factory-authorized service representative to perform startup service.

1. Complete installation and startup checks according to manufacturer's written instructions.
2. Verify that shipping, blocking, and bracing are removed.
3. Verify that unit is secure on mountings and supporting devices and that connections to piping, ducts, and electrical systems are complete. Verify that proper thermal-overload protection is installed in motors, controllers, and switches.
4. Verify proper motor rotation direction, free fan wheel rotation, and smooth bearing operations. Reconnect fan drive system, align belts, and install belt guards.

5. Verify that bearings, pulleys, belts, and other moving parts are lubricated with factory-recommended lubricants.
6. Verify that face-and-bypass dampers provide full face flow.
7. Verify that outdoor- and return-air mixing dampers open and close, and maintain minimum outdoor-air setting.
8. Comb coil fins for parallel orientation.
9. Verify that proper thermal-overload protection is installed for electric coils.
10. Install new, clean filters.
11. Verify that manual and automatic volume control and fire and smoke dampers in connected duct systems are in fully open position.

B. Starting procedures for air-handling units include the following:

1. Energize motor; verify proper operation of motor, drive system, and fan wheel. Adjust fan to indicated rpm.
2. Measure and record motor electrical values for voltage and amperage.
3. Manually operate dampers from fully closed to fully open position and record fan performance.

3.6 ADJUSTING

A. Adjust damper linkages for proper damper operation.

B. Comply with requirements in Division 23 Section "Testing, Adjusting, and Balancing for HVAC" for air-handling system testing, adjusting, and balancing.

3.7 CLEANING

A. After startup service, clean air-handling units internally on completion of installation, according to manufacturer's written instructions. Clean fan interiors to remove foreign material and construction dirt and dust. Vacuum clean fan wheels, cabinets, and coils entering air face.

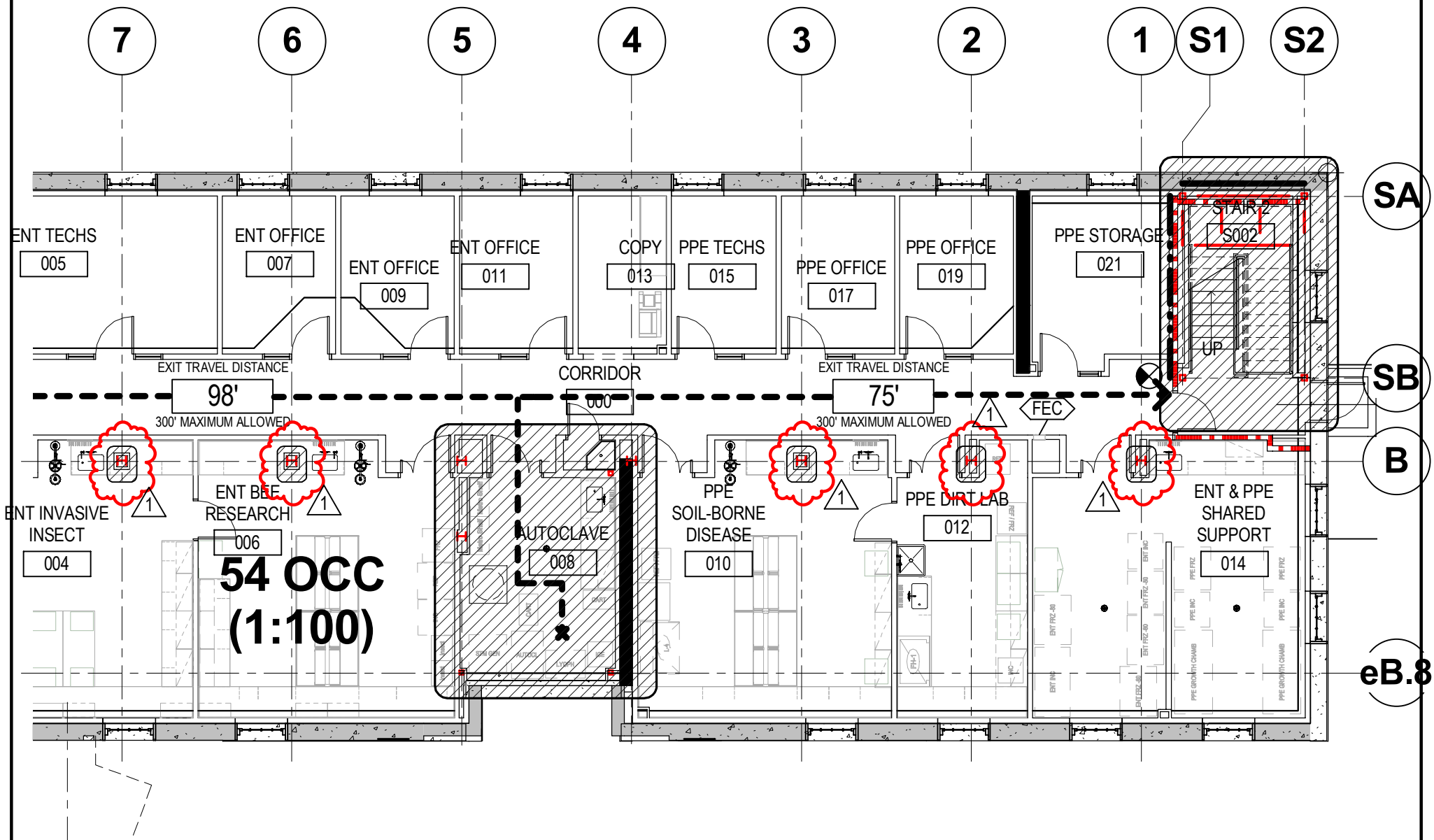
B. After completing system installation and testing, adjusting, and balancing air-handling unit and air-distribution systems, clean filter housings and install new, clean filters.

C. Replace filters immediately prior to occupancy according to the LEED EQ Credit 3.1, "Construction IAQ Management Plan."

3.8 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain air-handling units.

END OF SECTION
01/08/13

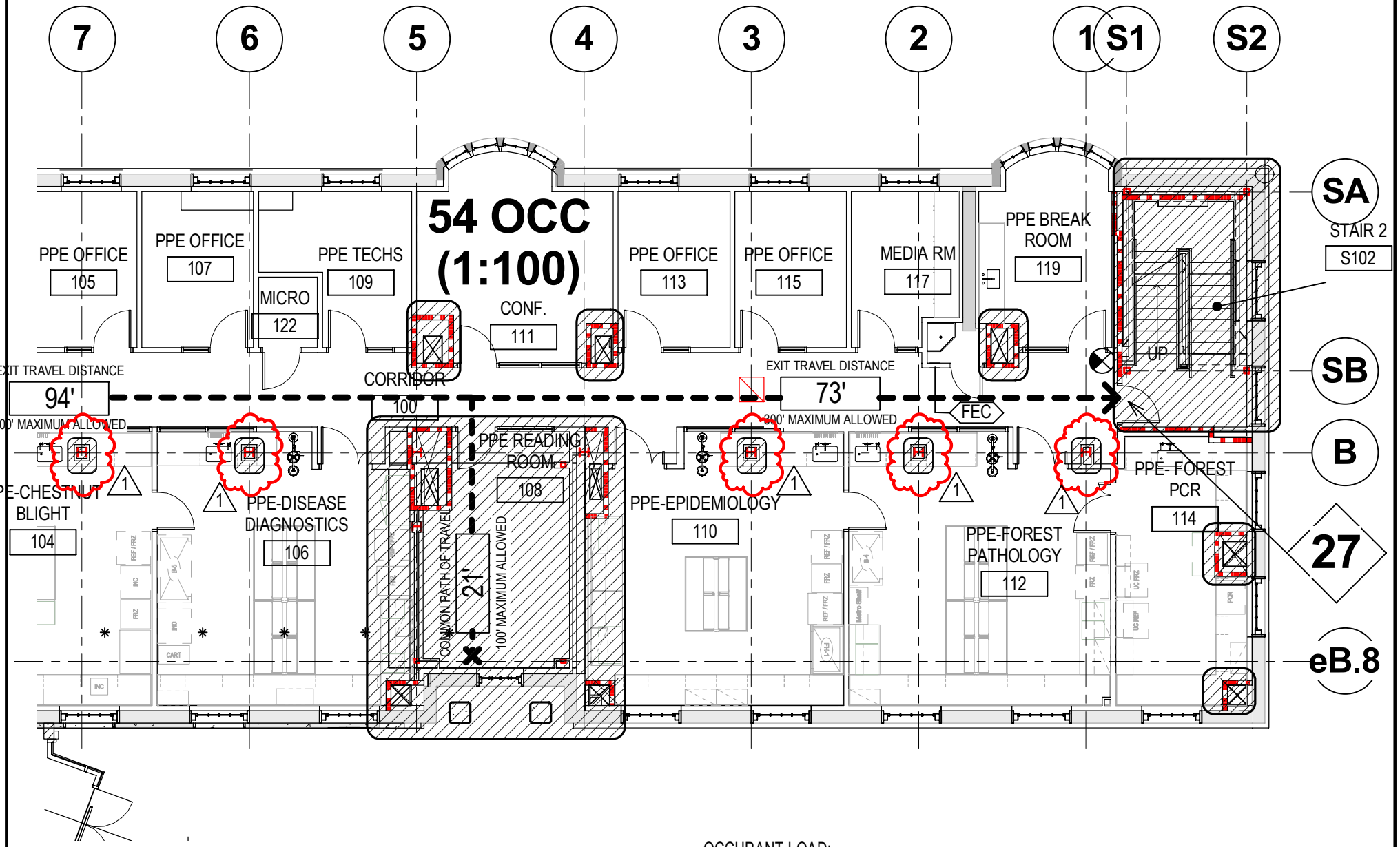


ADDENDUM NO. 1

Connecticut Department Of Construction Services

Flad Architects

Sketch Title	PART PLAN - LOWER LEVEL LIFE SAFETY PLAN			DCS Project Number: BI - P - 86	Sketch Revised
Project Title	Renovations & Additions to Jenkins-Waggoner Laboratory			FLAD Project Number: 10844-00	
Sketch Number **ASK-G003a**	RFI Number -	Reference Sheet G-003	Revision Number -	Sketch Issue Date 01/10/13	



OCCUPANT LOAD:

89 OCC OFFICE / LAB / SUPPORT

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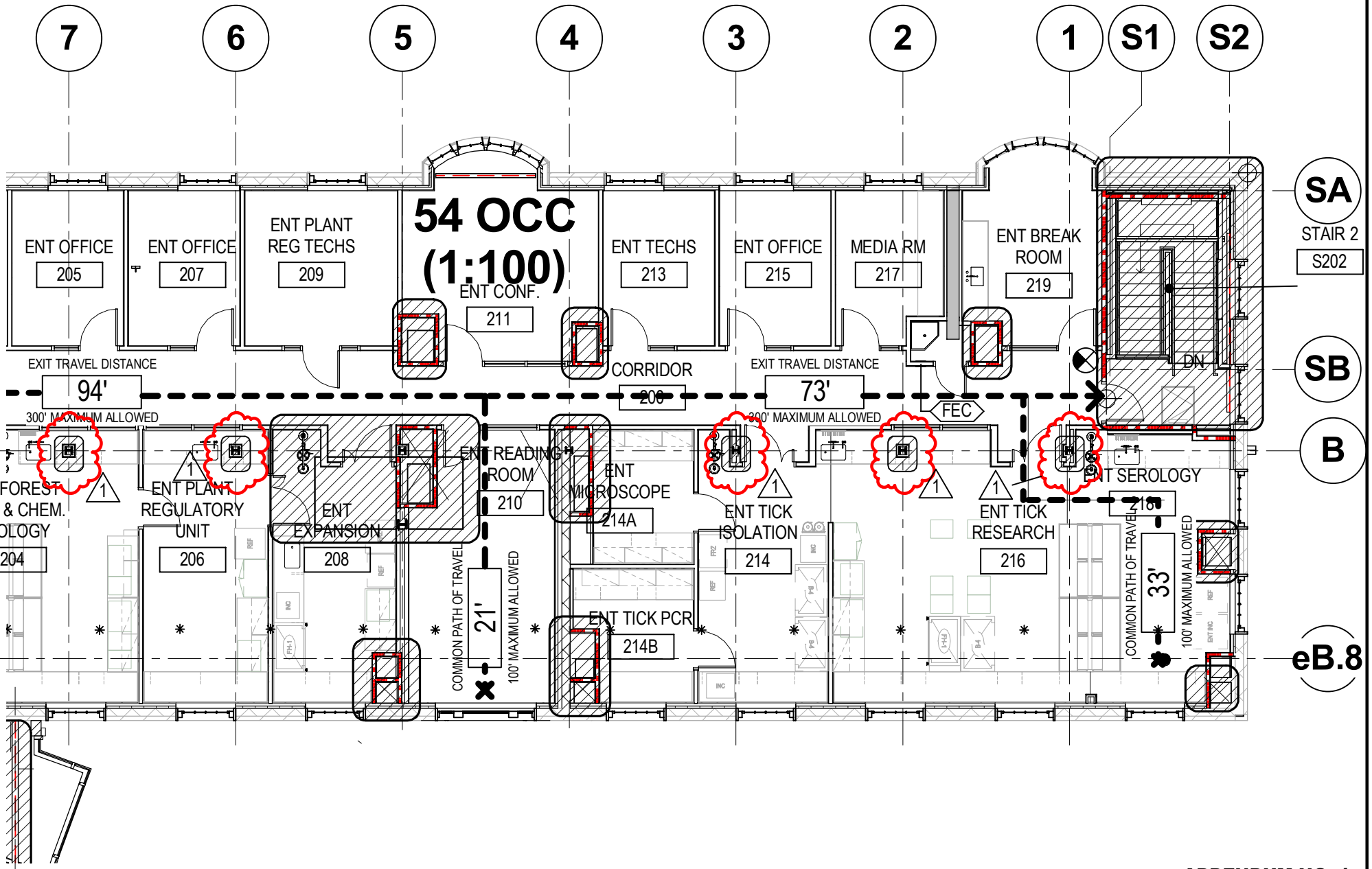
Sketch Title	PART PLAN - FIRST LEVEL LIFE SAFETY PLAN			DCS Project Number: BI - P - 86	Sketch Revised
Project Title	Renovations & Additions to Jenkins-Waggoner Laboratory			FLAD Project Number: 10844-00	
Sketch Number **ASK-G003b**	RFI Number -	Reference Sheet G-003		Revision Number -	Sketch Issue Date 01/10/13



ADDENDUM NO. 1

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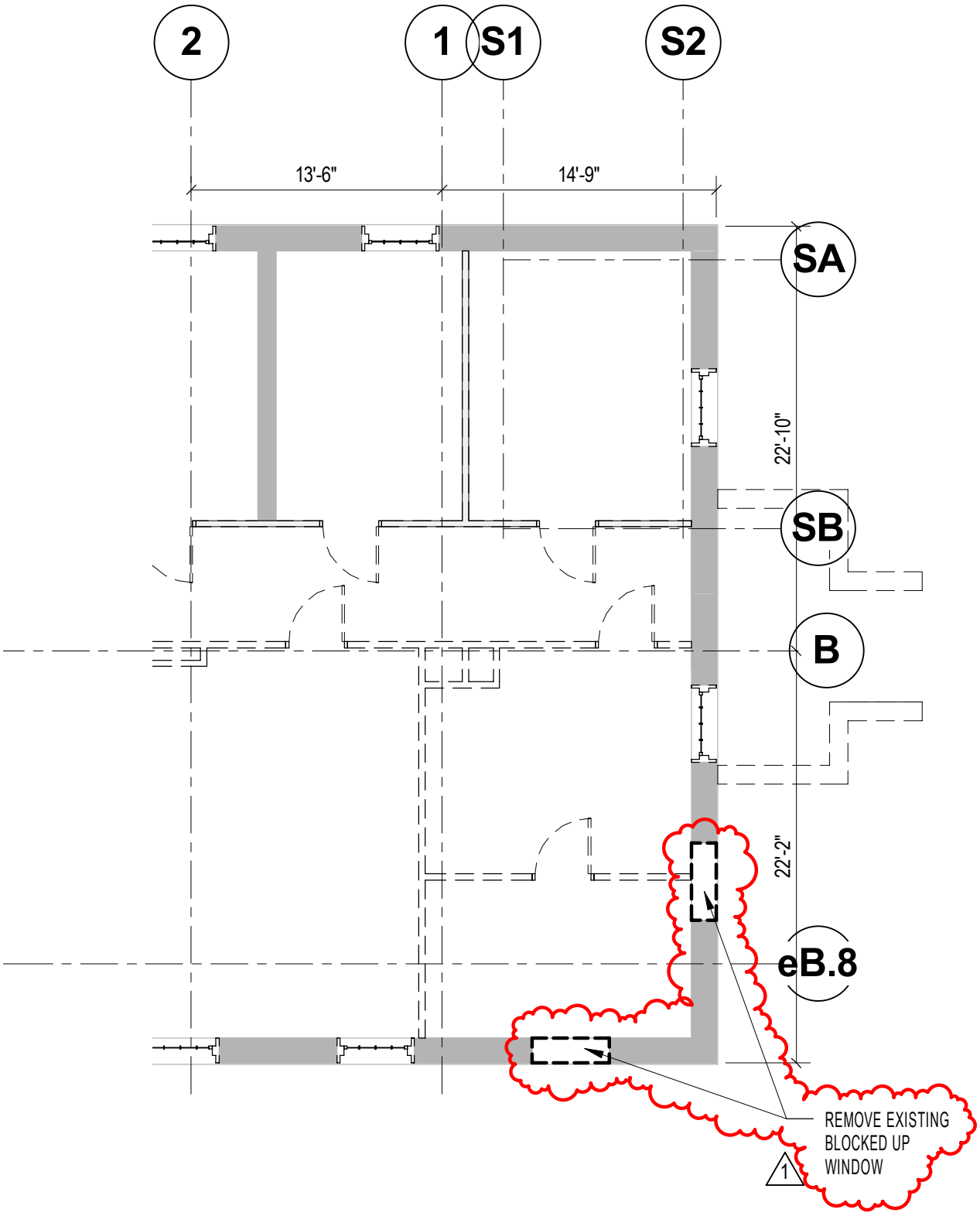
Sketch Title	PART PLAN - UPPER LEVEL LIFE SAFETY PLAN			DCS Project Number: BI - P - 86	Sketch Revised
Project Title	Renovations & Additions to Jenkins-Waggoner Laboratory			FLAD Project Number: 10844-00	
Sketch Number **ASK-G003c**	RFI Number -	Reference Sheet G-003		Revision Number -	Sketch Issue Date 01/10/13



ADDENDUM NO. 1

Connecticut Department Of Construction Services / Flad Architects	Sketch Title: PART PLAN - LOWER LEVEL DEMOLITION PLAN Project Title: **Renovations & Additions to Jenkins-Waggoner Laboratory**			DCS Project Number: **BI - P - 86** FLAD Project Number: **10844-00**	Sketch Revised
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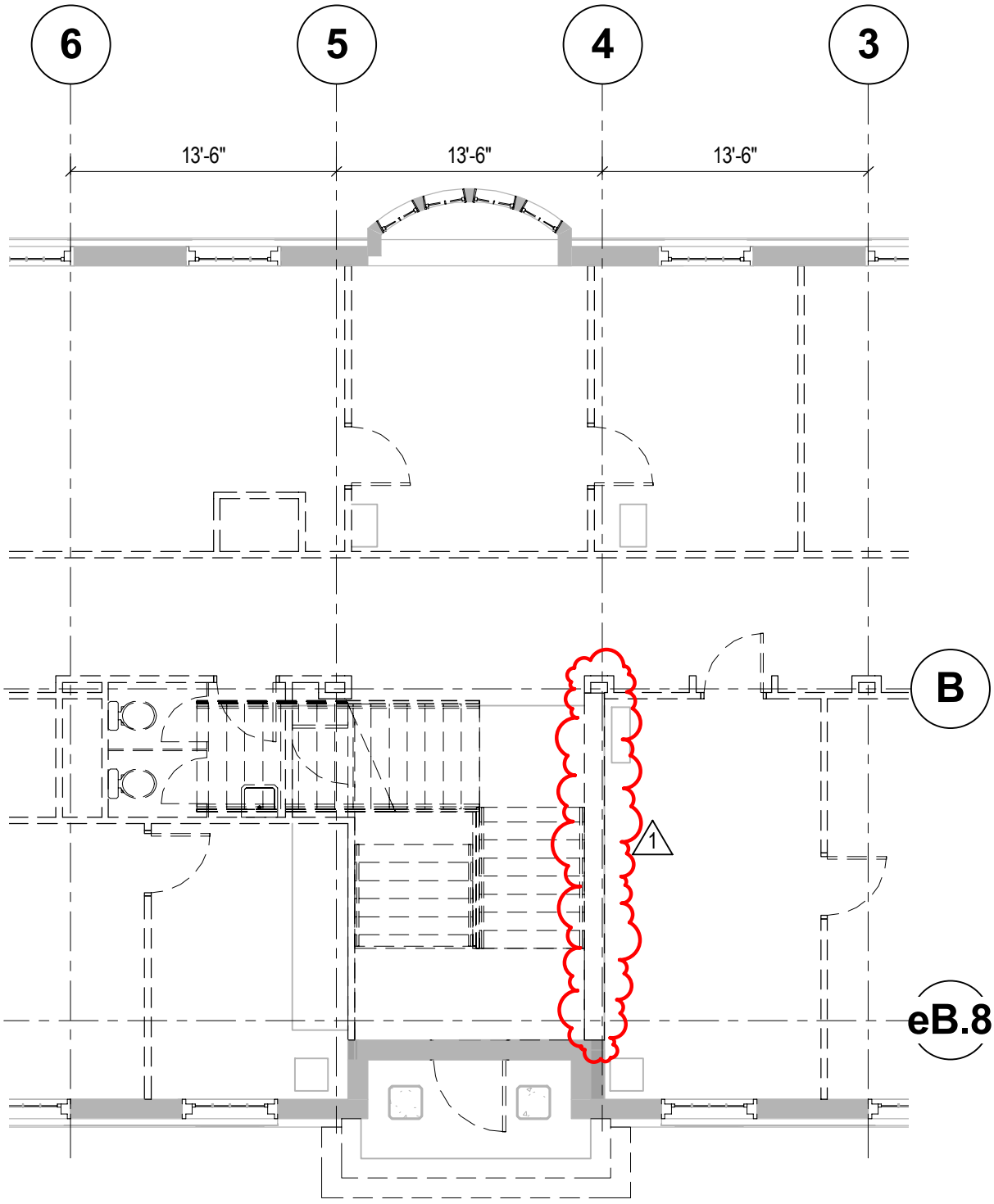

ADDENDUM NO. 1

Connecticut Department Of Construction Services Flad Architects	Sketch Title: PART PLAN - FIRST LEVEL DEMOLITION PLAN Project Title: **Renovations & Additions to Jenkins-Waggoner Laboratory**			DCS Project Number: **BI - P - 86** FLAD Project Number: **10844-00**	Sketch Revised
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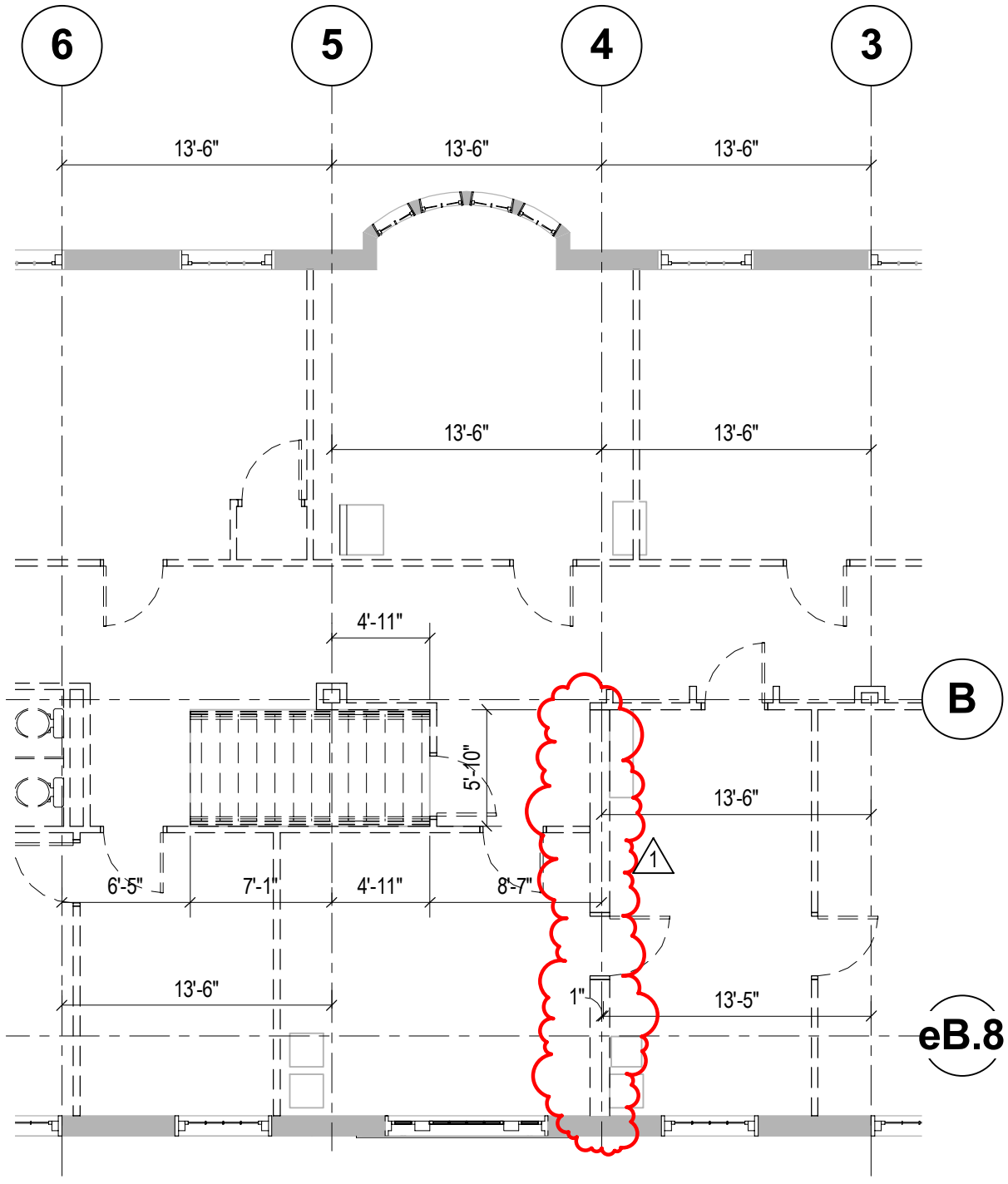

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Sketch Title: PART PLAN - UPPER LEVEL DEMOLITION PLAN				DCS Project Number: BI - P - 86	Sketch Revised
Project Title: **Renovations & Additions to Jenkins-Waggoner Laboratory**				FLAD Project Number: 10844-00	
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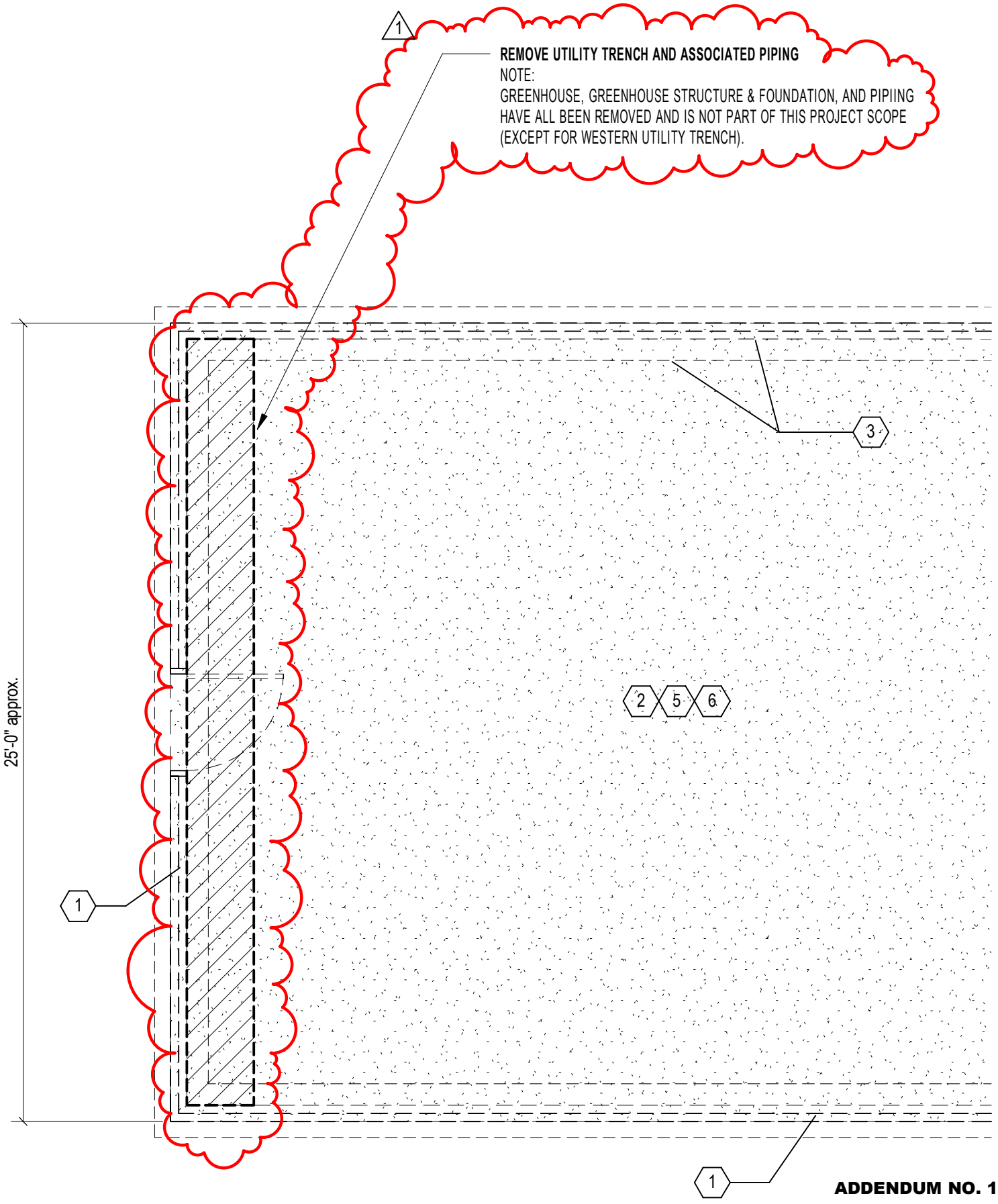

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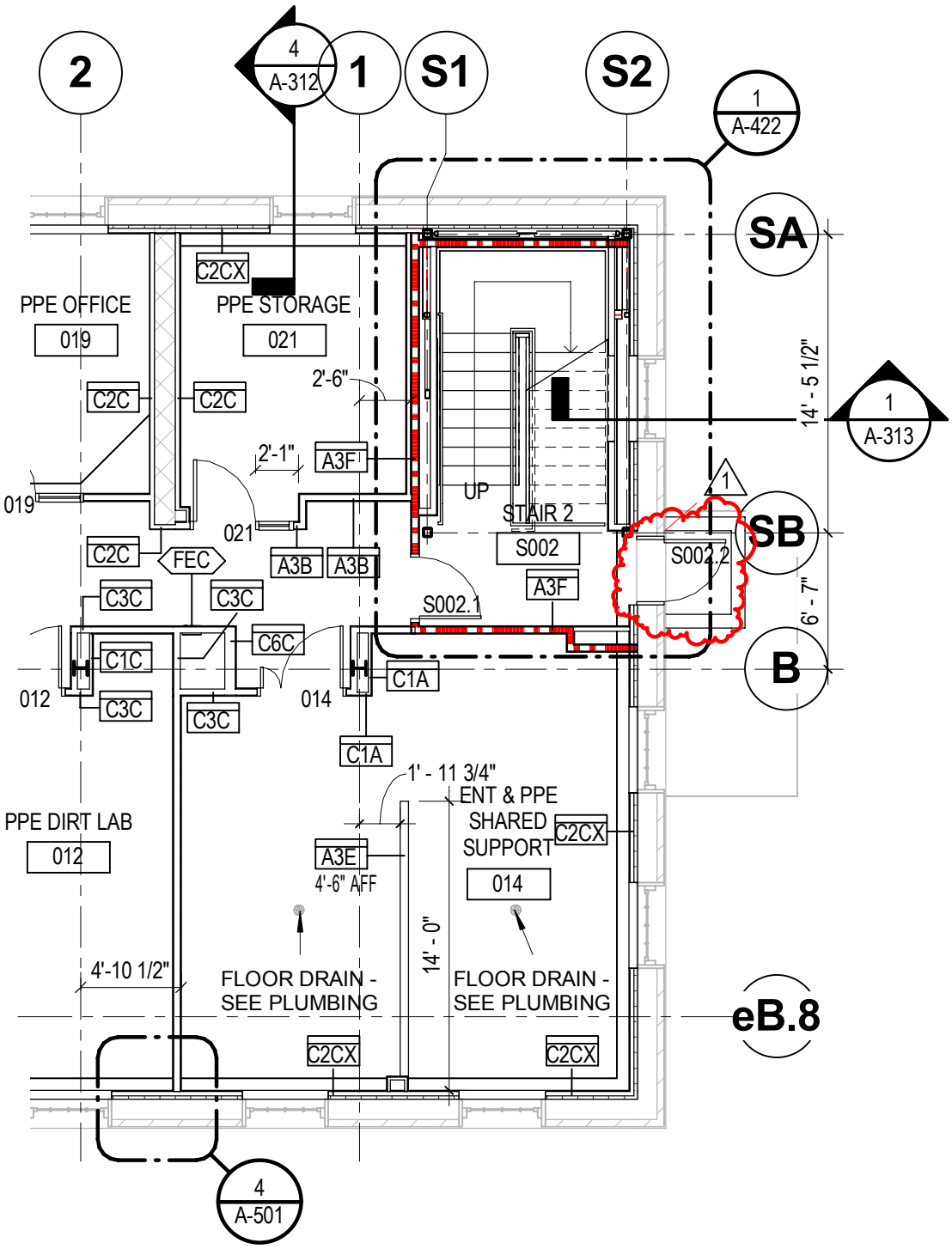
Sketch Title: PART PLAN - EXIST'G GREENHOUSE DEMOLITION PLAN Project Title: **Renovations & Additions to Jenkins-Waggoner Laboratory**				DCS Project Number: **BI - P - 86** FLAD Project Number: **10844-00**	Sketch Revised
Sketch Number: **ASK-AD102**	RFI Number: -	Reference Sheet: **AD-102**		Revision Number: -	Sketch Issue Date: **01/10/13**



ADDENDUM NO. 1

Connecticut Department Of Construction Services	Sketch Title: PART-PLAN - LOWER FLOOR PLAN			DCS Project Number: **BI - P - 86**	Sketch Revised
Flad Architects	Project Title: **Renovations & Additions to Jenkins-Waggoner Laboratory**			FLAD Project Number: **10844-00**	
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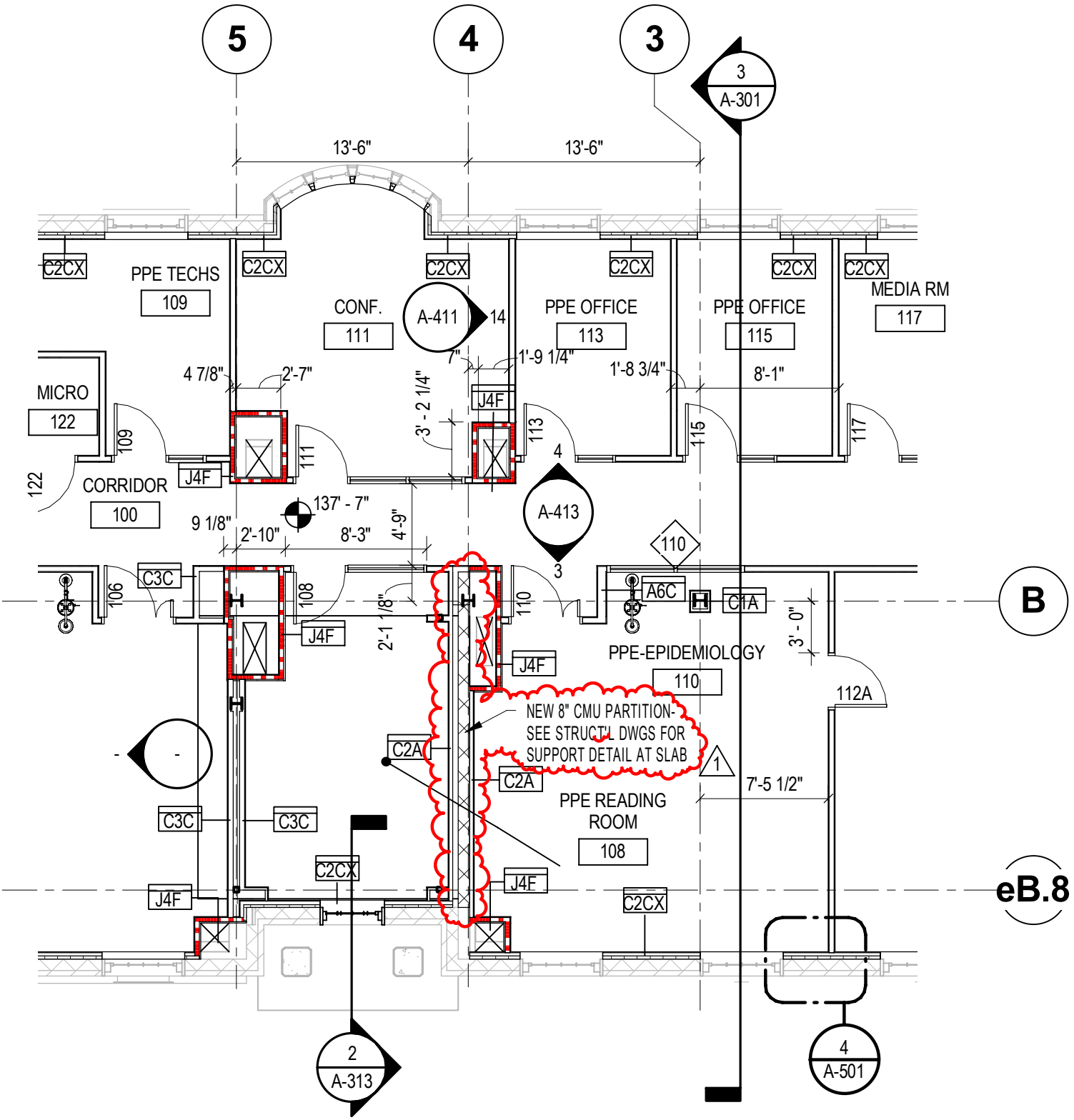

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Connecticut Department Of Construction Services	Sketch Title: PART-PLAN - FIRST FLOOR PLAN			DCS Project Number: **BI - P - 86**	Sketch Revised
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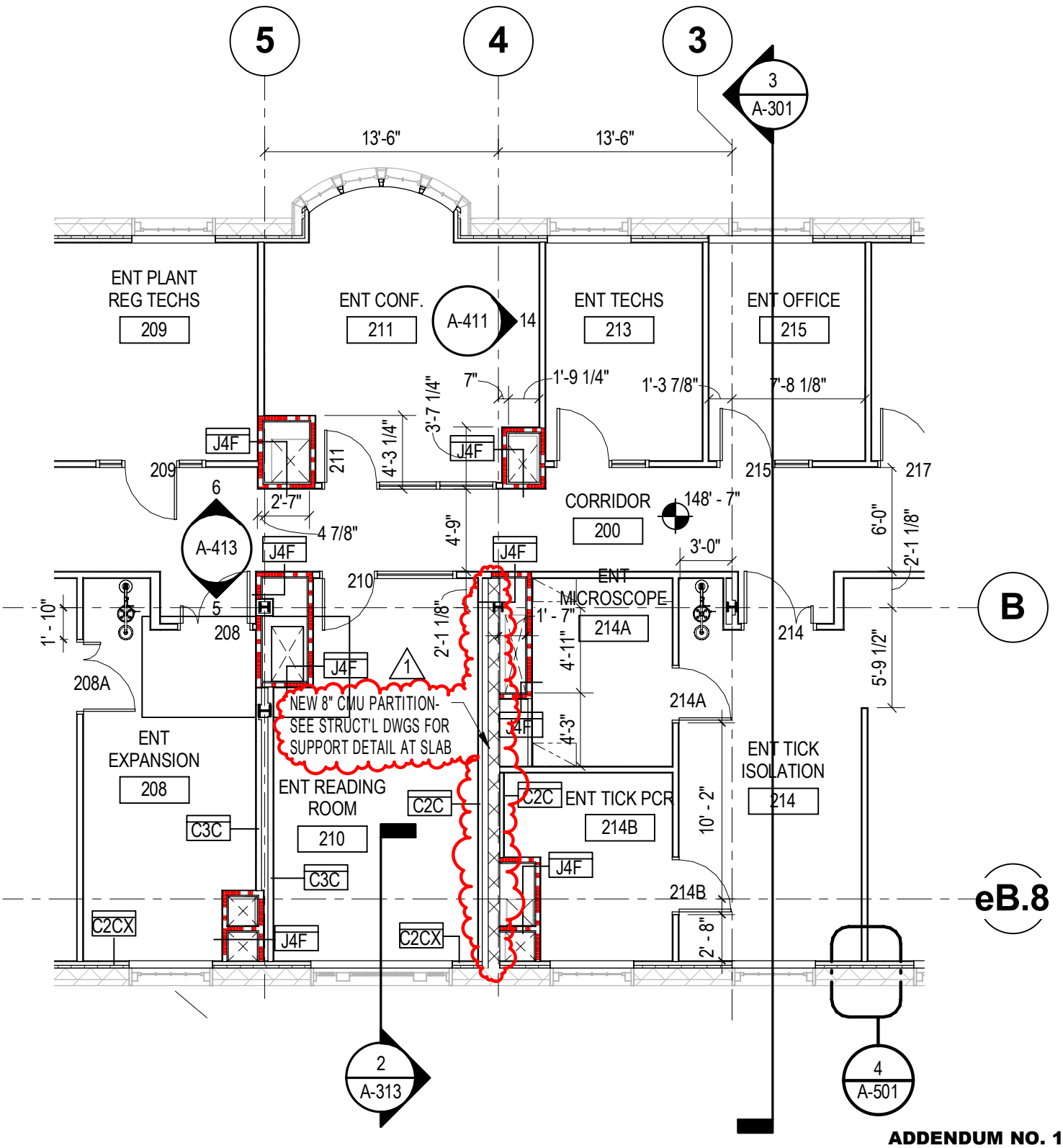

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Connecticut Department Of Construction Services / Flad Architects	Sketch Title: PART PLAN - UPPER LEVEL PLAN Project Title: **Renovations & Additions to Jenkins-Waggoner Laboratory**			DCS Project Number: **BI - P - 86** FLAD Project Number: **10844-00**	Sketch Revised
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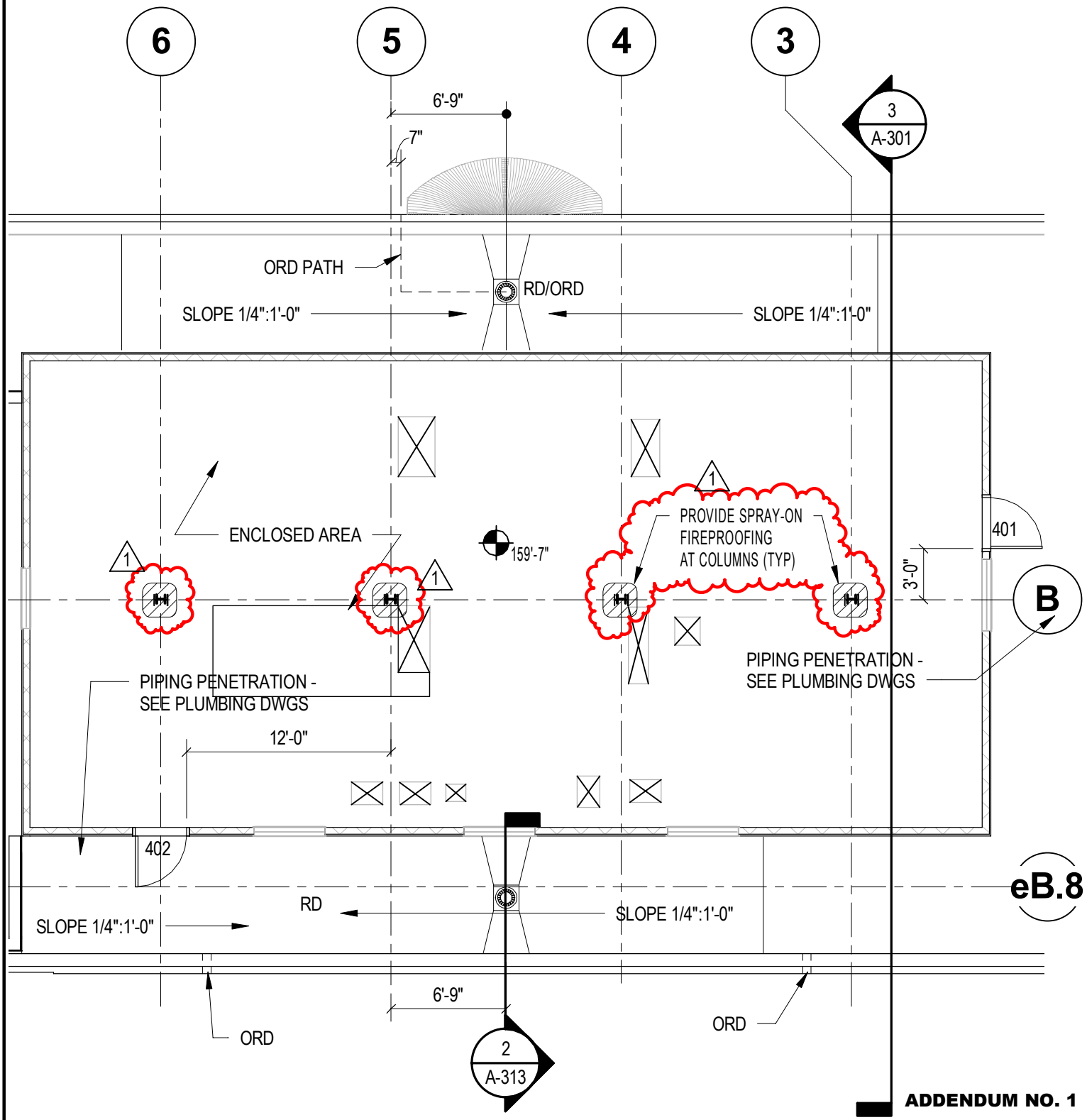

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Sketch Title: PART PLAN - ROOF PLAN @ PENTHOUSE				DCS Project Number: BI - P - 86	Sketch Revised
Project Title: Renovations & Additions to Jenkins-Waggoner Laboratory				FLAD Project Number: 10844-00	
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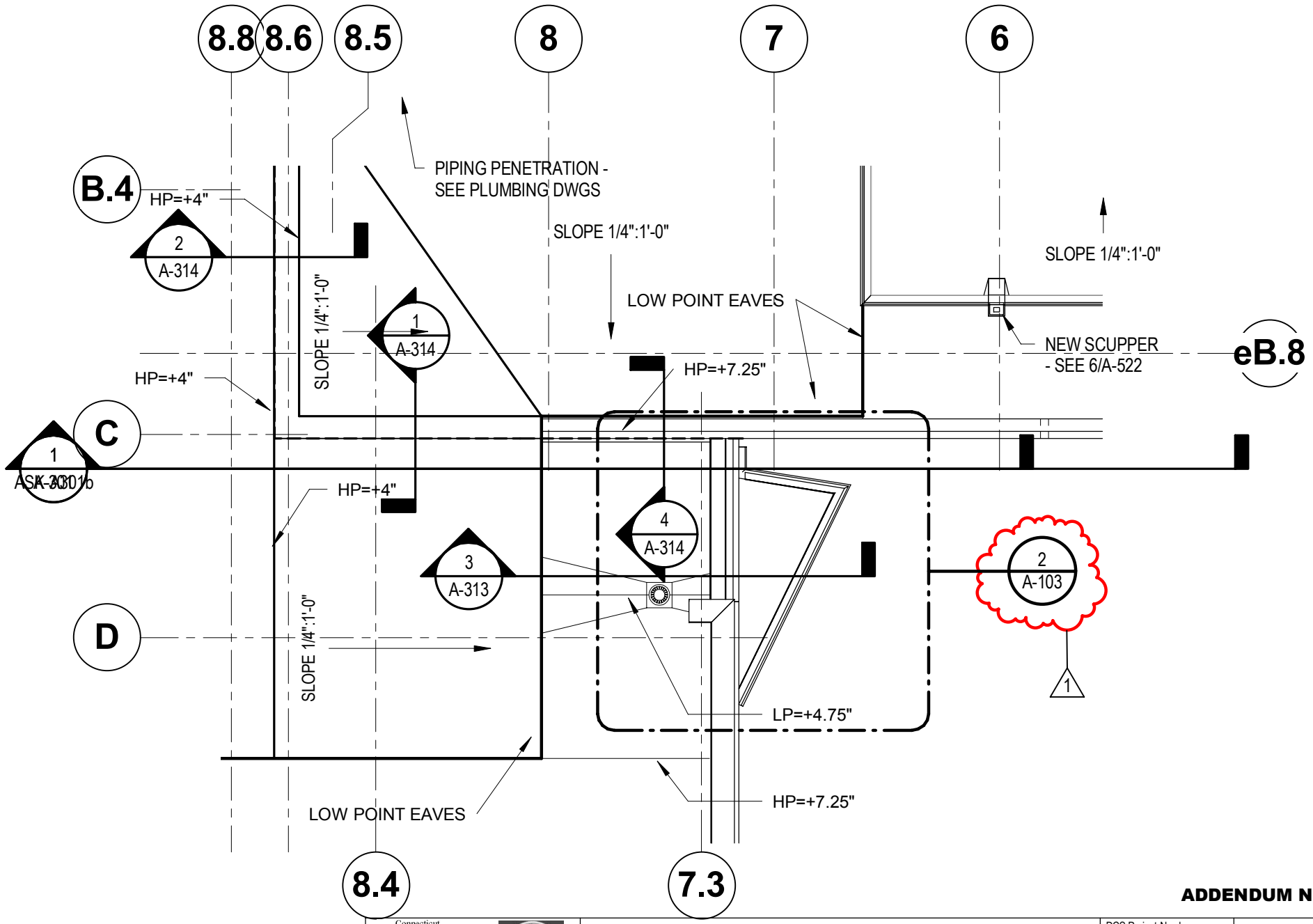

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Sketch Title: PART PLAN - OVERALL ROOF PLAN				DCS Project Number: BI - P - 86	Sketch Revised
Project Title: Renovations & Additions to Jenkins-Waggoner Laboratory				FLAD Project Number: 10844-00	
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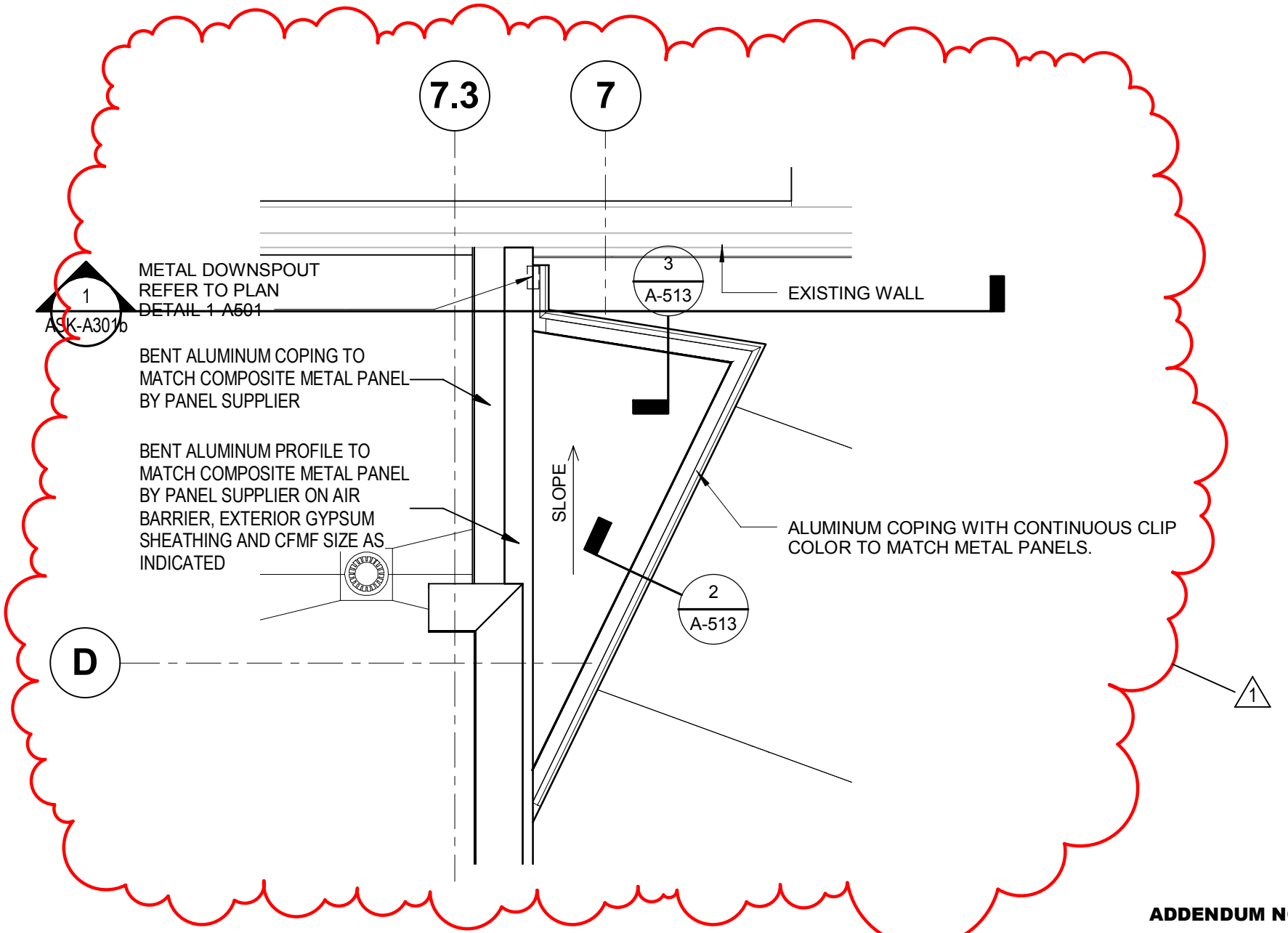

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Connecticut Department Of Construction Services / Flad Architects	Sketch Title: ENLARGED ROOF PLAN Project Title: **Renovations & Additions to Jenkins-Waggoner Laboratory**			DCS Project Number: **BI - P - 86** FLAD Project Number: **10844-00**	Sketch Revised
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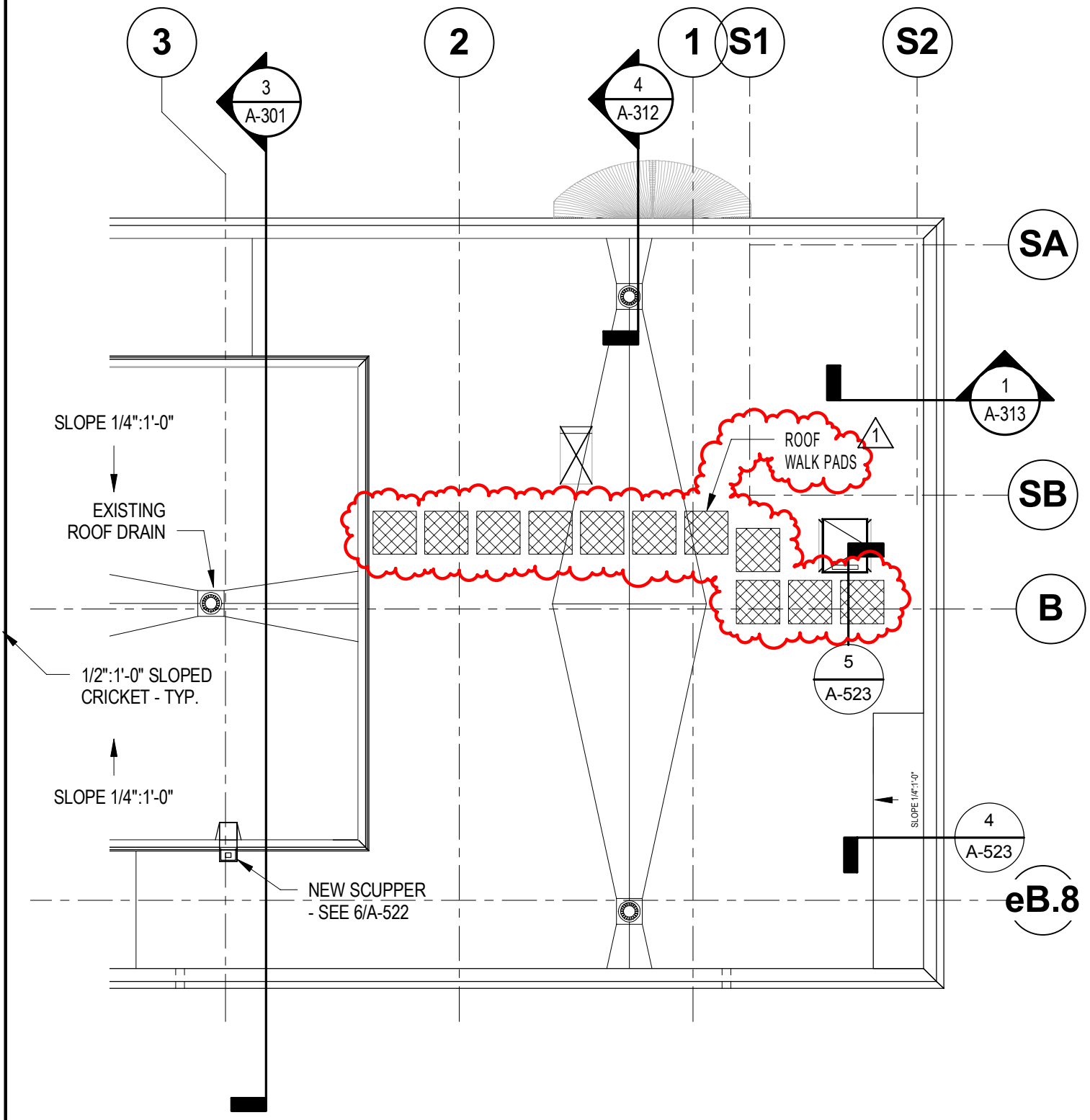

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Connecticut Department Of Construction Services	Sketch Title: PART PLAN - OVERALL ROOF PLAN			DCS Project Number: BI - P - 86	Sketch Revised
Flad Architects	Project Title: Renovations & Additions to Jenkins-Waggoner Laboratory			FLAD Project Number: 10844-00	
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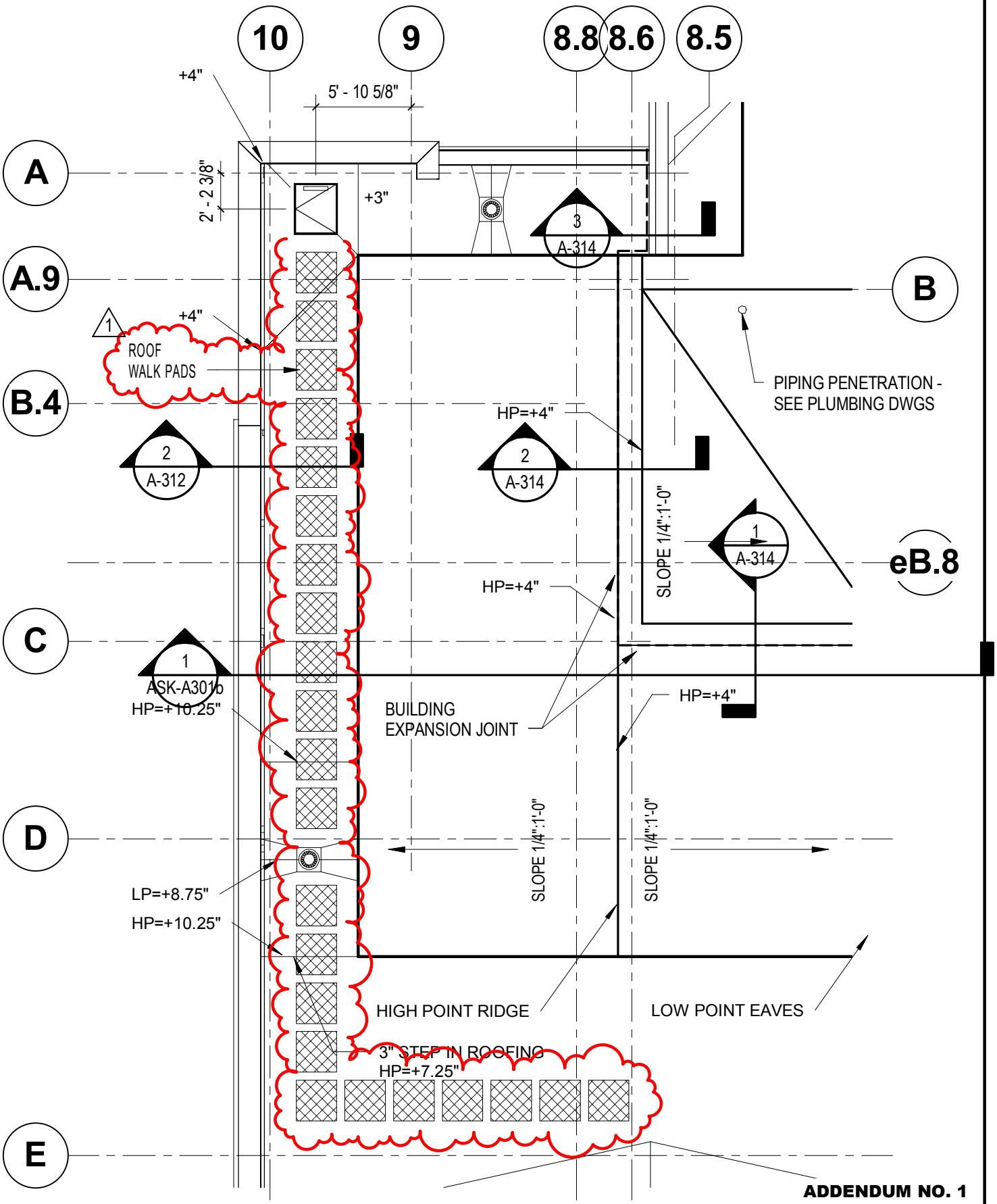

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Sketch Title: PART PLAN - OVERALL ROOF PLAN				DCS Project Number: BI - P - 86	Sketch Revised
Project Title: Renovations & Additions to Jenkins-Waggoner Laboratory				FLAD Project Number: 10844-00	
Sketch Number: **ASK-A103d**	RFI Number: -	Reference Sheet: A-103	Revision Number: -		Sketch Issue Date: 01/10/13

LEGEND

EXTENT OF CONCRETE SLAB INFILL

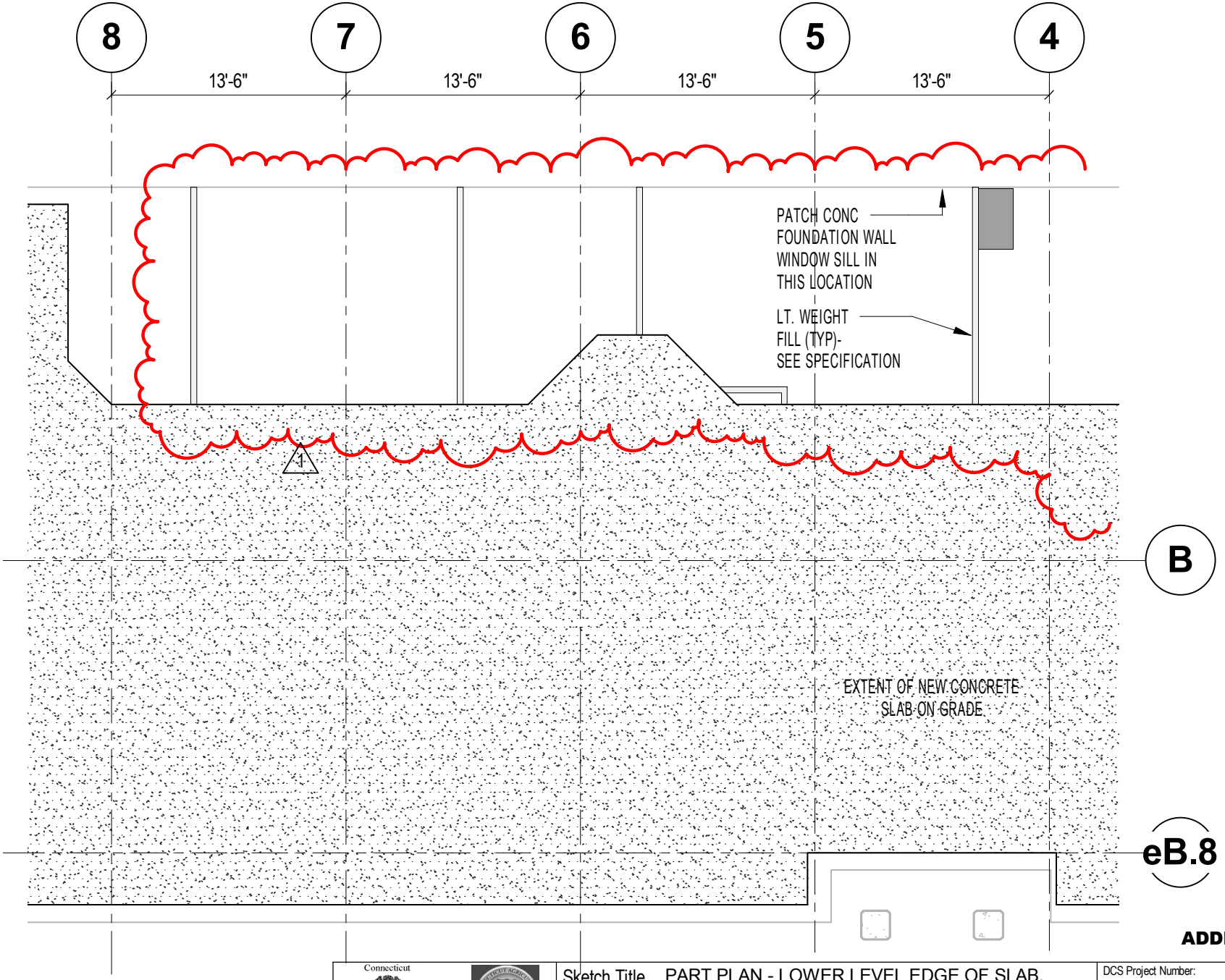
EXTENT OF LIGHT WEIGHT INFILL (SEE SPECIFICATION)
(+/- 1 3/4") AT EXISTING SLAB;
SEE STUCT'L DWGS FOR CMU SUPPORT

EXTENT OF 4" CMU EXTERIOR WALL PATCH, AND
FIRE SAFING OF OPENING AT SLAB (TYP)

1

ADDENDUM NO. 1

Connecticut Department Of Construction Services Flad Architects	Sketch Title: LEGEND - ARCHITECTURAL EDGE OF SLAB, FLOOR INFILL & EXTERIOR WALL PATCH PLANS Project Title: **Renovations & Additions to Jenkins-Waggoner Laboratory**			DCS Project Number: **BI - P - 86** FLAD Project Number: **10844-00**	Sketch Revised
Sketch Number: **ASK-A104a**	RFI Number: -	Reference Sheet: **A-104**	Revision Number: -		Sketch Issue Date: **01/10/13**



ADDENDUM NO. 1

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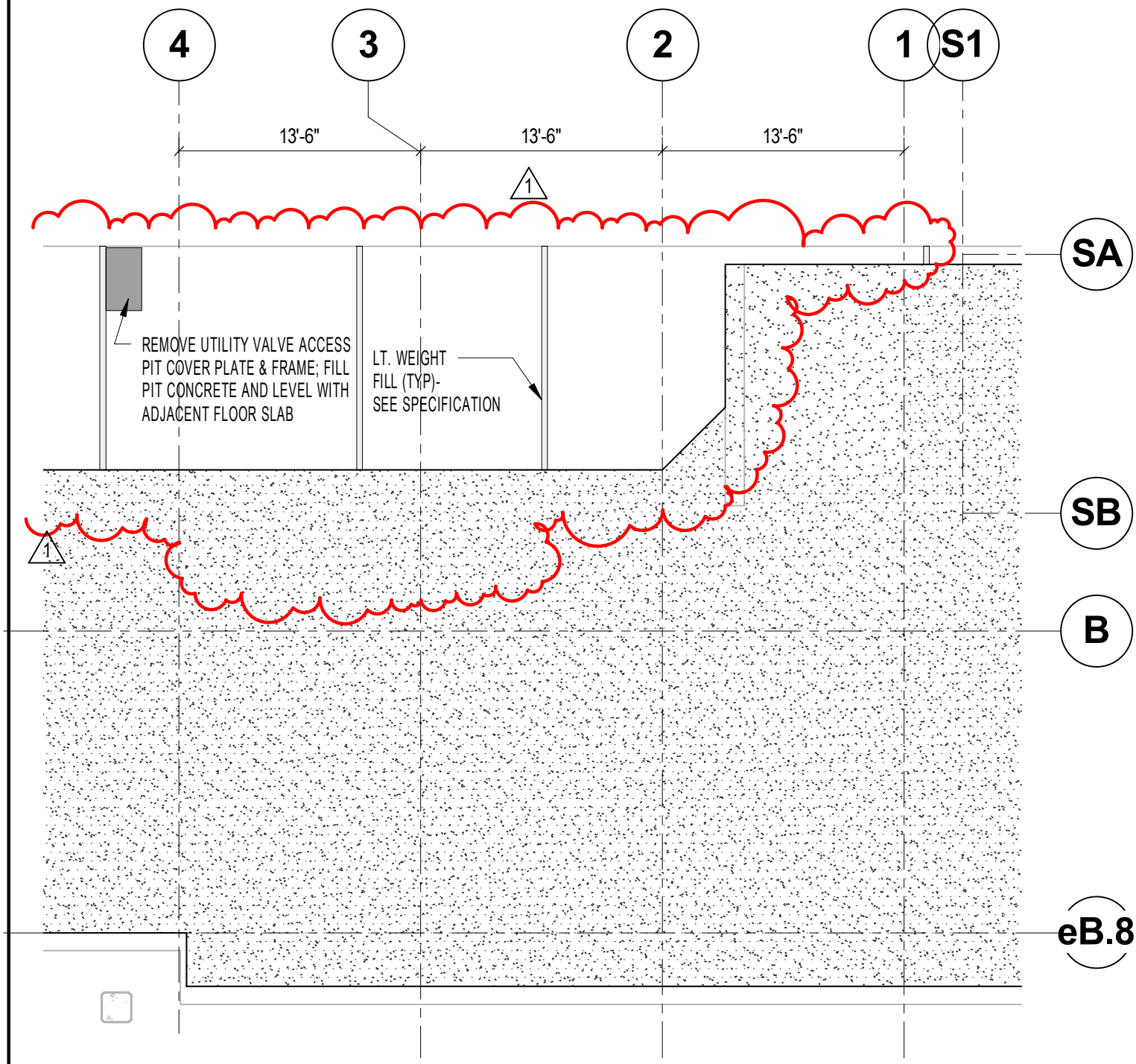
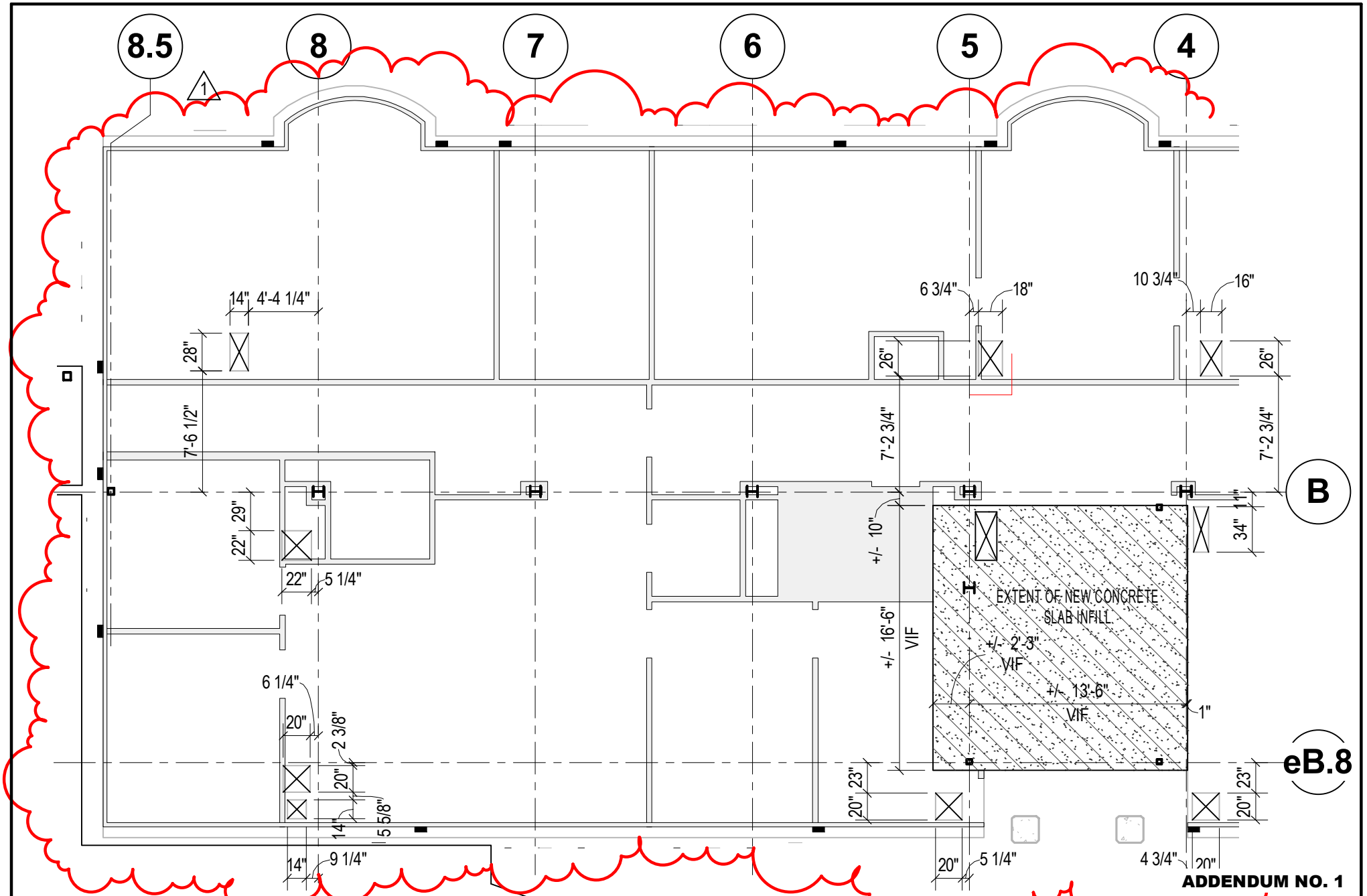
Sketch Title / Project Title	PART PLAN - LOWER LEVEL EDGE OF SLAB, FLOOR INFILL & EXTERIOR WALL PATCH PLAN **Renovations & Additions to Jenkins-Waggoner Laboratory**			DCS Project Number: **BI - P - 86** FLAD Project Number: **10844-00**	Sketch Revised
Sketch Number **ASK-A104b**	RFI Number **-**	Reference Sheet **A-104**		Revision Number **-**	Sketch Issue Date **01/10/13**



ADDENDUM NO. 1

Connecticut Department Of Construction Services / Flad Architects	Sketch Title: PART PLAN - LOWER LEVEL EDGE OF SLAB, FLOOR INFILL & EXTERIOR WALL PATCH PLAN Project Title: **Renovations & Additions to Jenkins-Waggoner Laboratory**			DCS Project Number: **BI - P - 86** FLAD Project Number: **10844-00**	Sketch Revised
Sketch Number: **ASK-A104c**	RFI Number: -	Reference Sheet: **A-104**	Revision Number: -		Sketch Issue Date: **01/10/13**



ADDENDUM NO. 1

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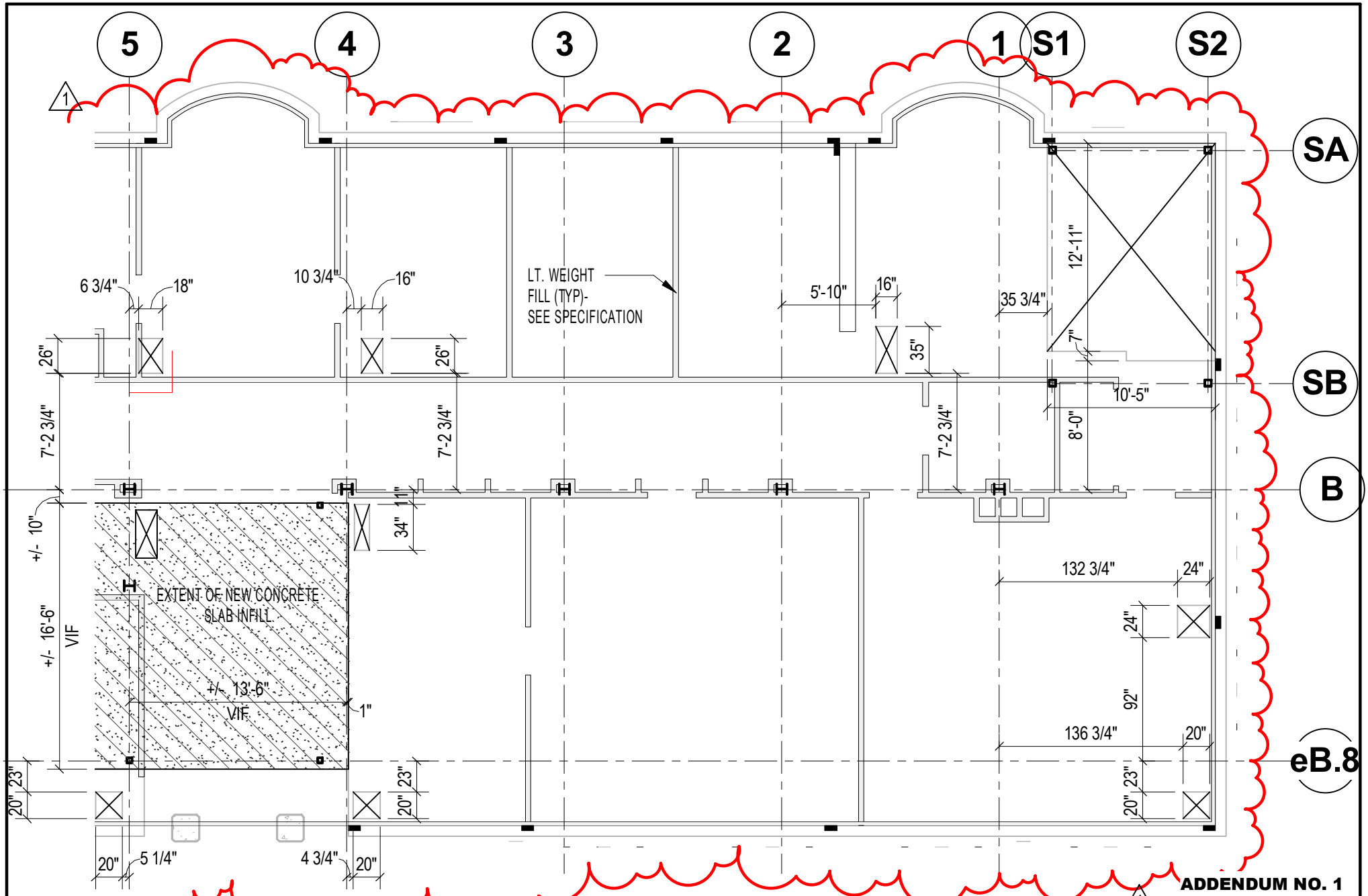
Sketch Title	PART PLAN - FIRST LEVEL EDGE OF SLAB, FLOOR INFILL & EXTERIOR WALL PATCH PLAN			DCS Project Number: BI - P - 86	Sketch Revised
Project Title	Renovations & Additions to Jenkins-Waggoner Laboratory			FLAD Project Number: 10844-00	
Sketch Number **ASK-A104d**	RFI Number -	Reference Sheet A-104	Revision Number -	Sketch Issue Date 01/10/13	



ADDENDUM NO. 1

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Sketch Title	PART PLAN - FIRST LEVEL EDGE OF SLAB, FLOOR INFILL & EXTERIOR WALL PATCH PLAN			DCS Project Number: BI - P - 86	Sketch Revised
Project Title	Renovations & Additions to Jenkins-Waggoner Laboratory			FLAD Project Number: 10844-00	
Sketch Number **ASK-A104e**	RFI Number -	Reference Sheet A-104		Revision Number -	Sketch Issue Date 01/10/13

1

LEGEND

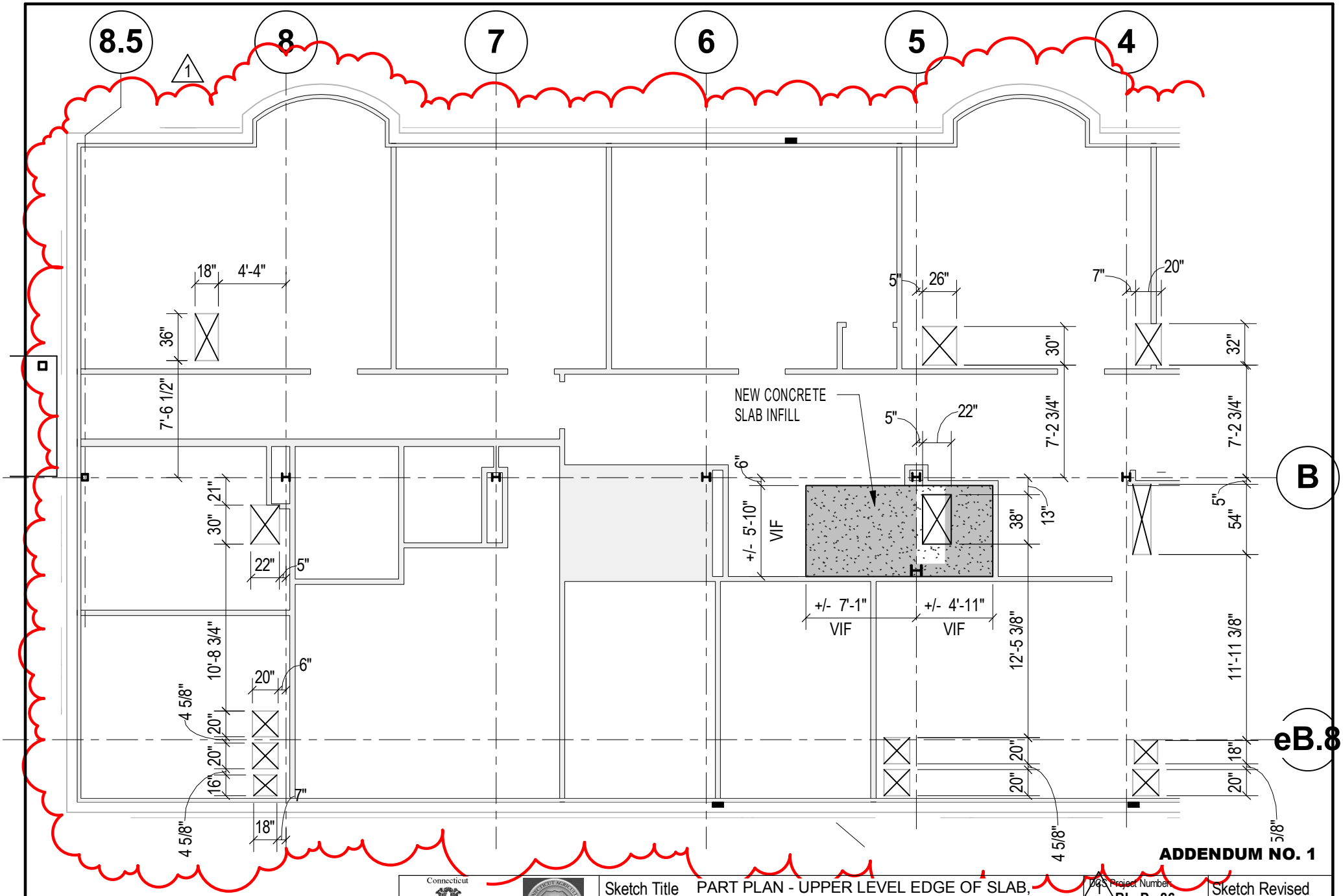
EXTENT OF CONCRETE SLAB INFILL

EXTENT OF LIGHT WEIGHT INFILL (SEE SPECIFICATION)
(+/- 1 3/4") AT EXISTING SLAB;
SEE STUCT'L DWGS FOR CMU SUPPORT

EXTENT OF 4" CMU EXTERIOR WALL PATCH, AND
FIRE SAFING OF OPENING AT SLAB (TYP)

ADDENDUM NO. 1

Connecticut Department Of Construction Services / Flad Architects	Sketch Title: LEGEND - ARCHITECTURAL EDGE OF SLAB, FLOOR INFILL & EXTERIOR WALL PATCH PLANS Project Title: **Renovations & Additions to Jenkins-Waggoner Laboratory**			DCS Project Number: **BI - P - 86** FLAD Project Number: **10844-00**	Sketch Revised
Sketch Number: **ASK-A105a**	RFI Number: -	Reference Sheet: **A-105**	Revision Number: -		Sketch Issue Date: **01/10/13**

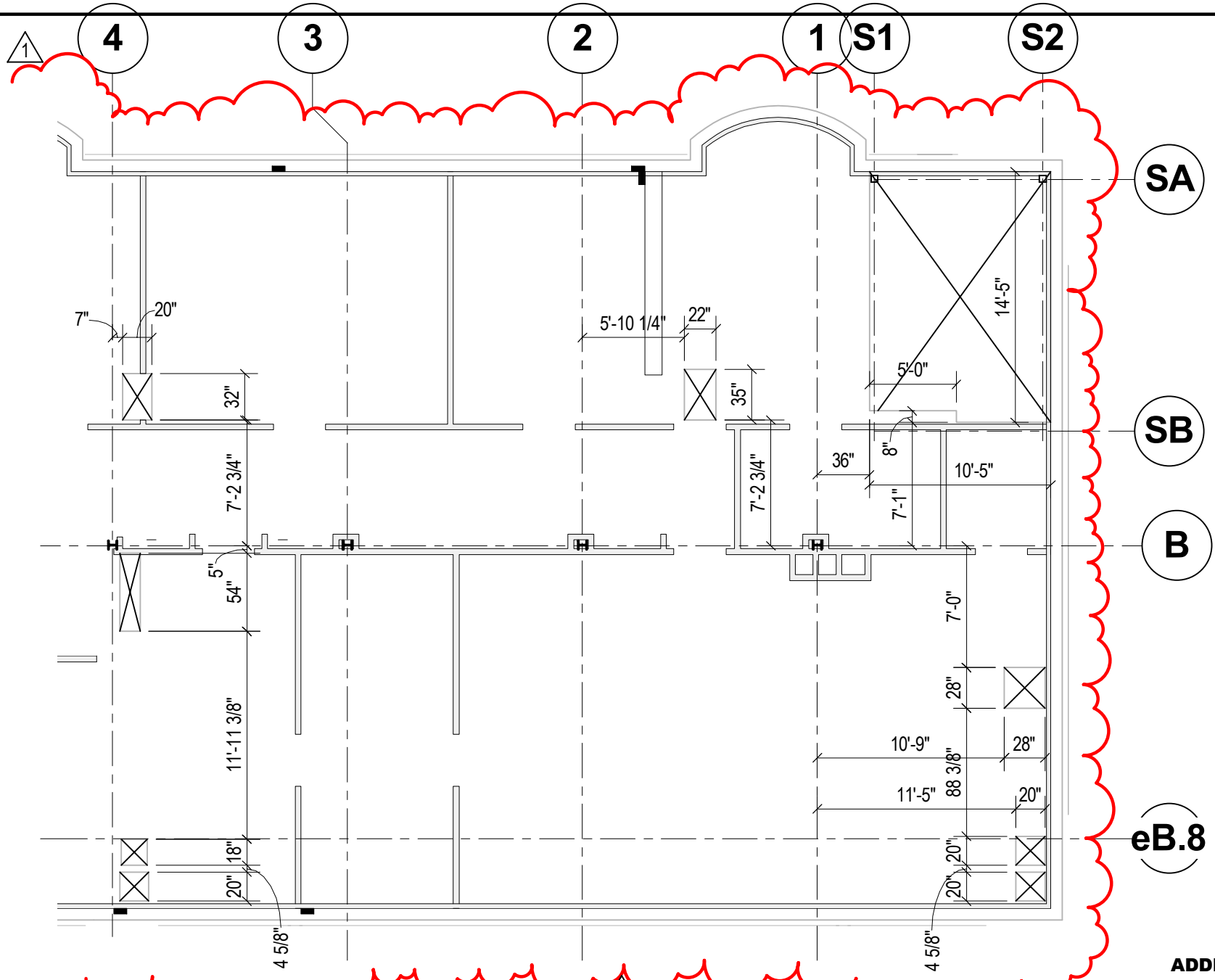


ADDENDUM NO. 1

Connecticut
Department Of
Construction Services

Flad Architects

Sketch Title	PART PLAN - UPPER LEVEL EDGE OF SLAB, FLOOR INFILL & EXTERIOR WALL PATCH PLAN			DCS Project Number: BI - P - 86	Sketch Revised
Project Title	Renovations & Additions to Jenkins-Waggoner Laboratory			FLAD Project Number: 10844-00	
Sketch Number **ASK-A105b**	RFI Number -	Reference Sheet A-105		Revision Number -	Sketch Issue Date 01/10/13



ADDENDUM NO. 1

Connecticut
Department Of Construction Services

Flad Architects

Sketch ~~Title~~ 1 / Project Title: PART PLAN - UPPER LEVEL EDGE OF SLAB, FLOOR INFILL & EXTERIOR WALL PATCH PLAN **Renovations & Additions to Jenkins-Waggoner Laboratory**				DCS Project Number: **BI - P - 86** FLAD Project Number: **10844-00**	Sketch Revised
Sketch Number **ASK-A105c**	RFI Number -	Reference Sheet A-105		Revision Number -	Sketch Issue Date 01/10/13

GENERAL SHEET NOTES

1. REFER TO PROJECT MANUAL FOR MATERIAL SPECIFICATIONS, REFER TO INDIVIDUAL SPECIFICATION SECTIONS FOR MATERIAL SELECTION, KEY CODES & COLOR SCHEDULE.

2. REFER TO MEP DRAWINGS/SPEC FOR FIXTURE & EQUIPMENT SCHEDULES.

3. REFER TO ELECTRICAL DRAWINGS FOR LIGHT FIXTURE SCHEDULE.

4. SPRINKLER HEADS, DOWN LIGHTS AND EXIT LIGHTS TO BE CENTERED IN ACOUSTICAL CEILING TILES U.N.O.

5. SPRINKLER LOCATIONS TO BE VERIFIED IN FIELD. SEE FIRE PROTECTION SHEETS FOR FURTHER INFO.

6. TYPICAL CEILING HEIGHT TO BE 8'-0" U.N.O. (UNLESS NOTED OTHERWISE).

7. TYPICAL ACOUSTICAL CEILING TO BE ACP-1 U.N.O.

8. ALL ACOUSTICAL CEILING GRIDS WITH LIGHTS TO BE CENTERED WITHIN ROOM U.N.O.

1 9. ALL GWB CEILINGS, SOFFITS & EXPOSED CEILINGS/MECHANICALS (EXP-1) TO BE PAINTED PT-1 U.N.O.
SEE SPECIFICATIONS FOR EXP-1 FINISH COMPOUND.
AT EXISTING LOWER LEVEL EXPOSED CEILING AREA FILL IN FULL DEPTH OF EXISTING PARTITION RECESS & SKIM COAT ENTIRE EXPOSED CEILING.

10. REFER TO SHEET A-541 FOR TYPICAL CEILING DETAILS.

11. REFER TO SHEET A-515 FOR CEILING EXPANSION JOINT DETAILS.

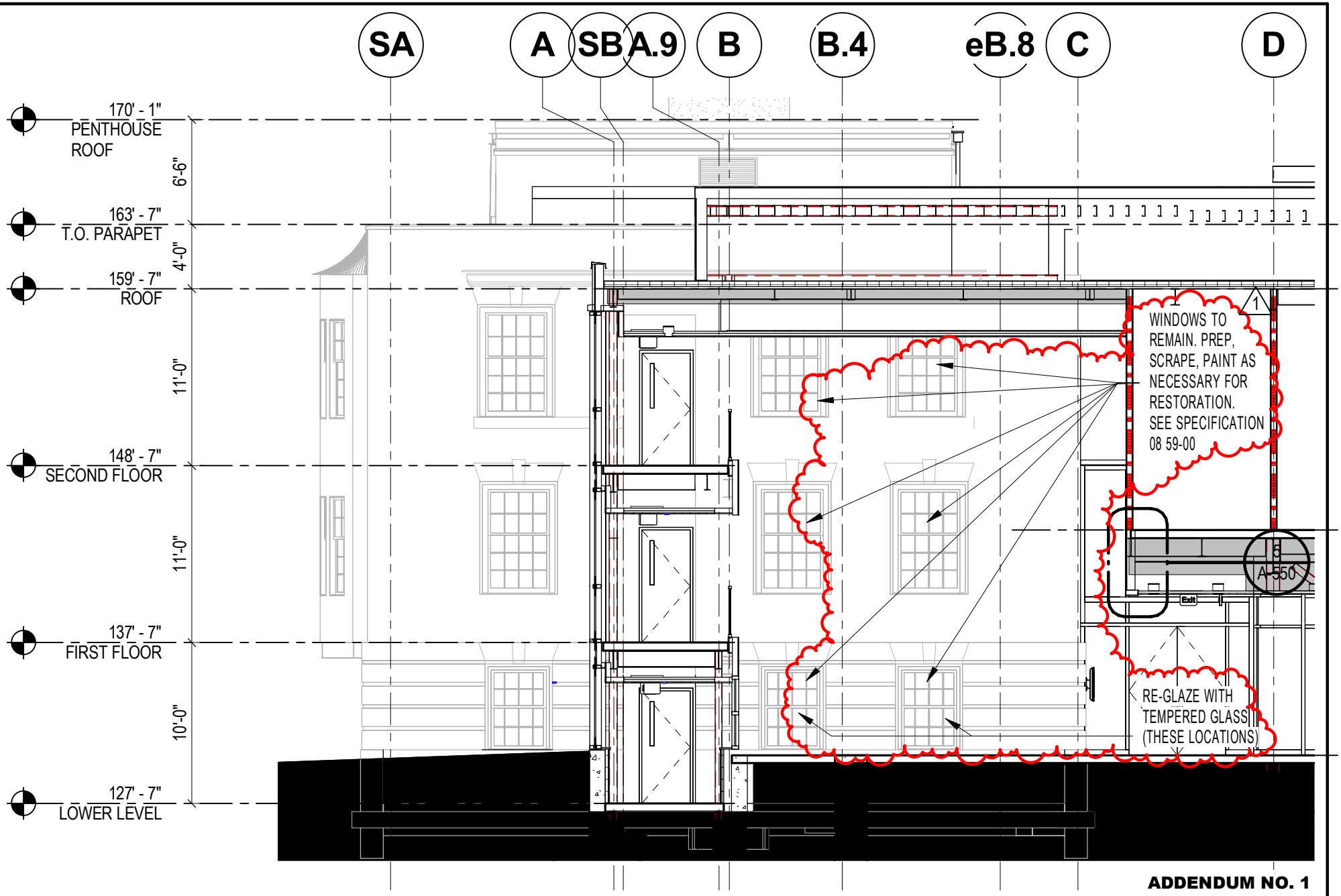
12. REFER TO INTERIOR ELEVATIONS FOR ADDITIONAL SOFFIT INFORMATION.

ADDENDUM NO. 1

Connecticut Department Of Construction Services

Flad Architects

Sketch Title: Reflected Ceiling Plan - General Notes				DCS Project Number: BI - P - 86	Sketch Revised
Project Title: Renovations & Additions to Jenkins-Waggoner Laboratory				FLAD Project Number: 10844-00	
Sketch Number: ASK-A121	RFI Number: -	Reference Sheet: A-121 & A-122	Revision Number: -		Sketch Issue Date: 01/10/13

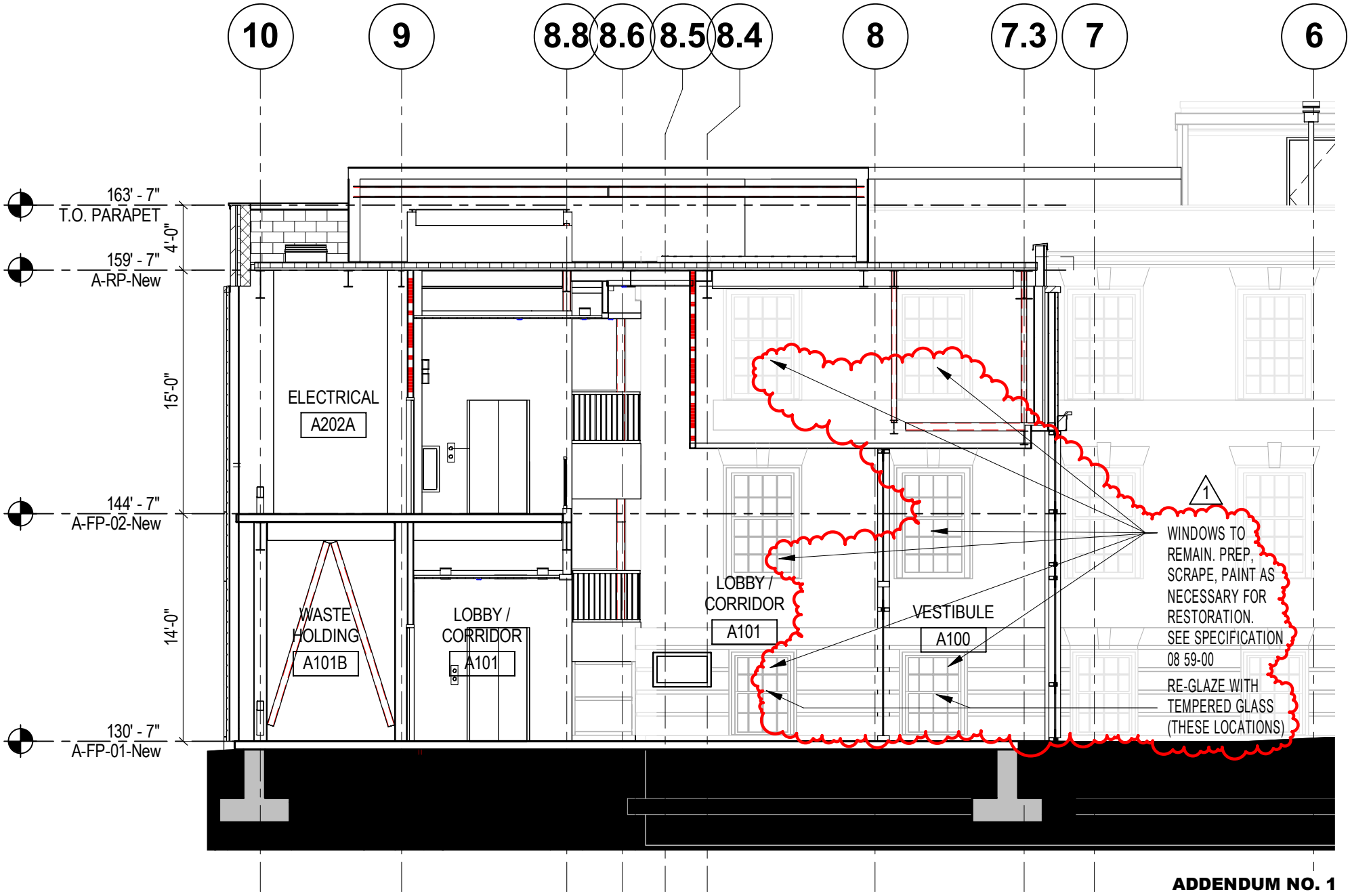


ADDENDUM NO. 1

Connecticut
Department Of Construction Services

Flad Architects

Sketch Title: PART BUILDING SECTION-ADDITION LONG.				DCS Project Number: BI - P - 86	Sketch Revised
Project Title: Renovations & Additions to Jenkins-Waggoner Laboratory				FLAD Project Number: 10844-00	
Sketch Number: **ASK-A301a**	RFI Number: -	Reference Sheet: A-301	Revision Number: -	Sketch Issue Date: 01/10/13	

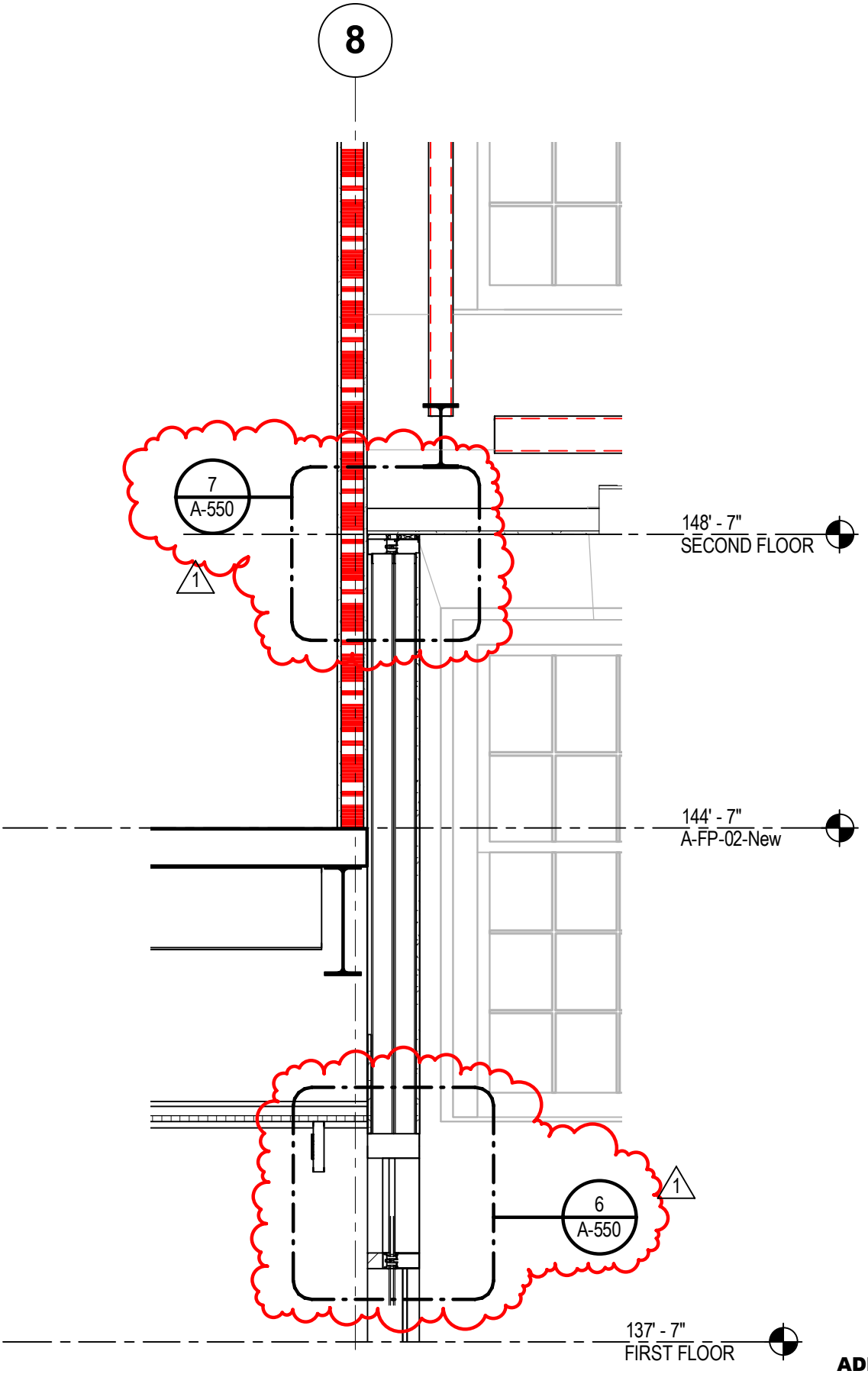


ADDENDUM NO. 1

Connecticut
Department Of Construction Services

Flad Architects

Sketch Title: PART BUILDING SECTION-ADDITION TRANSV.				DCS Project Number: BI - P - 86	Sketch Revised
Project Title: Renovations & Additions to Jenkins-Waggoner Laboratory				FLAD Project Number: 10844-00	
Sketch Number: **ASK-A301b**	RFI Number: -	Reference Sheet: A-301		Revision Number: -	Sketch Issue Date: 01/10/13

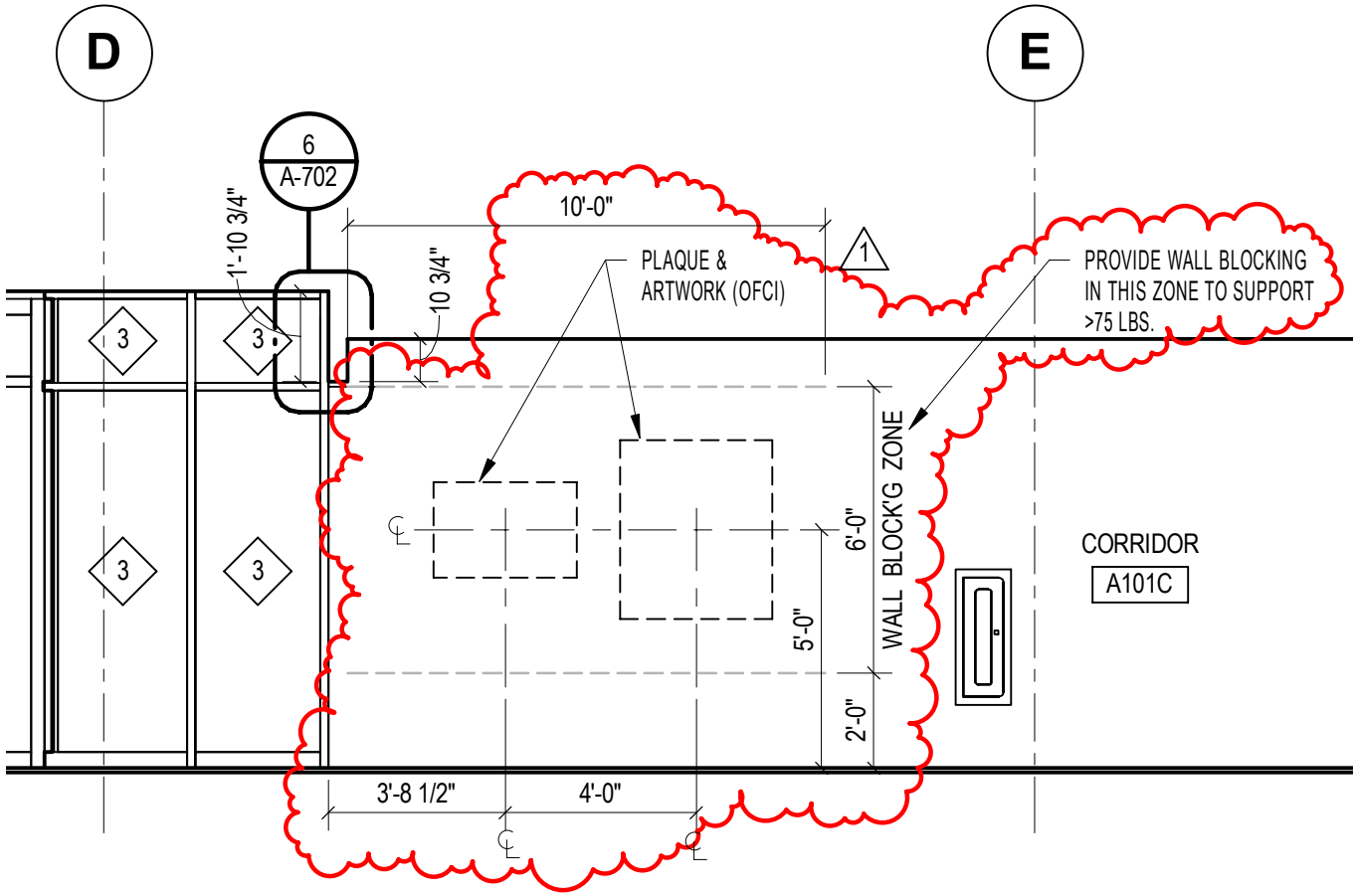


ADDENDUM NO. 1

Connecticut
Department Of
Construction Services

Flad Architects

Sketch Title: PARTIAL - ENTRY WALL SECTION				DCS Project Number: **BI - P - 86**	Sketch Revised
Project Title: **Renovations & Additions to Jenkins-Waggoner Laboratory**				FLAD Project Number: **10844-00**	
Sketch Number: **ASK-A313**	RFI Number: -	Reference Sheet: **A-313**	Revision Number: -		Sketch Issue Date: **01/10/13**



ADDENDUM NO. 1

Connecticut Department Of Construction Services / Flad Architects	Sketch Title: PART ELEV - LOBBY INTERIOR ELEVATION 3 Project Title: **Renovations & Additions to Jenkins-Waggoner Laboratory**			DCS Project Number: **BI - P - 86** FLAD Project Number: **10844-00**	Sketch Revised
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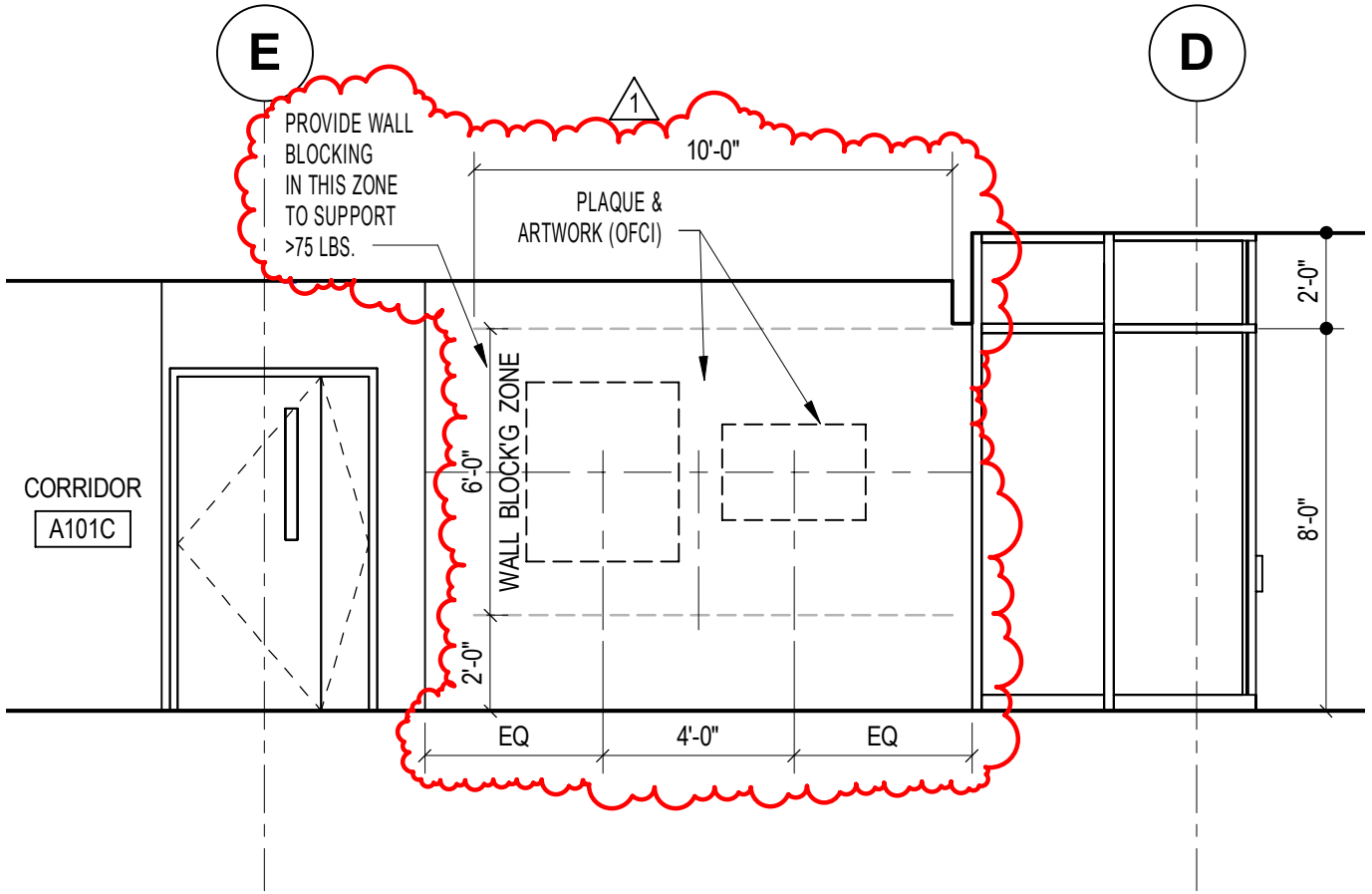
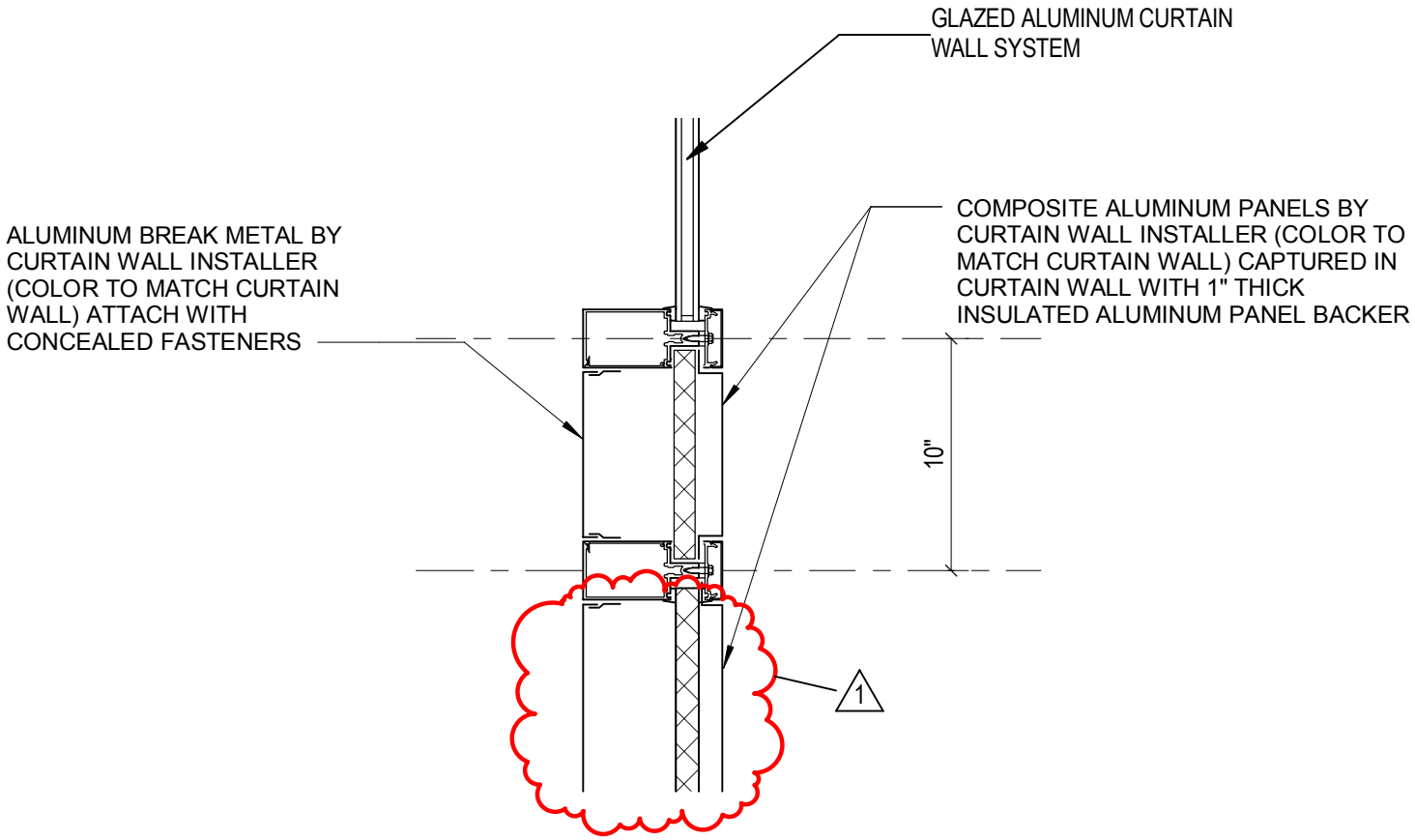


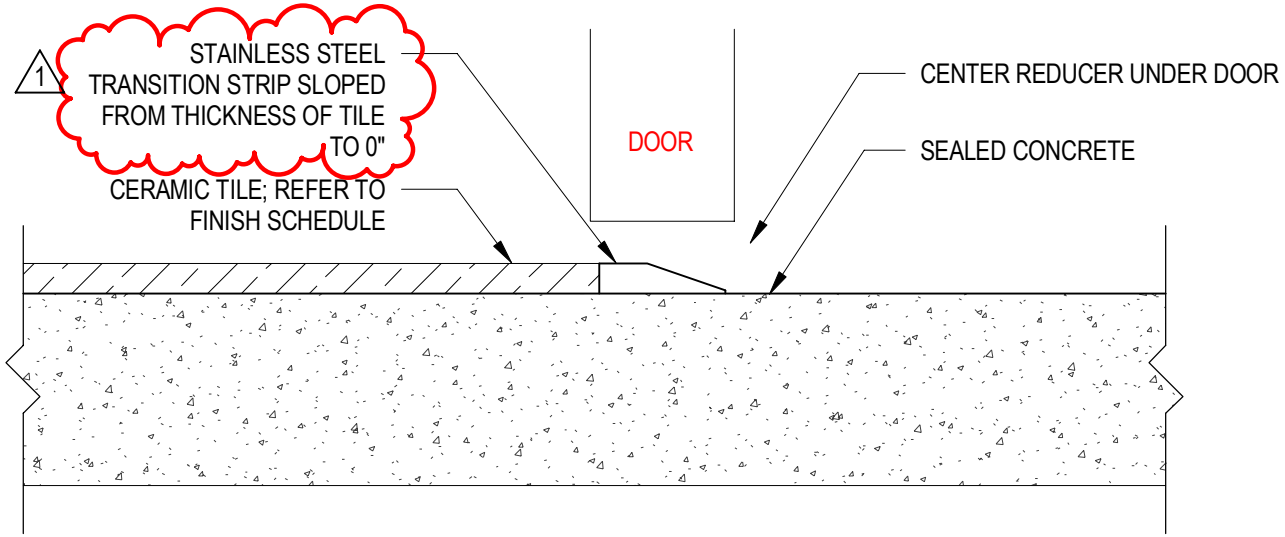
ADDENDUM NO. 1

Connecticut Department Of Construction Services / Flad Architects	Sketch Title: PART ELEV - LOBBY INTERIOR ELEVATION 4 Project Title: **Renovations & Additions to Jenkins-Waggoner Laboratory**			DCS Project Number: **BI - P - 86** FLAD Project Number: **10844-00**	Sketch Revised
	Sketch Number: **ASK-A412b**	RFI Number: **-**	Reference Sheet: **A-412**	Revision Number: **-**	Sketch Issue Date: **01/10/13**



ADDENDUM NO. 1

Connecticut Department Of Construction Services / Flad Architects	Sketch Title: HORIZONTAL MULLION DETAIL Project Title: **Renovations & Additions to Jenkins-Waggoner Laboratory**			DCS Project Number: **BI - P - 86** FLAD Project Number: **10844-00**	Sketch Revised
Sketch Number: **ASK-A516**	RFI Number: **-**	Reference Sheet: **A-516**		Revision Number: **-**	Sketch Issue Date: **01/10/13**

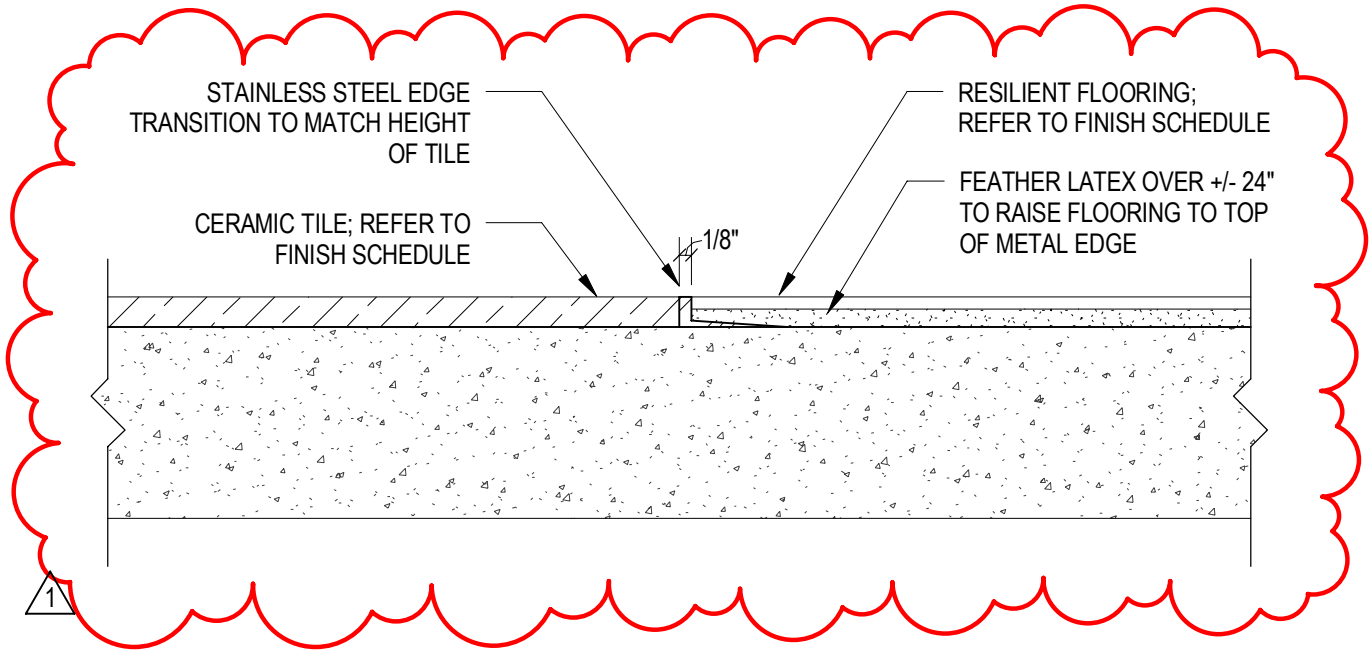


8 TRANSITION - CERAMIC TILE TO CONCRETE

6" = 1'-0"

ADDENDUM NO. 1

Connecticut Department Of Construction Services / Flad Architects	Sketch Title: FLOORING TRANSITIONS Project Title: Renovations & Additions to Jenkins-Waggoner Laboratory			DCS Project Number: BI - P - 86 FLAD Project Number: 10844-00	Sketch Revised
Sketch Number: **ASK-A542a**	RFI Number: -	Reference Sheet: A-542		Revision Number: -	Sketch Issue Date: 01/10/13

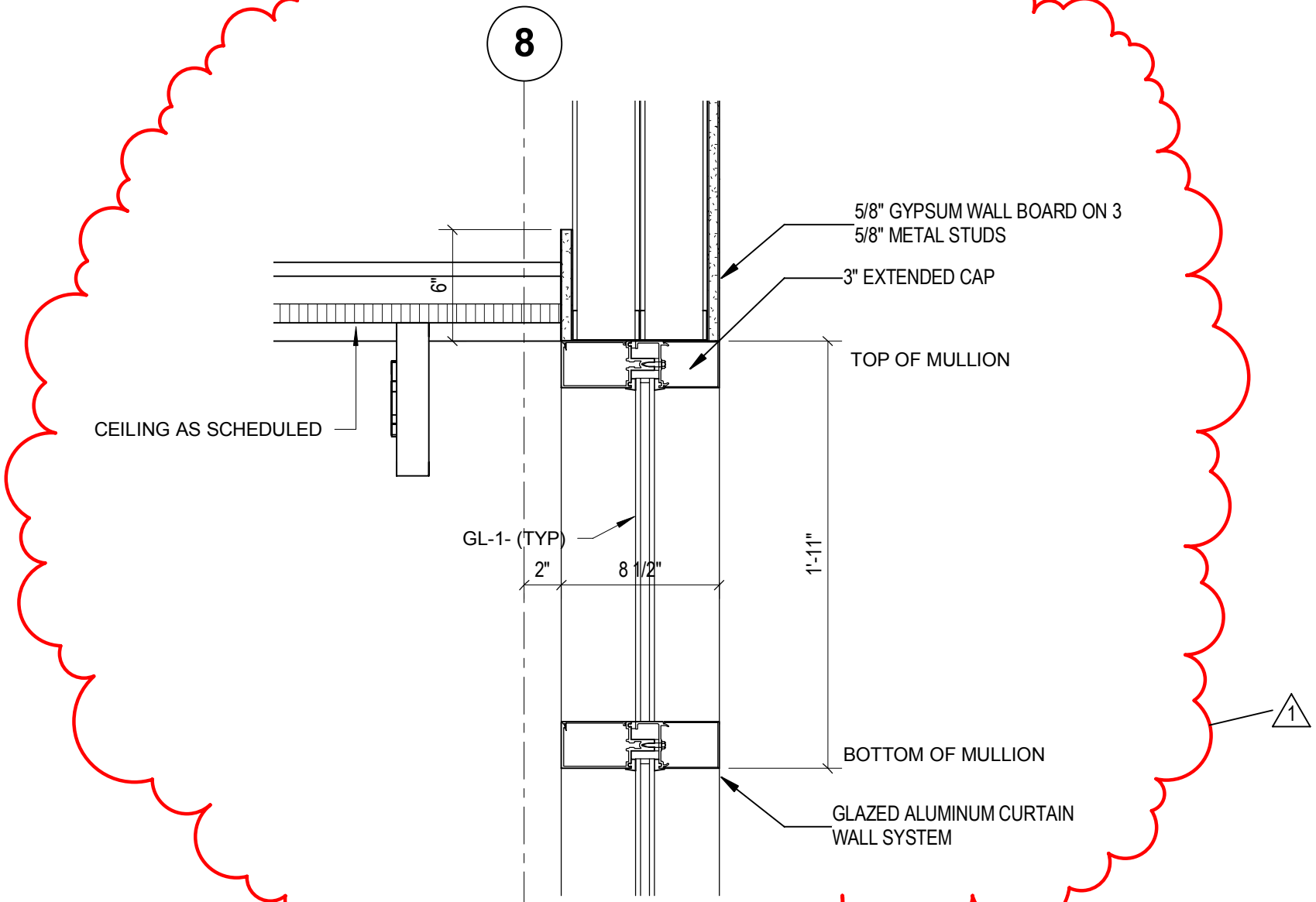


13 TRANSITION -CERAMIC TILE TO RESILIENT

6" = 1'-0"

ADDENDUM NO. 1

Connecticut Department Of Construction Services / Flad Architects	Sketch Title: FLOORING TRANSITIONS Project Title: Renovations & Additions to Jenkins-Waggoner Laboratory			DCS Project Number: BI - P - 86 FLAD Project Number: 10844-00	Sketch Revised
Sketch Number: **ASK-A542b**	RFI Number: -	Reference Sheet: A-542		Revision Number: -	Sketch Issue Date: 01/10/13



6 SECTION DETAIL

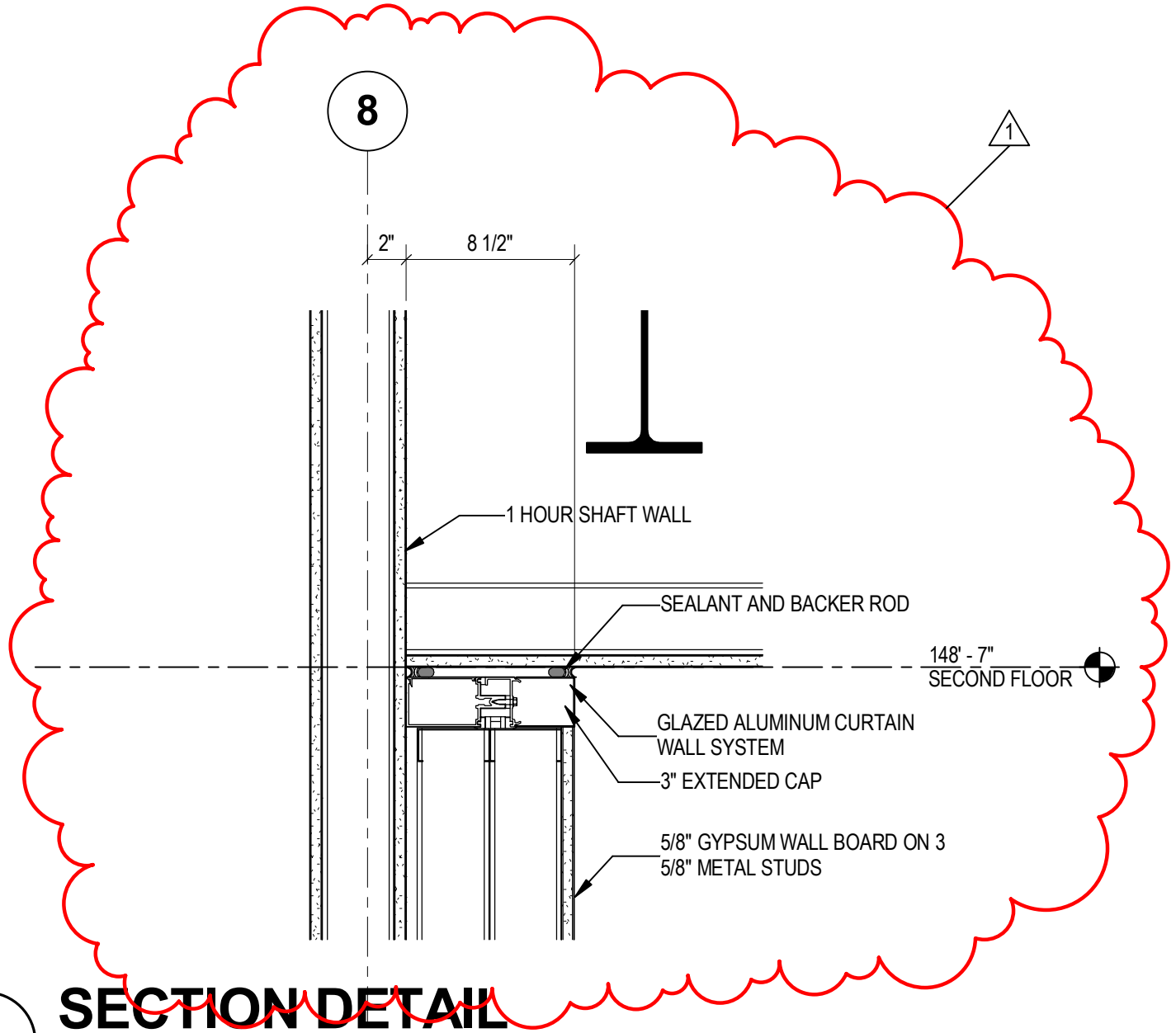
1 1/2" = 1'-0"

ADDENDUM NO. 1

Connecticut
Department Of Construction Services

Flad Architects

Sketch Title: INTERIOR DETAIL				DCS Project Number: BI - P - 86	Sketch Revised
Project Title: Renovations & Additions to Jenkins-Waggoner Laboratory				FLAD Project Number: 10844-00	
Sketch Number: **ASK-A550a**	RFI Number: -	Reference Sheet: A-550	Revision Number: -		Sketch Issue Date: 01/10/13



7 SECTION DETAIL

1 1/2" = 1'-0"

ADDENDUM NO. 1

Connecticut Department Of Construction Services

Flad Architects

Sketch Title: INTERIOR DETAIL				DCS Project Number: BI - P - 86	Sketch Revised
Project Title: Renovations & Additions to Jenkins-Waggoner Laboratory				FLAD Project Number: 10844-00	
Sketch Number: **ASK-A550b**	RFI Number: -	Reference Sheet: A-550	Revision Number: -	Sketch Issue Date: 01/10/13	

ARCHITECTURAL DOOR SCHEDULE (STAIRS NO. 1 & STAIR NO. 2)_ADD1

Door Number	Room Name	Room Number	Type	Width	Height	Panel Material	Frame Type	Frame Material	Glazing	Fire Rating	Hardware Set No.	Comments
S001.1	STAIR 1	S001	D4	3' - 0"	7' - 0"	WD	HM-1	HM-1	-	1 HR	17	LOWER LEVEL - ADDITION
S002.1	STAIR 2	S002	D4	3' - 0"	7' - 0"	WD	HM-1	HM-1	-	1 HR	17	LOWER LEVEL - EXISTING BUILDING
S002.2	STAIR 2	S002	D1	3' - 0"	7' - 0"	HM-1	HM-1	HM-1	-	-	2	LOWER LEVEL - EXISTING BUILDING (EXTERIOR)
S101.1	STAIR 1	S001	D4	3' - 0"	8' - 0"	WD	HM-1	HM-1	-	1 HR	15	FIRST FLOOR - ADDITION
S101.2	STAIR 1	S101	D4	3' - 0"	7' - 0"	WD	HM-1	HM-1	-	1 HR	17	FIRST FLOOR - ADDITION
S102	STAIR 2	S102	D4	3' - 0"	7' - 0"	WD	HM-1	HM-1	-	1 HR	17	FIRST FLOOR - EXISTING BUILDING
S201.1	STAIR 1	S201	D4	3' - 0"	7' - 0"	WD	HM-1	HM-1	-	1 HR	17	SECOND FLOOR - ADDITION
S201.2	STAIR 1	S201	D4	3' - 0"	7' - 0"	WD	HM-1	HM-1	-	1 HR	17	SECOND FLOOR - ADDITION
S202	STAIR 2	S202	D4	3' - 0"	7' - 0"	WD	HM-1	HM-1	-	1 HR	17	SECOND FLOOR - EXISTING BUILDING

1

ADDENDUM NO. 1

Connecticut
Department Of Construction Services

Flad Architects

Sketch Title: DOOR SCHEDULE (STAIRS NO. 1 & STAIR NO. 2)			DCS Project Number: BI - P - 86	Sketch Revised
Project Title: Renovations & Additions to Jenkins-Waggoner Laboratory			FLAD Project Number: 10844-00	
Sketch Number: **ASK-A601**	RFI Number: -	Reference Sheet: A-601	Revision Number: -	Sketch Issue Date: 01/10/13

ROOM FINISH SCHEDULE - ASK-A611.1a									
Room No.	Room Name	Floor Finish	Base Finish	Finish East Wall	Finish North Wall	Finish South Wall	Finish West Wall	Ceiling Finish	Notes
002B	MEN /SHWR	CT-2	CTB-1	CT-2&3/PT-2	PT-2	CT-2&3/PT-2	CT-2&3/PT-2	GWB/EPT-1	
002C	WOMEN /SHWR	CT-2	CTB-1	CT-2&3/PT-2	PT-2	CT-2&3/PT-2	CT-2&3/PT-2	GWB/EPT-1	

1

ROOM FINISH SCHEDULE - ASK-A611.1b									
Room No.	Room Name	Floor Finish	Base Finish	Finish East Wall	Finish North Wall	Finish South Wall	Finish West Wall	Ceiling Finish	Notes
102B	MEN	CT-2	CTB-1	CT-2&3/PT-2	PT-2	PT-2	PT-2	GWB/PT-1	
102C	WOMEN	CT-2	CTB-1	PT-2	PT-2	CT-2&3/PT-2	PT-2	GWB/PT-1	

1

ROOM FINISH SCHEDULE - ASK-A611.1c									
Room No.	Room Name	Floor Finish	Base Finish	Finish East Wall	Finish North Wall	Finish South Wall	Finish West Wall	Ceiling Finish	Notes
202B	MEN	CT-2	CTB-1	CT-2&3/PT-2	PT-2	PT-2	PT-2	GWB/PT-1	
202C	WOMEN	CT-2	CTB-1	PT-2	PT-2	CT-2&3/PT-2	PT-2	GWB/PT-1	

1

ADDENDUM NO. 1

Connecticut
Department Of Construction Services

Flad Architects

Sketch Title	ROOM FINISH SCHEDULE - RESTROOMS			DCS Project Number: BI - P - 86	Sketch Revised
Project Title	Renovations & Additions to Jenkins-Waggoner Laboratory			FLAD Project Number: 10844-00	
Sketch Number **ASK-A611a**	RFI Number -	Reference Sheet A-611	Revision Number -	Sketch Issue Date 01/10/13	

STAIRS FINISH SCHEDULE

Room No.	Room Name	Floor Finish	Base Finish	Finish East Wall	Finish North Wall	Finish South Wall	Finish West Wall	Ceiling Finish	Notes
S001	STAIR 1	RST-1&2	RB-1	PT-1	PT-1	PT-1	PT-1	GWB/PT-1	
S002	STAIR 2	RST-1&2	RB-1	PT-1	PT-1	PT-1	PT-1	GWB/PT-1	
S101	STAIR 1	RST-1&2	RB-1	PT-1	PT-1	PT-1	PT-1	GWB/PT-1	
S102	STAIR 2	RST-1&2	RB-1	PT-1	PT-1	PT-1	PT-1	GWB/PT-1	
S201	STAIR 1	RST-1&2	RB-1	PT-1	PT-1	PT-1	PT-1	GWB/PT-1	
S202	STAIR 2	RST-1&2	RB-1	PT-1	PT-1	PT-1	PT-1	GWB/PT-1	

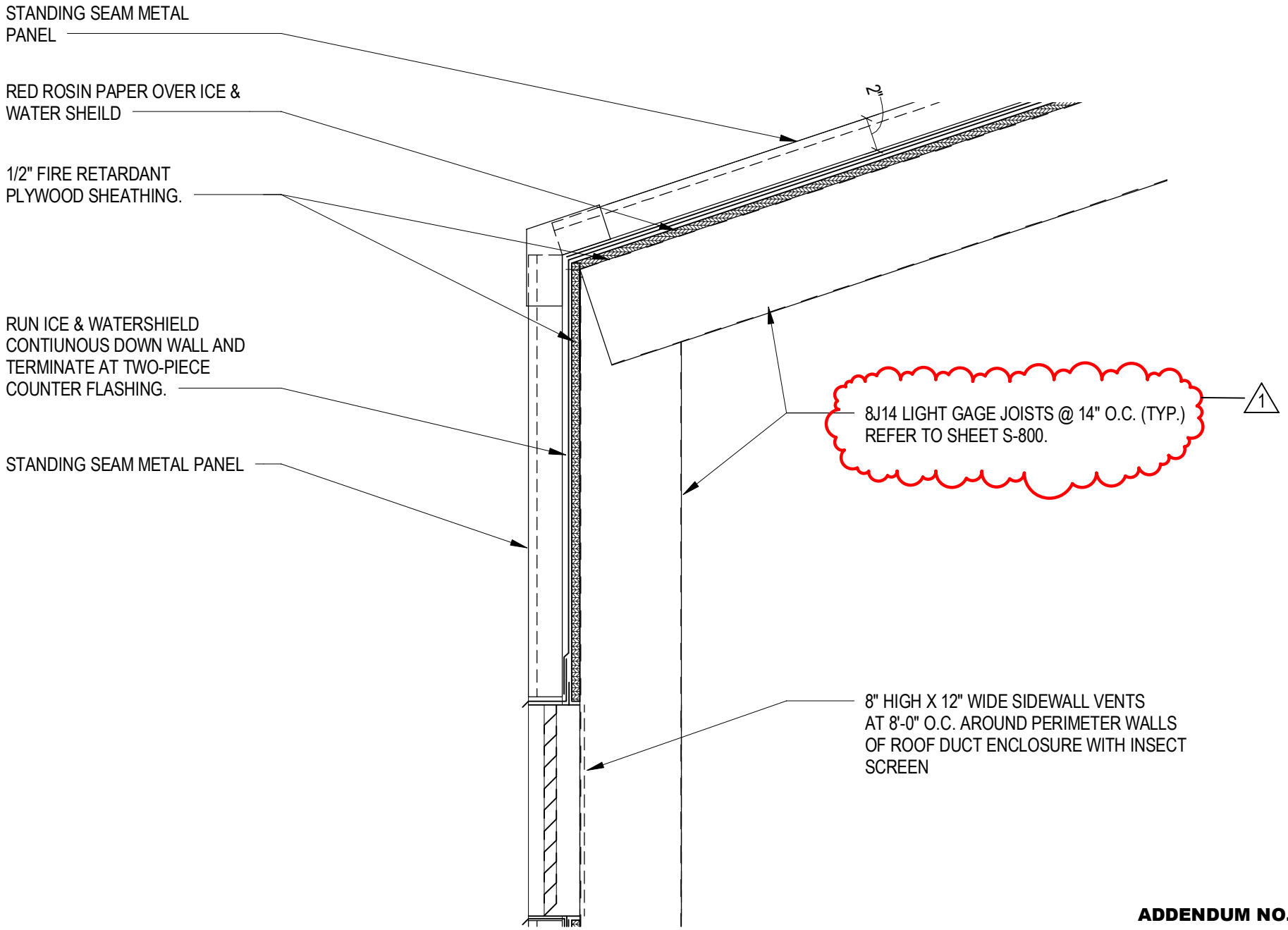
1

ADDENDUM NO. 1

Connecticut Department Of Construction Services

Flad Architects

Sketch Title	ROOM FINISH SCHEDULE - STAIRS			DCS Project Number: BI - P - 86	Sketch Revised
Project Title	Renovations & Additions to Jenkins-Waggoner Laboratory			FLAD Project Number: 10844-00	
Sketch Number **ASK-A611b**	RFI Number -	Reference Sheet A-611	Revision Number -	Sketch Issue Date 01/10/13	

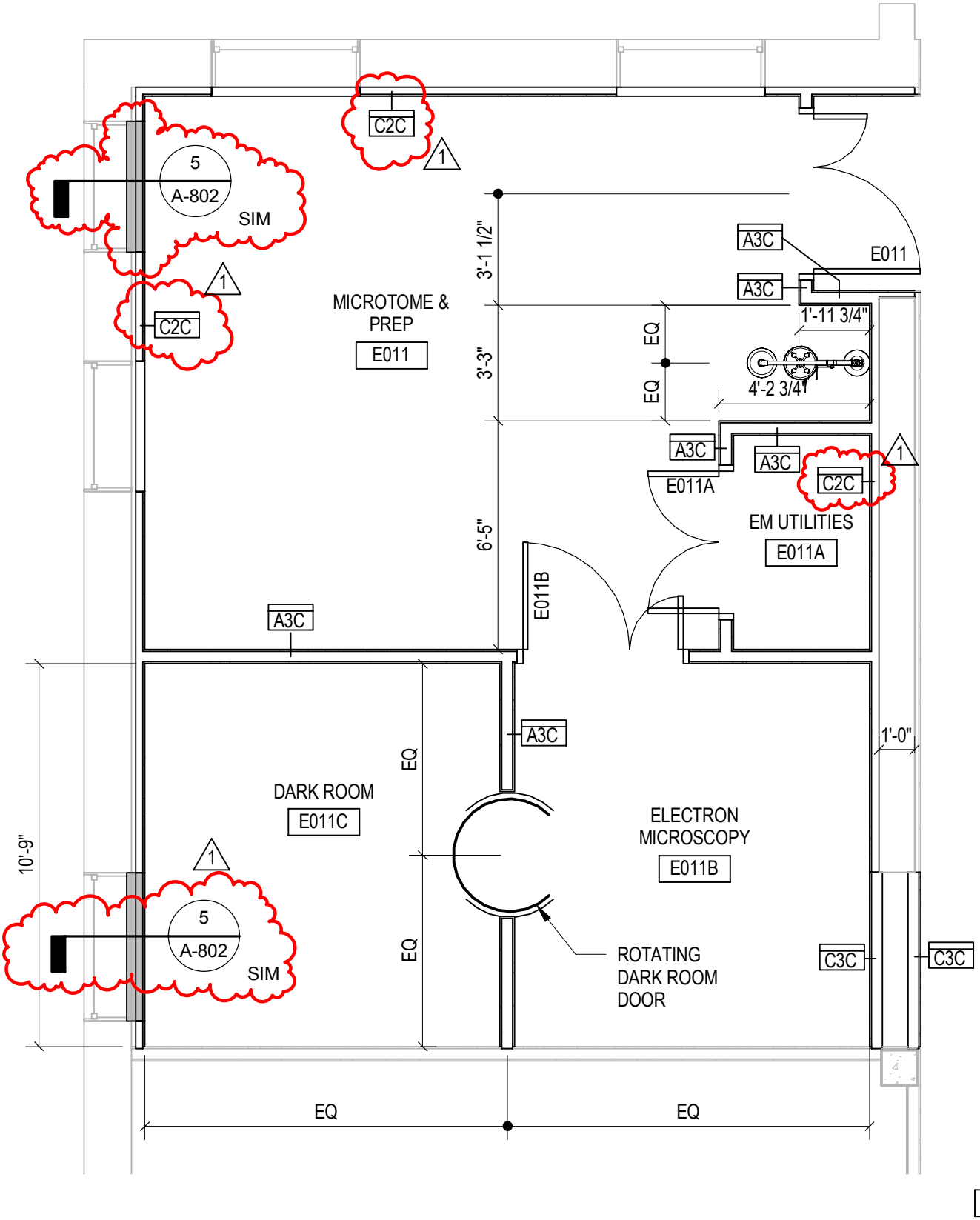


ADDENDUM NO. 1

Connecticut
Department Of Construction Services

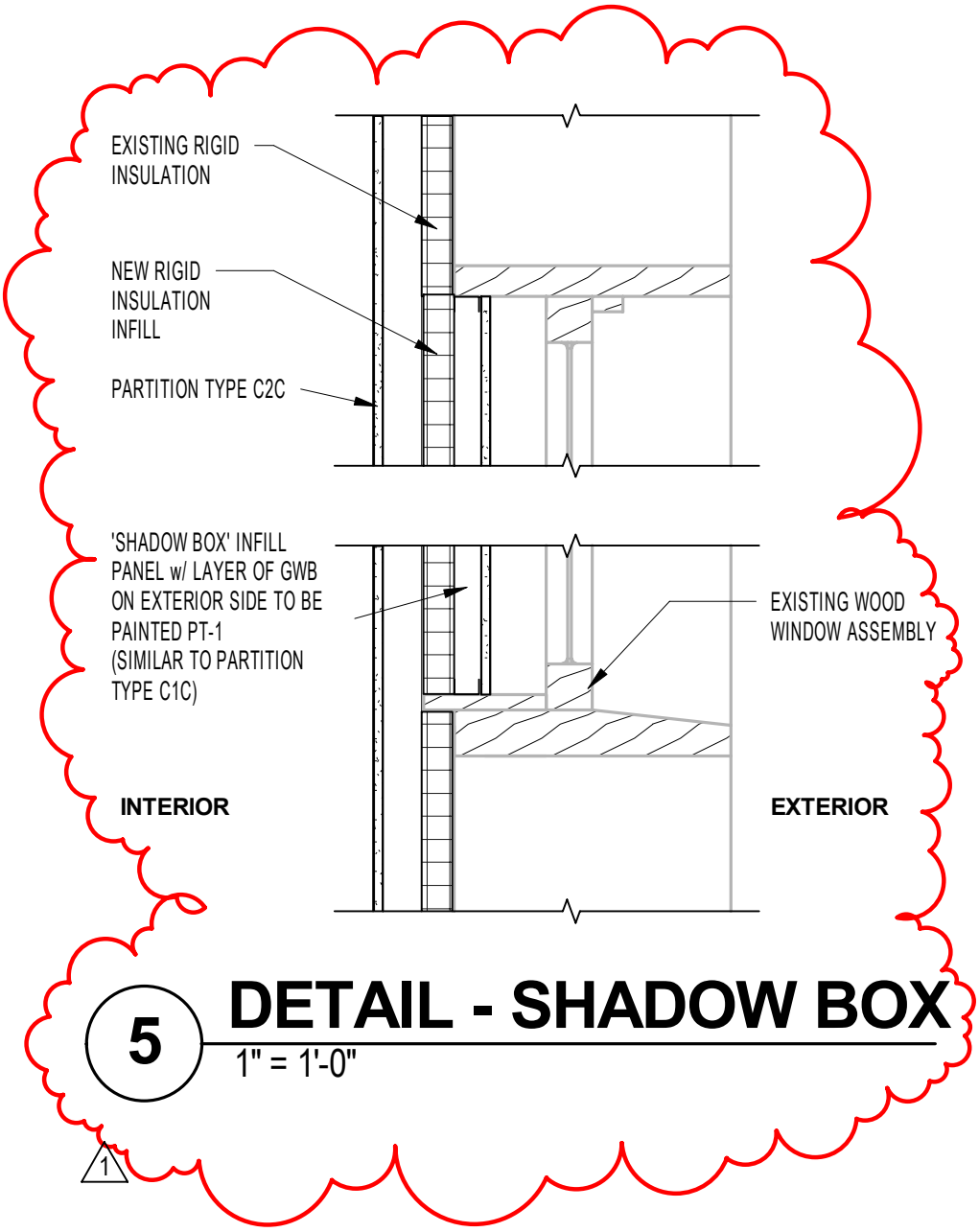
Flad Architects

Sketch Title: HIP ROOF SECTION DETAIL				DCS Project Number: BI - P - 86	Sketch Revised
Project Title: Renovations & Additions to Jenkins-Waggoner Laboratory				FLAD Project Number: 10844-00	
Sketch Number: **ASK-A801**	RFI Number: -	Reference Sheet: A-801	Revision Number: -	Sketch Issue Date: 01/10/13	



ADDENDUM NO. 1

Connecticut Department Of Construction Services / Flad Architects	Sketch Title: PART PLAN - ELECTRON MICROSCOPY SUITE (SUPPLEMENTAL BID #2) Project Title: **Renovations & Additions to Jenkins-Waggoner Laboratory**			DCS Project Number: **BI - P - 86** FLAD Project Number: **10844-00**	Sketch Revised
	Sketch Number: **ASK-A802a**	RFI Number: -	Reference Sheet: **A-802**	Revision Number: -	Sketch Issue Date: **01/10/13**



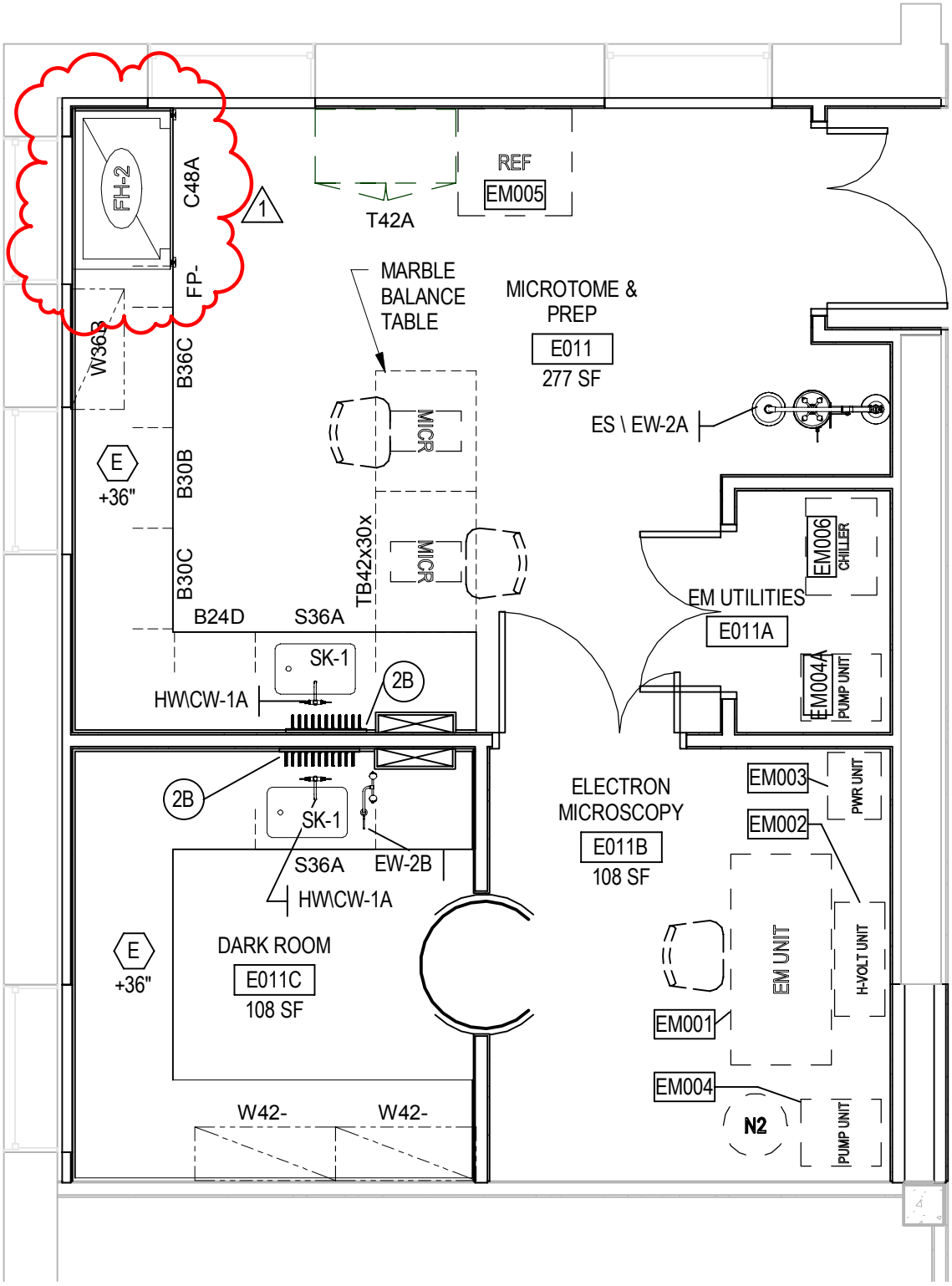
5 DETAIL - SHADOW BOX

1" = 1'-0"

1

ADDENDUM NO. 1

Connecticut Department Of Construction Services / Flad Architects	Sketch Title: SECTION DETAIL - SHADOW BOX (@ ELECTRON MICROSCOPY) - SUPPLEMENTAL BID #2 Project Title: **Renovations & Additions to Jenkins-Waggoner Laboratory**			DCS Project Number: **BI - P - 86** FLAD Project Number: **10844-00**	Sketch Revised
Sketch Number **ASK-A802b**	RFI Number: -	Reference Sheet: **A-802**	Revision Number: -		Sketch Issue Date: **01/10/13**



ADDENDUM NO. 1

Connecticut
Department Of
Construction Services

Flad Architects

Sketch Title / Project Title	PART PLAN - LAB FURNISHINGS (@ ELECTRON MICROSCOPY)-SUPPLEMENTAL BID #2 **Renovations & Additions to Jenkins-Waggoner Laboratory**			DCS Project Number: **BI - P - 86** FLAD Project Number: **10844-00**	Sketch Revised
Sketch Number **ASK-A802c**	RFI Number **-**	Reference Sheet **A-802**		Revision Number **-**	Sketch Issue Date **01/10/13**

FUME HOOD SCHEDULE

HOOD NO.	SIZE / DESCRIPTION	FACE VELOCITY @ 18" OPEN SASH (FPM)	SASH TYPE	PANELS / TRACKS / SASH	INTERIOR HOOD DEPTH	SERVICES	NOTES
FH-2	4' FUME HOOD (DUCTLESS)	100	VERTICAL RISING	N/A	-	SEE PLAN	

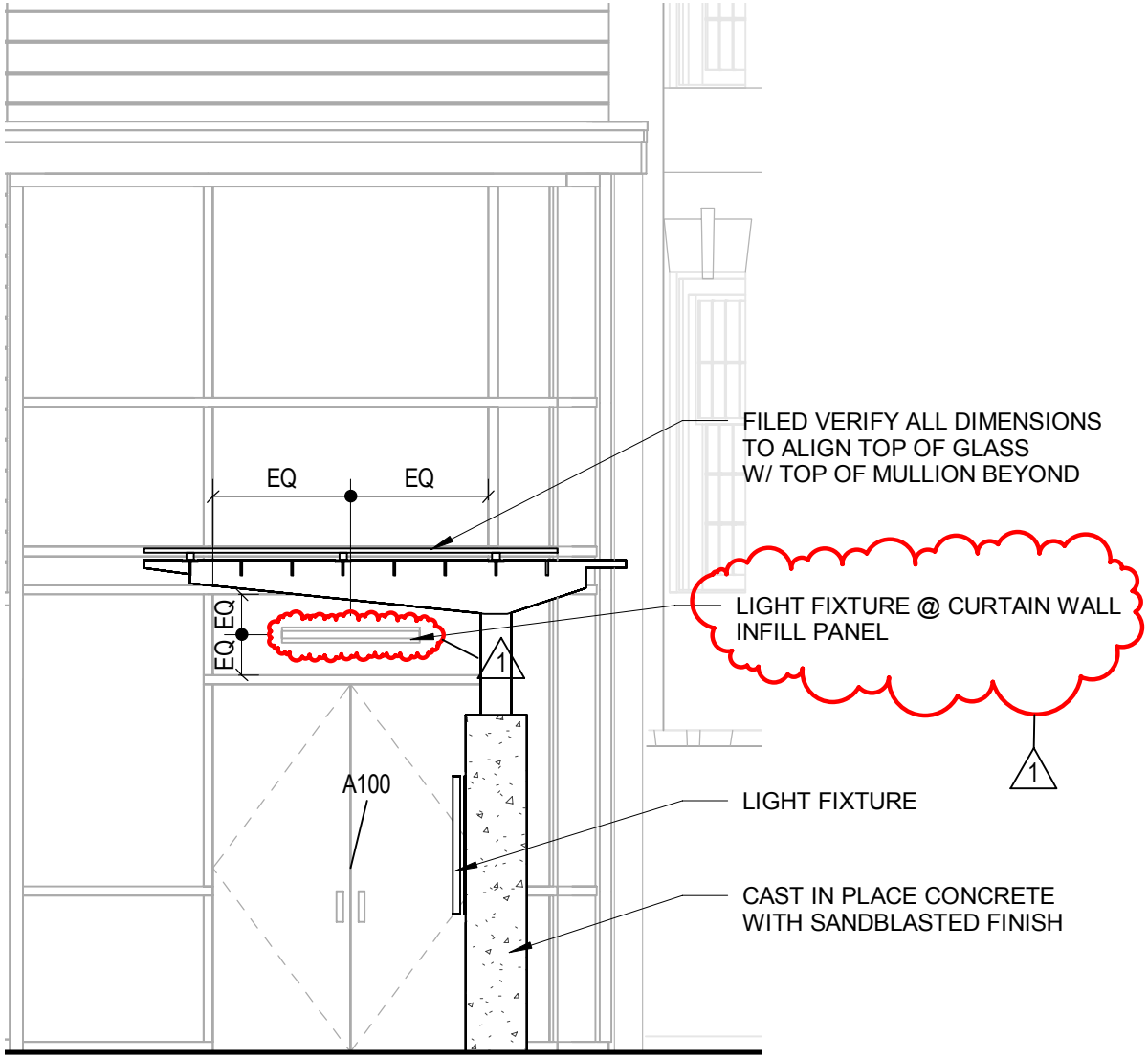
1

ADDENDUM NO. 1

Connecticut Department Of Construction Services

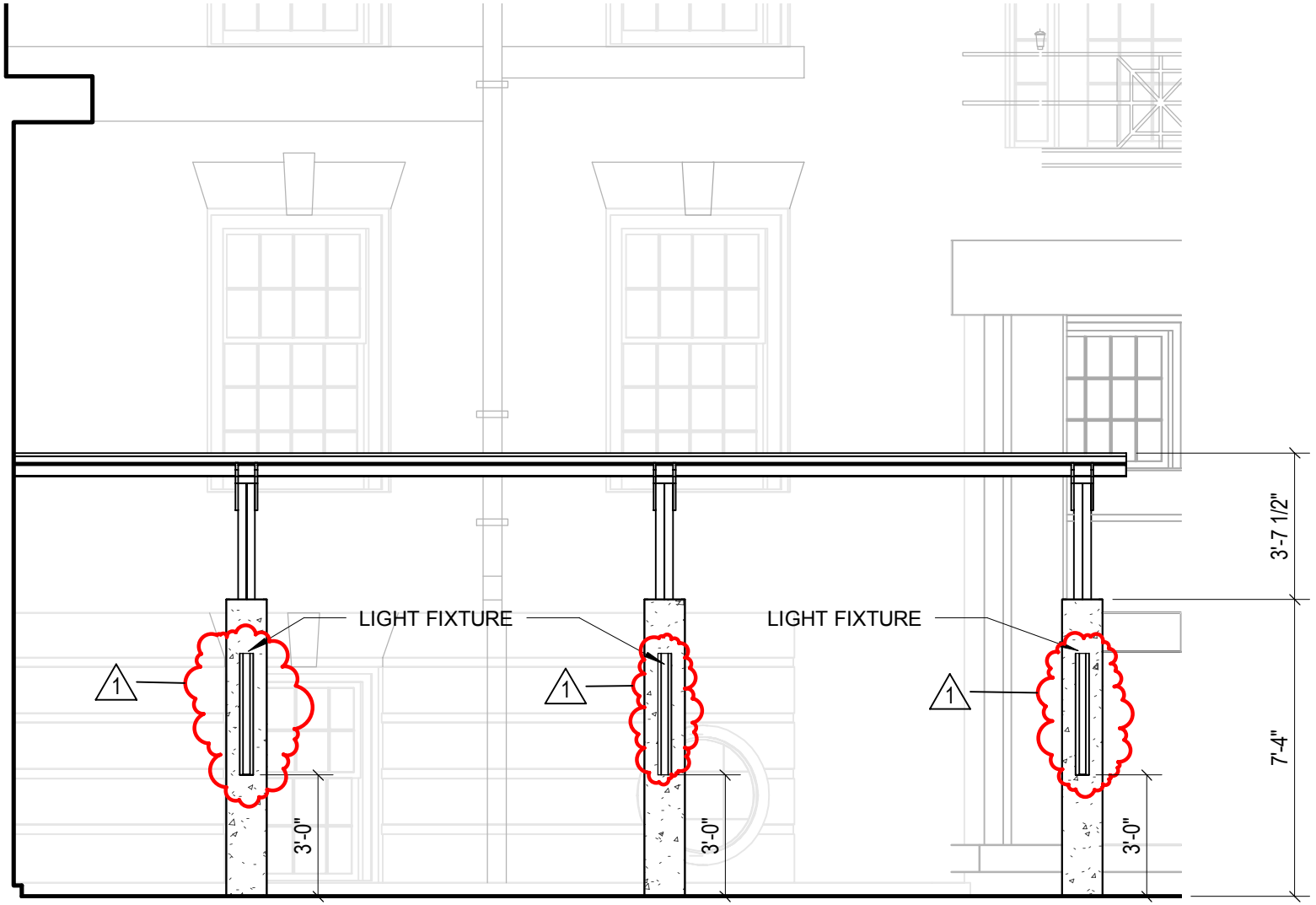
Flad Architects

Sketch Title	FUME HOOD SCHED (@ ELECTRON MICROSCOPY ONLY) SUPPLEMENTAL BID #2			DCS Project Number: BI - P - 86	Sketch Revised
Project Title	Renovations & Additions to Jenkins-Waggoner Laboratory			FLAD Project Number: 10844-00	
Sketch Number	RFI Number	Reference Sheet	Revision Number	Sketch Issue Date	
ASK-A802d	-	A-802	-	01/10/13	



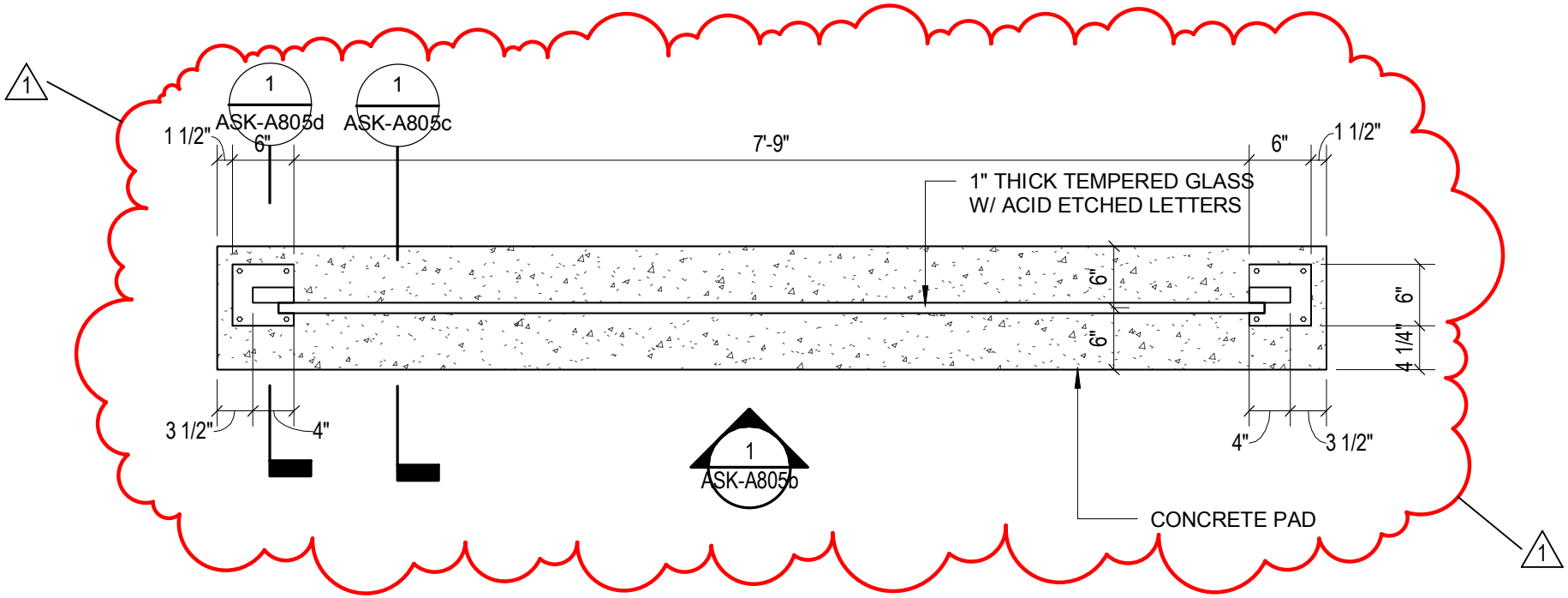
ADDENDUM NO. 1

Connecticut Department Of Construction Services / Flad Architects	Sketch Title: ENTRY CANOPY ELEVATION Project Title: **Renovations & Additions to Jenkins-Waggoner Laboratory**			DCS Project Number: **BI - P - 86** FLAD Project Number: **10844-00**	Sketch Revised
Sketch Number: **ASK-A804a**	RFI Number: -	Reference Sheet: **A-804**		Revision Number: -	Sketch Issue Date: **01/10/13**



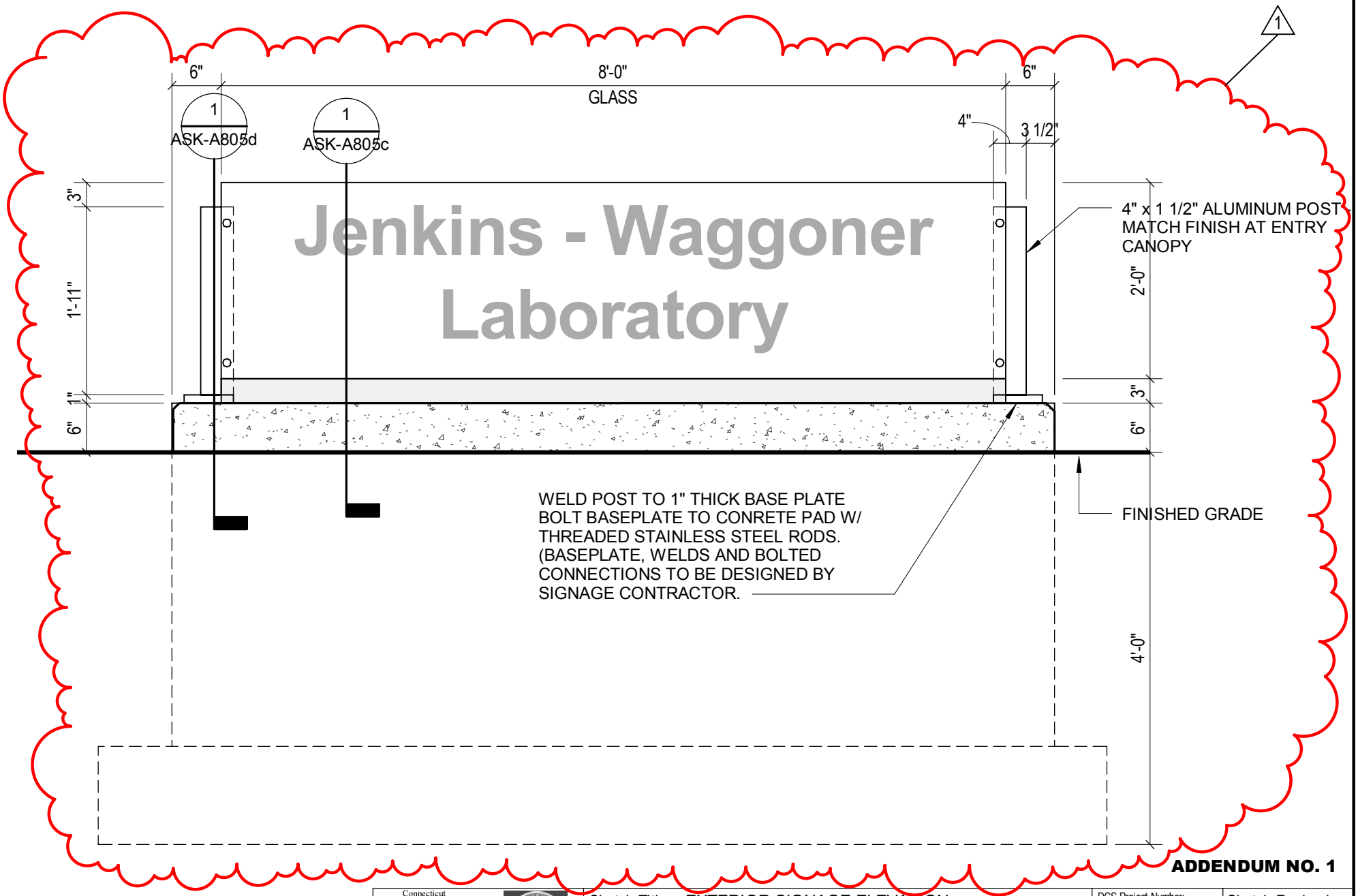
ADDENDUM NO. 1

Connecticut Department Of Construction Services / Flad Architects	Sketch Title: ENTRY CANOPY ELEVATION - SUPPLEMENTAL BID #4 Project Title: **Renovations & Additions to Jenkins-Waggoner Laboratory**			DCS Project Number: **BI - P - 86** FLAD Project Number: **10844-00**	Sketch Revised
Sketch Number: **ASK-A804b**	RFI Number: **-**	Reference Sheet: **A-804**		Revision Number: **-**	Sketch Issue Date: **01/10/13**



ADDENDUM NO. 1

Connecticut Department Of Construction Services / Flad Architects	Sketch Title: EXTERIOR SIGNAGE PLAN - SUPPLEMENTAL BID #4 Project Title: Renovations & Additions to Jenkins-Waggoner Laboratory			DCS Project Number: BI - P - 86 FLAD Project Number: 10844-00	Sketch Revised
Sketch Number: **ASK-A805a**	RFI Number: -	Reference Sheet: A-805		Revision Number: -	Sketch Issue Date: 01/10/13

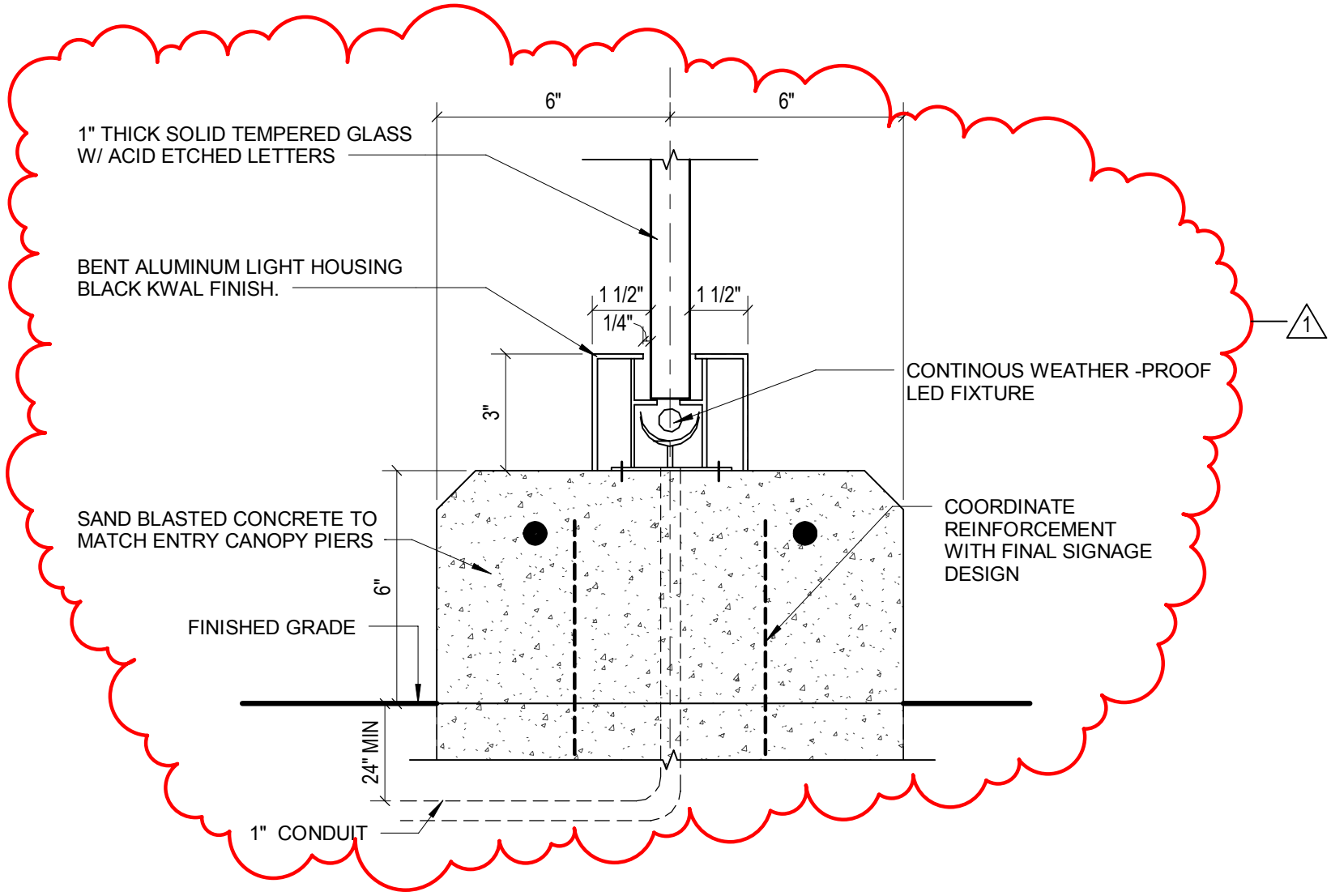


ADDENDUM NO. 1

Connecticut
Department Of Construction Services

Flad Architects

Sketch Title	EXTERIOR SIGNAGE ELEVATION - SUPPLEMENTAL BID #4			DCS Project Number: BI - P - 86	Sketch Revised
Project Title	Renovations & Additions to Jenkins-Waggoner Laboratory			FLAD Project Number: 10844-00	
Sketch Number **ASK-A805b**	RFI Number -	Reference Sheet A-805	Revision Number -	Sketch Issue Date 01/10/13	



ADDENDUM NO. 1

Connecticut Department Of Construction Services / Flad Architects	Sketch Title: EXTERIOR SIGNAGE DETAIL - SUPPLEMENTAL BID #4 Project Title: Renovations & Additions to Jenkins-Waggoner Laboratory			DCS Project Number: BI - P - 86 FLAD Project Number: 10844-00	Sketch Revised
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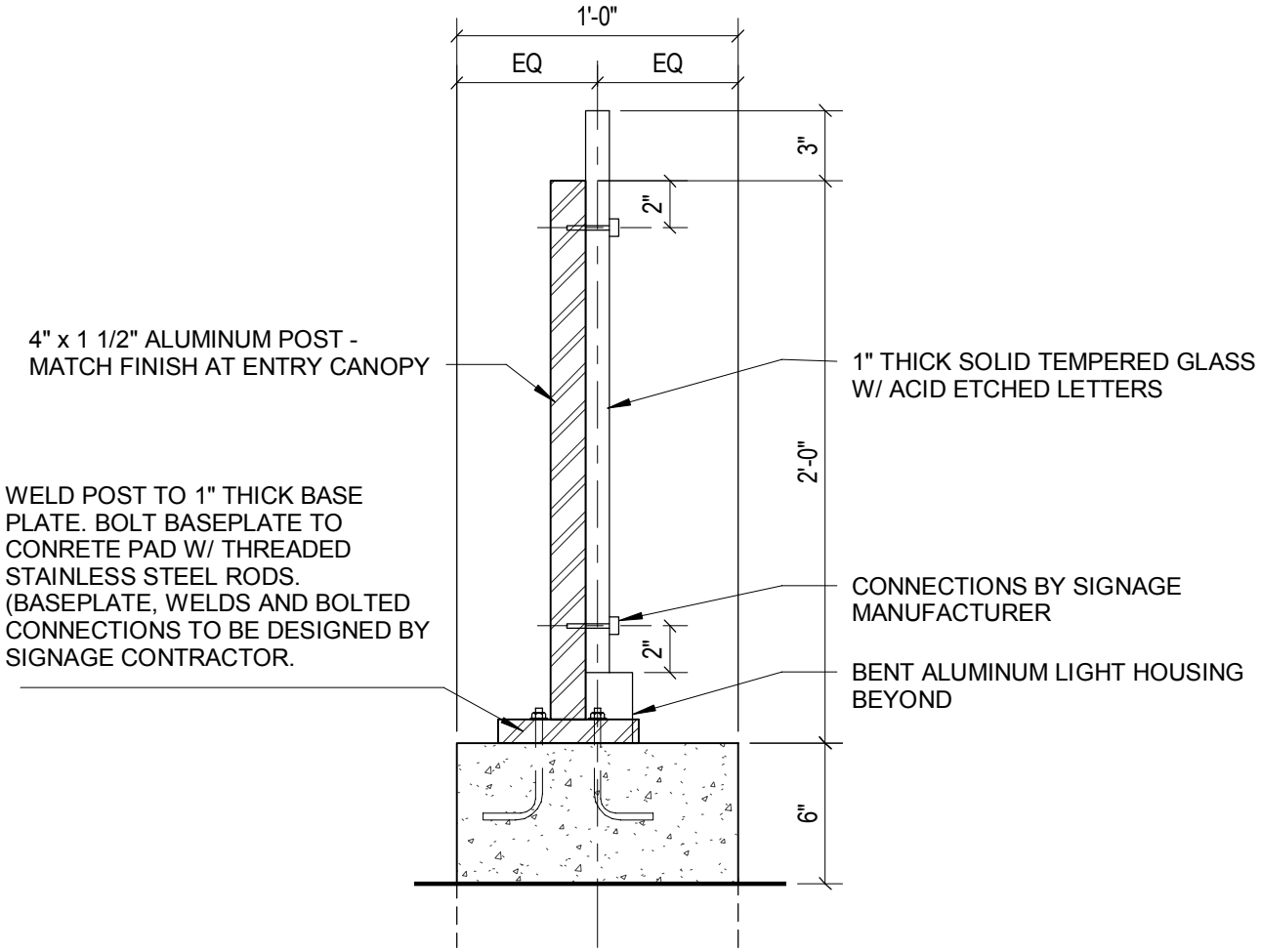


ADDENDUM NO. 1

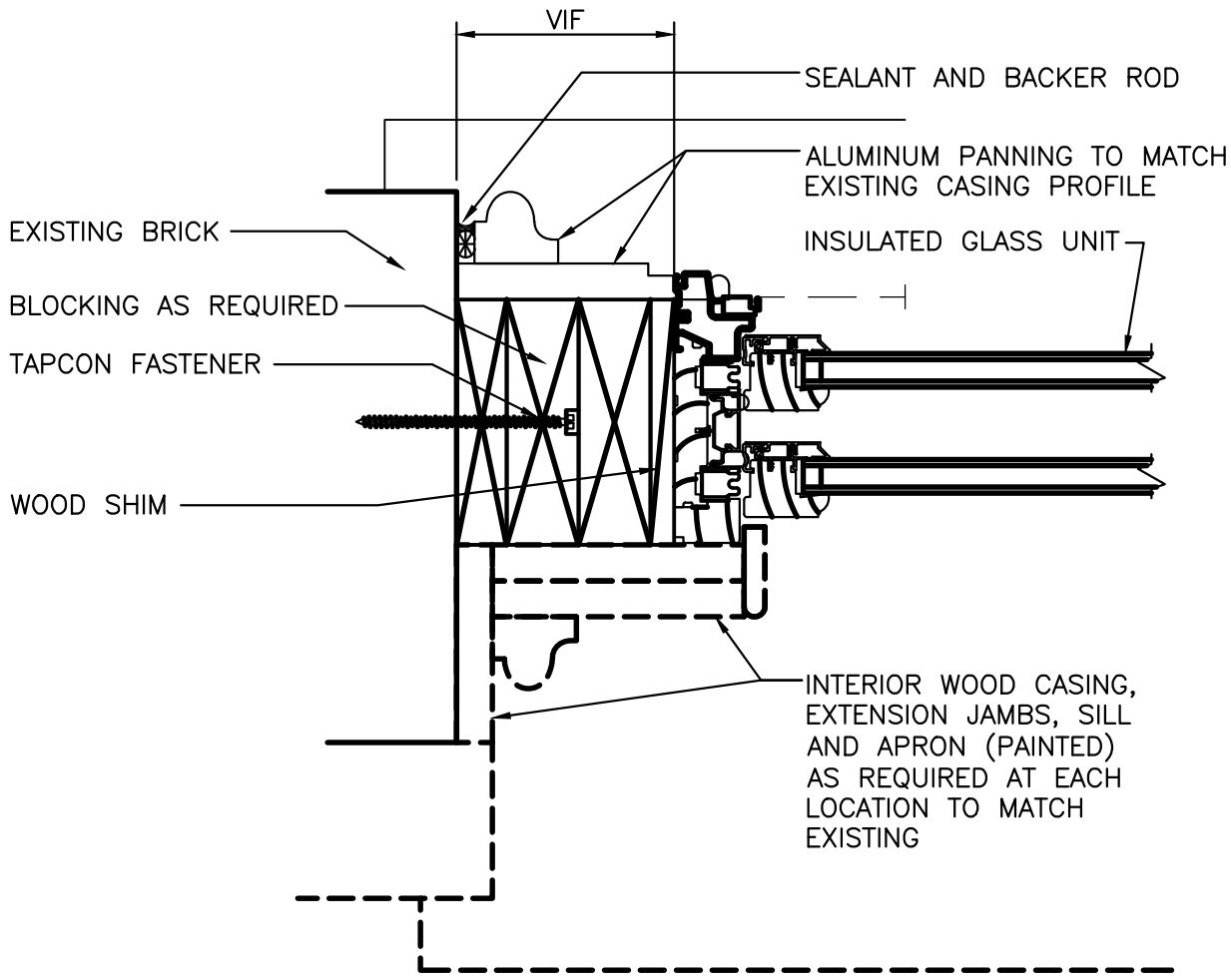
Connecticut Department Of Construction Services / Flad Architects	Sketch Title: EXTERIOR SIGNAGE DETAIL - SUPPLEMENTAL BID #4 Project Title: **Renovations & Additions to Jenkins-Waggoner Laboratory**			DCS Project Number: **BI - P - 86** FLAD Project Number: **10844-00**	Sketch Revised
Sketch Number: **ASK-A805d**	RFI Number: **-**	Reference Sheet: **A-805**		Revision Number: **-**	Sketch Issue Date: **01/10/13**

00 31 19.26 Existing Conditions Survey

The "Existing Conditions Survey" for this project is located in the existing drawings contained in the plans and the test results contained in the specifications.

1. The information is made available for the convenience of all Bidders and is not a part of the Contract.
2. All Bidders must interpret this information according to their own judgment and acknowledge that they are not relying upon the information shown as accurately describing the conditions which may be found to exist.
3. Other components of the information, including but not limited to recommendations, may not be relied upon by the Bidders. The Owner shall not be responsible for any interpretation.
4. All Bidders further acknowledge that they assume all risk contingents upon the nature of the existing conditions which shall be actually be encountered by them.
5. All Bidders should visit the site and become acquainted with all existing conditions in relationship to this information and may make their own investigations to satisfy themselves as to the existing conditions. Such investigations shall be conducted only under time schedules and arrangements approved in advance by the Owner.

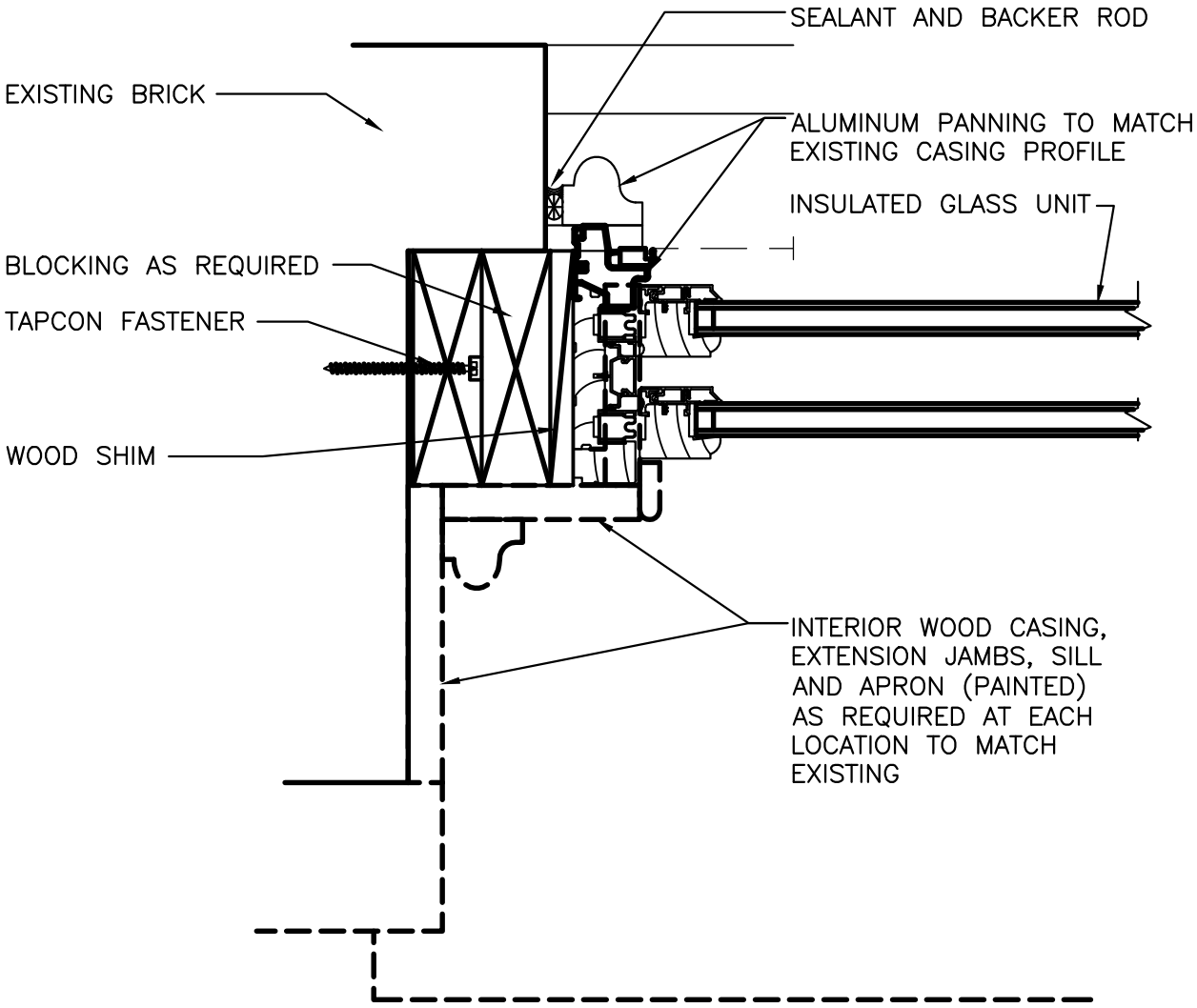
END Section 00 31 19.26



NOTE: INTENDED SCOPE OF WINDOW REPLACEMENT IS TO PROVIDE NEW CLAD WOOD WINDOWS AND ASSOCIATED PANNING TO MATCH EXISTING. CONTRACTOR TO FIELD VERIFY ALL EXISTING CONDITIONS AND DIMENSIONS PRIOR TO REMOVAL OF EXISTING WINDOW AND TRIM ASSEMBLIES.

ADDENDUM NO. 1

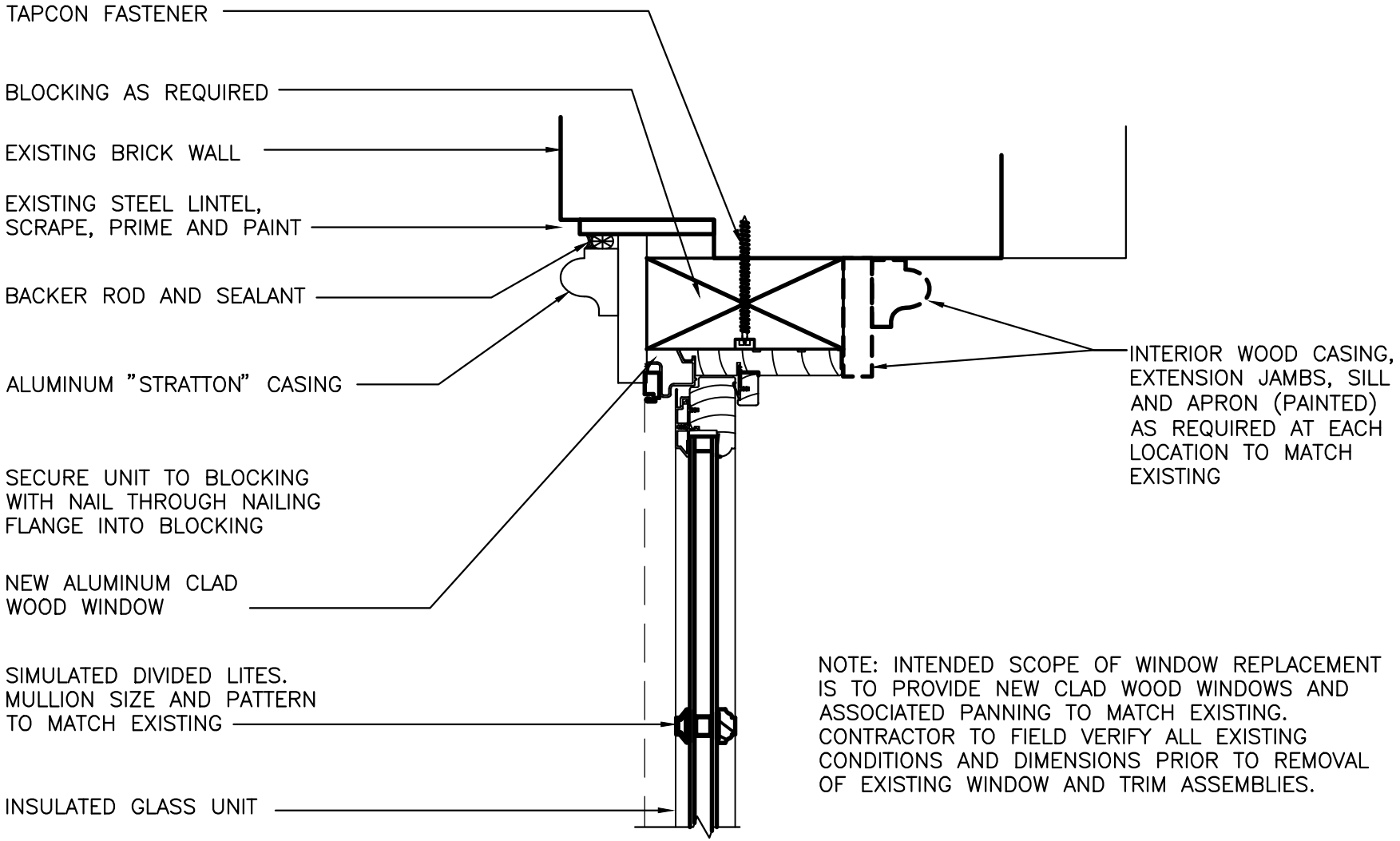
Connecticut Department Of Construction Services	Sketch Title: TYPICAL UPPER LEVEL JAMB DETAIL			DCS Project Number: **BI - P - 86**	Sketch Revised
	Project Title: **Renovations and Addition to Jenkins-Waggoner Laboratory**			XXXX Project Number: **XXXXX**	-
	Sketch Number **ASK-A521a**	RFI Number -	Reference Sheet A-521	Revision Number -	Sketch Issue Date 01/10/13



NOTE: INTENDED SCOPE OF WINDOW REPLACEMENT IS TO PROVIDE NEW CLAD WOOD WINDOWS AND ASSOCIATED PANNING TO MATCH EXISTING. CONTRACTOR TO FIELD VERIFY ALL EXISTING CONDITIONS AND DIMENSIONS PRIOR TO REMOVAL OF EXISTING WINDOW AND TRIM ASSEMBLIES.

ADDENDUM NO. 1

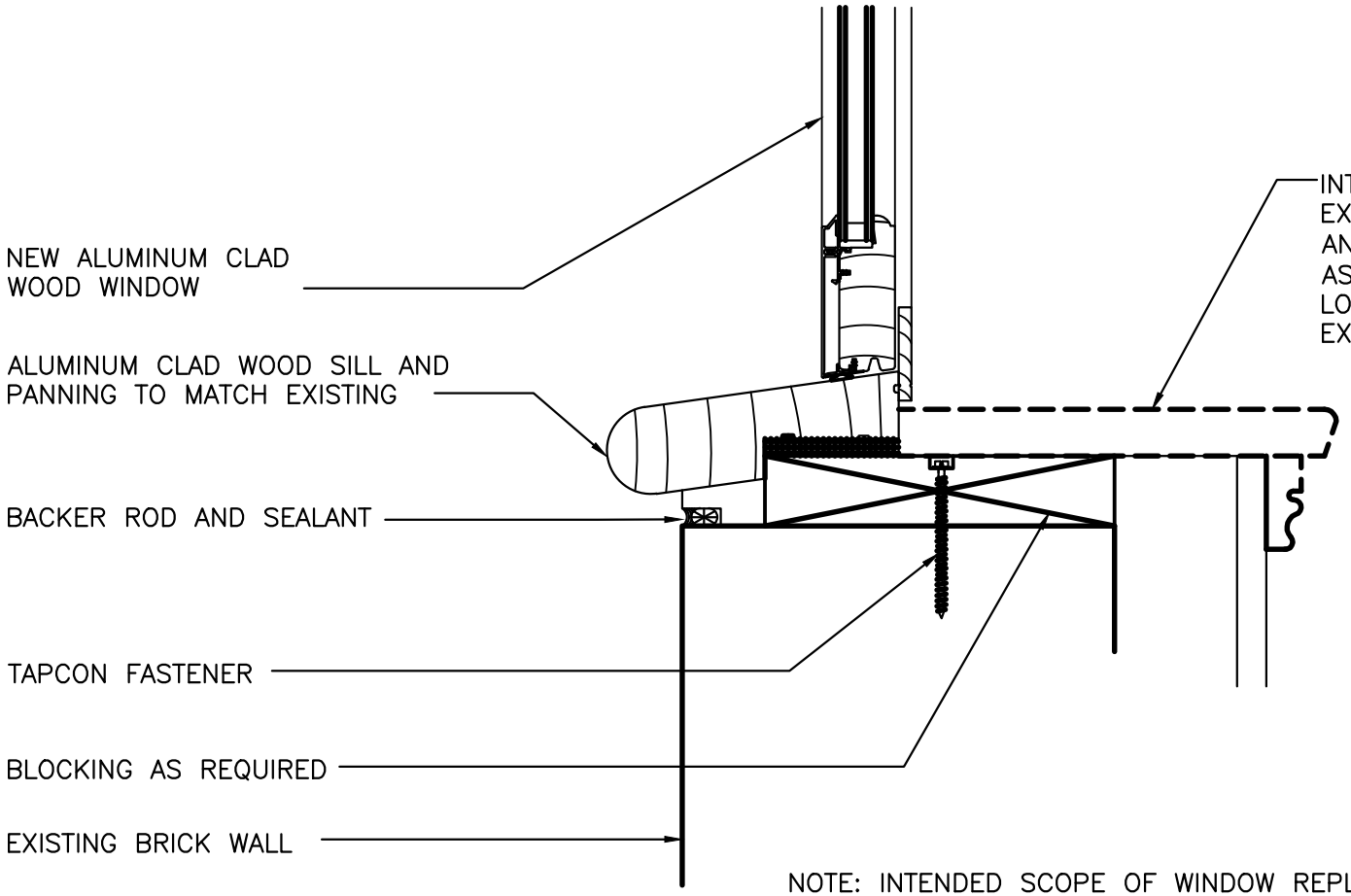
Connecticut Department Of Construction Services	Sketch Title: TYPICAL LOWER LEVEL JAMB DETAIL			DCS Project Number: **BI - P - 86**	Sketch Revised
	Project Title: **Renovations and Addition to Jenkins-Waggoner Laboratory**			XXXX Project Number: **XXXXX**	-
	Sketch Number **ASK-A521b**	RFI Number -	Reference Sheet A-521	Revision Number -	Sketch Issue Date 01/10/13



NOTE: INTENDED SCOPE OF WINDOW REPLACEMENT IS TO PROVIDE NEW CLAD WOOD WINDOWS AND ASSOCIATED PANNING TO MATCH EXISTING. CONTRACTOR TO FIELD VERIFY ALL EXISTING CONDITIONS AND DIMENSIONS PRIOR TO REMOVAL OF EXISTING WINDOW AND TRIM ASSEMBLIES.

ADDENDUM NO. 1

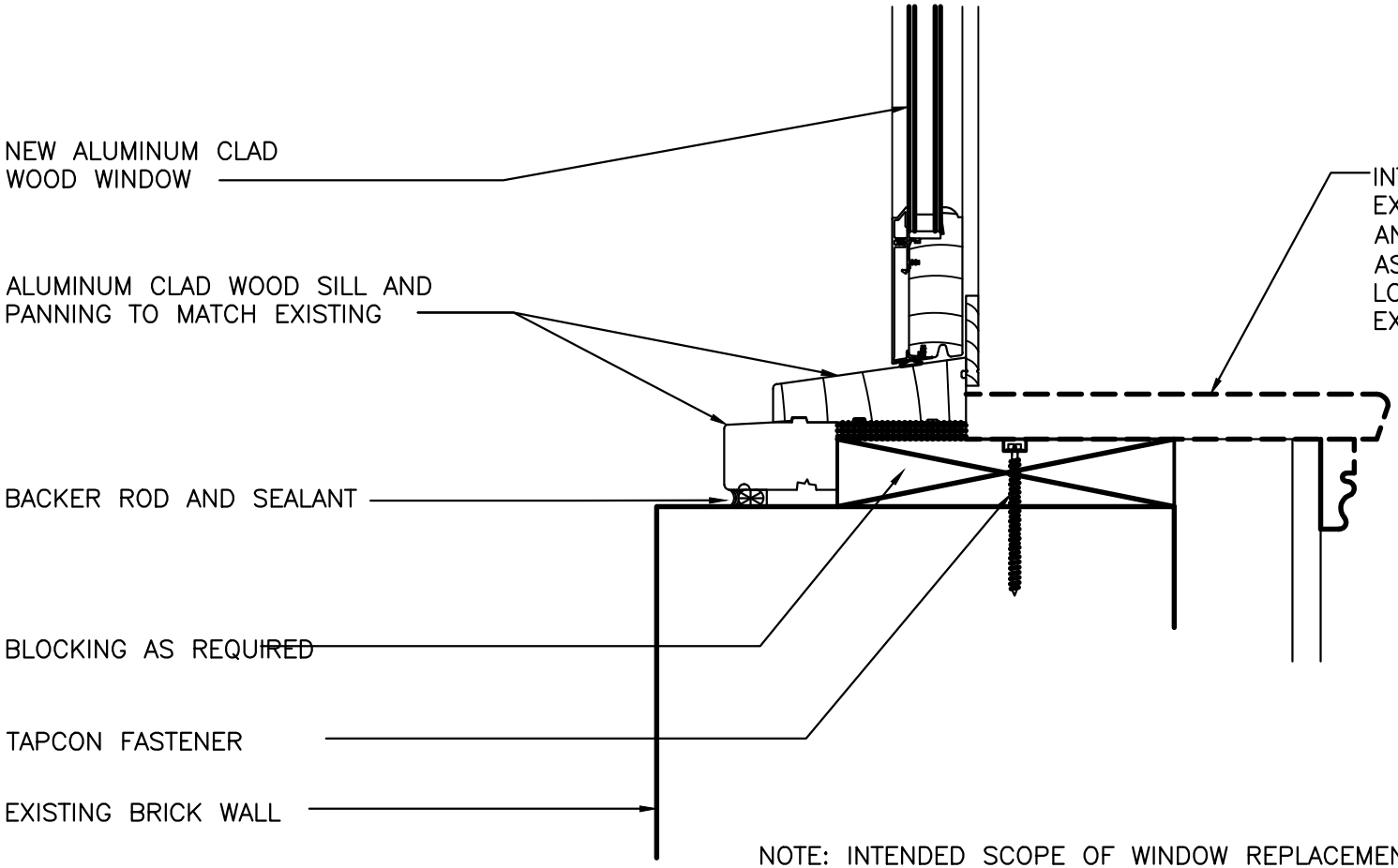
Connecticut Department Of Construction Services	Sketch Title: TYPICAL HEAD DETAIL Project Title: **Renovations and Addition to Jenkins-Waggoner Laboratory**			DCS Project Number: **BI - P - 86** XXXX Project Number: **XXXXX**	Sketch Revised: -
	Sketch Number: **ASK-A521c**	RFI Number: -	Reference Sheet: A-521	Revision Number: -	Sketch Issue Date: 01/10/13



NOTE: INTENDED SCOPE OF WINDOW REPLACEMENT IS TO PROVIDE NEW CLAD WOOD WINDOWS AND ASSOCIATED PANNING TO MATCH EXISTING. CONTRACTOR TO FIELD VERIFY ALL EXISTING CONDITIONS AND DIMENSIONS PRIOR TO REMOVAL OF EXISTING WINDOW AND TRIM ASSEMBLIES.

ADDENDUM NO. 1

Connecticut Department Of Construction Services	Sketch Title: TYPICAL HEAD DETAIL			DCS Project Number: **BI - P - 86**	Sketch Revised
	Project Title: **Renovations and Addition to Jenkins-Waggoner Laboratory**			XXXX Project Number: **XXXXX**	-
	Sketch Number: **ASK-A521d**	RFI Number: -	Reference Sheet: **A-521**	Revision Number: -	Sketch Issue Date: **01/10/13**



NOTE: INTENDED SCOPE OF WINDOW REPLACEMENT IS TO PROVIDE NEW CLAD WOOD WINDOWS AND ASSOCIATED PANNING TO MATCH EXISTING. CONTRACTOR TO FIELD VERIFY ALL EXISTING CONDITIONS AND DIMENSIONS PRIOR TO REMOVAL OF EXISTING WINDOW AND TRIM ASSEMBLIES.

Connecticut Department Of Construction Services	Sketch Title: TYPICAL LOWER LEVEL SILL DETAIL Project Title: Renovations and Addition to Jenkins-Waggoner Laboratory			DCS Project Number: BI - P - 86 XXXX Project Number: XXXXX	Sketch Revised: -
	Sketch Number: **ASK-A521e**	RFI Number: -	Reference Sheet: A-521	Revision Number: -	Sketch Issue Date: 01/10/13