



**Capital Projects & Purchasing Department
113 Mable T. Willis Blvd.
Walterboro, SC 29488
843.539.1968**

**BID: CPST-11
LOWCOUNTRY REGIONAL AIRPORT TERMINAL
RENOVATION & EXPANSION**

**Mandatory Pre-bid Conference will be held
Wednesday, March 7, 2018 at 10:00am
at the project site location:
537 Aviation Way, Walterboro, SC**

BID DUE: WEDNESDAY, MARCH 21, 2018 at 2:00pm

MAIL RESPONSE TO:

Capital Projects & Purchasing Department
Attn: Kaye B Syfrett
113 Mable T. Willis Blvd.
Walterboro, SC 29488

DELIVER RESPONSE TO:

Capital Projects & Purchasing Department
Attn: Kaye B Syfrett
113 Mable T. Willis Blvd.
Walterboro, SC 29488

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END OF SECTION

Advertisement for Bid

Owner: Colleton County, 109 Benson Street, Walterboro, South Carolina

Sealed Bid: **CPST-11** Colleton-Walterboro Lowcountry Regional Airport Renovation and Expansion, 537 Aviation Way Walterboro, South Carolina will be received at the Capital Projects and Purchasing Department located at 113 Mable T. Willis Boulevard until **2:00pm, Wednesday, March 21, 2018** and publicly opened and read aloud. The work to be completed as a part of this project consists of providing all required materials, equipment and labor necessary to complete the Renovation and Expansion of the facility located at, 537 Aviation Way, Walterboro, South Carolina, with the following approximate quantities:

Renovation and Expansion of the facility located at 537 Aviation Way, Walterboro South Carolina. Approximately ± 1,618 sf of new construction consisting of a new Conference room and Flight Crew rest area, along with ± 2,270 sf of renovation to the current facility as it stands now.

The Instructions to Bidders, bid packet, Contract, Plans, Specifications, and other contract documents may be examined at the following location:

Colleton County website: <http://www.colletoncounty.org/bids-and-proposal-requests>

Bidders must deposit security with all bids. Security shall be in the form of a certified check or bid bond made payable to Colleton County, and shall be for an amount equal to not less than five percent (5%) of the amount of the bid. Provisions of the security shall be as described in the Information for Bidders. No bid will be considered unless the bidder is legally qualified under the provisions of the South Carolina Sections 40-11-10 through 40-11-428).

NOTICE TO BIDDERS:

Each bidder shall fully acquaint himself with conditions of this Bid. The failure or omission of a bidder to acquaint him/herself with existing conditions shall in no way relieve him/herself of any obligation with respect to this Bid or to the Contract.

BIDS WILL NOT BE CONSIDERED FROM ANY VENDOR THAT OWES DELINQUENT PROPERTY TAXES TO THE COUNTY OF COLLETON.

NOTICE TO BIDDERS: All amendments to and interpretations of this solicitation shall be in writing and issued by the Colleton County Capital Projects & Purchasing Department. Colleton County shall not be legally bound by any amendment or interpretation that is not in writing. Award of the project is contingent on funding approval by Colleton County Council.

The Owner reserves the right to waive any informality or to reject any or all bids.

Architect

Watson Tate Savory, INC.
1316 Washington Street Suit 100
Columbia SC 29201
John McLean, AIA, LEED AP

Owner

Colleton County
109 Benson Street
Walterboro, SC 29488

Information for Bidders

ARTICLE 1 - DEFINED TERMS

- 1.01 Terms used in these Instructions to Bidders have the meanings indicated in the 001, General Conditions. Additional terms used in these Instructions to Bidders have the meanings indicated below:
- A. **Issuing Office** - The office from which the Bidding Documents are to be issued and where the bidding procedures are to be administered.
 - B. **Architect, Engineer, Owner** - The person or firm in charge of the design of the project. In some instances, the owner will self-perform, acting as the Architect.
 - C. **Construction Coordinator**- The person or company acting on behalf of the owner and in some instances, the owner will self-perform, acting as the Construction Coordinator.
 - D. **Owner**- Colleton County
 - E. **Official Time**. The time as noted on the Atom Clock located in the Capital Projects and Purchasing Department lobby. All times are Eastern Standard Time.

ARTICLE 2 - COPIES OF BIDDING DOCUMENTS

- 2.01 Complete sets of the Bidding Documents can be found at <http://www.colletoncounty.org/bids-and-proposal-requests>.
- 2.02 Complete sets of Bidding Documents shall be used in preparing Bids; neither Owner nor Engineer or Architect assumes any responsibility for errors or misinterpretations resulting from the use of incomplete sets of Bidding Documents.
- 2.03 Owner and Engineer or Architect, in making copies of Bidding Documents available on the above terms, do so only for the purpose of obtaining Bids for the Work and do not confer a license or grant for any other use.

ARTICLE 3 - QUALIFICATIONS OF BIDDERS

- 3.01 Bidders must be licensed as a General Contractor in the State of South Carolina and will hold all Trade Contracts and the Building Permit on the project.
- 3.02 To demonstrate Bidder's qualifications to perform the Work, within five (5) days of Owner's request, Bidder shall submit written evidence such as financial data; previous experience, present commitments.

ARTICLE 4 - EXAMINATION OF BIDDING DOCUMENTS, OTHER RELATED DATA, AND SITE

- 4.00 ***Mandatory Pre-bid Conference*** will be held **Wednesday, March 7, 2018 at 10:00am** in the conference room at the project site, located at **537 Aviation Way, Walterboro, SC 29488**. *No other scheduled tours will be conducted.* Sub-contractors are encouraged to attend this meeting. The Pre-bid meeting will start at the appointed time. Attendees not present at the appointed time may be barred from entering the meeting. Attendees are responsible for signing the sign in sheet. No bid will be accepted from any Firm, Company or Organization not attending the Mandatory Pre-Bid meeting.
- 4.01 Subsurface and Physical Conditions
- A. The General Conditions identify:

Reports of explorations and tests of conditions at or contiguous to the Site that the Owner, Engineer or Architect has used in preparing the Bidding Documents including the Asbestos and Lead Paint Assessment Report that has been completed for the project by S&ME, dated May 10, 2017, along with the Geotechnical report provided by Soil Consultants, Inc. dated March 09, 2016.

- B. Copies of reports and drawings referenced in Paragraph 4.01.A are included herein. Those reports and drawings are not part of the Contract Documents, but the “technical data” contained therein upon which Bidder is entitled to rely as provided in Paragraph 4.02 of the General Conditions has been identified and established. Bidder is responsible for any interpretation or conclusion Bidder draws from any “technical data” or any other data, interpretations, opinions or information contained in such reports or shown or indicated in such drawings.

4.02 Underground Facilities

- A. Information and data shown or indicated in the Bidding Documents with respect to existing Underground Facilities at or contiguous to the Site is based upon information and data furnished to Owner and Engineer or Architect by owners of such Underground Facilities, including Owner, or others.

4.03 Hazardous Environmental Condition

- A. The General Conditions identify those reports and drawings relating to a Hazardous Environmental Condition identified at the Site, if any, that Engineer or Architect has used in preparing the Bidding Documents.
- B. Copies of reports and drawings referenced in Paragraph 4.03.A are included herein. Those reports and drawings are not part of the Contract Documents, but the “technical data” contained therein upon which Bidder is entitled to rely as provided in Paragraph 4.06 of the General Conditions has been identified and established. Bidder is responsible for any interpretation or conclusion Bidder draws from any “technical data” or any other data, interpretations, opinions, or information contained in such reports or shown or indicated in such drawings.

4.04 Provisions concerning responsibilities for the adequacy of data furnished to prospective Bidders with respect to subsurface conditions, other physical conditions and Underground Facilities, and possible changes in the Bidding Documents due to differing or unanticipated conditions appear in Paragraphs 4.02, 4.03, and 4.04 of the General Conditions. Provisions concerning responsibilities for the adequacy of data furnished to prospective Bidders with respect to a Hazardous Environmental Condition at the Site, if any, and possible changes in the Contract Documents due to any Hazardous Environmental Condition uncovered or revealed at the Site which was not shown or indicated in the Drawings or Specifications or identified in the Contract Documents to be within the scope of the Work appear in Paragraph 4.06 of the General Conditions.

4.05 During the Mandatory Pre-Bid meeting the Owner will provide Bidder access to the Site to conduct such examinations, investigations, explorations, tests, and studies as Bidder deems necessary for submission of a Bid. Bidder shall fill all holes and clean up and restore the Site to its former condition upon completion of such explorations, investigations, tests, and studies. Bidder shall comply with all applicable Laws and Regulations relative to excavation and utility locates. Construction Coordinator and Owner shall be notified prior to the Mandatory Pre-Bid meeting that the Bidder request to explore the site in further detail to include any site digging.

4.06 Reference is made to Article 7 of the General Conditions for the identification of the general nature of other work that is to be performed at the Site by Owner or others (such as utilities and other prime contractors) that relates to the Work contemplated by these Bidding Documents. On request, Owner will provide to each Bidder for examination access to or copies of Contract Documents (other than portions thereof related to price) for such other work.

4.07 It is the responsibility of each Bidder before submitting a Bid to:

- a. Examine and carefully study the Bidding Documents, the other related data identified in the Bidding Documents, and any Addenda.
- b. Visit the Site and become familiar with and satisfy Bidder as to the general, local, and Site conditions that may affect cost, progress, and performance of the Work.
- c. Become familiar with and satisfy Bidder as to all federal, state, and local Laws and Regulations that may affect cost, progress, and performance of the Work.
- d. Carefully study all: (1) reports of explorations and tests of subsurface conditions at or contiguous to the Site and all drawings of physical conditions in or relating to existing surface or subsurface structures at or contiguous to the Site (except Underground Facilities), which have been identified in Paragraph 4.02 of the General Conditions, and (2) reports and drawings of Hazardous Environmental Conditions at the Site which have been identified in Paragraph 4.06 of the General Conditions.
- e. Obtain and carefully study (or accept consequences of not doing so) all additional or supplementary examinations, investigations, explorations, tests, studies, and data concerning conditions (surface, subsurface, and Underground Facilities) at or contiguous to the Site, which may affect cost, progress, or performance of the Work or which relate to any aspect of the means, methods, techniques, sequences, and procedures of construction to be employed by Bidder, including applying any specific means, methods, techniques, sequences, and procedures of construction expressly required by the Bidding Documents, and safety precautions and programs incident thereto.
- f. Agree at the time of submitting its Bid that no further examinations, investigations, explorations, tests, studies, or data are necessary for the determination of its Bid for performance of the Work at the price(s) bid and within the times and in accordance with the other terms and conditions of the Bidding Documents.
- g. Become aware of the general nature of the work to be performed by Owner and others at the Site that relates to the Work as indicated in the Bidding Documents.
- h. Correlate the information known to Bidder, information and observations obtained from visits to the Site, reports and drawings identified in the Bidding Documents, and all additional examinations, investigations, explorations, tests, studies, and data with the Bidding Documents.
- i. Promptly give Owner written notice of all conflicts, errors, ambiguities, or discrepancies that Bidder discovers in the Bidding Documents and confirm that the written resolution thereof by Owner is acceptable to Bidder.
- j. Determine that the Bidding Documents are generally sufficient to indicate and convey understanding of all terms and conditions for the performance of the Work.
- k. No plea of ignorance of conditions that exist or may hereafter exist on the site of the work, or difficulties that may be encountered in the execution of the work, as a result of failure to make necessary investigations and examinations, will be accepted as an excuse for any failure or omission on the part of the Contractor to fulfill in every detail all the requirements of the contract documents and to complete the work for the consideration set forth therein, or as basis for any claim whatsoever.
- l. Apparent omission of a detailed description concerning any point, shall be regarded as meaning the best commercial practice is to prevail and that only material and workmanship of the finest quality is to be used.
- m. Bidders may refer to Sections 2-67, 2-73, and 2-74 of Ordinance #2008-09, also known as the Colleton County, South Carolina Purchasing Policy to determine their remedies

concerning this competitive process. The failure to be awarded a bid shall not be valid grounds for protest.

- n. The Bidder further agrees that the performance time specified is a reasonable time, having carefully considered the nature and scope of the project as aforesaid.
- 4.08 The submission of a Bid will constitute an incontrovertible representation by Bidder that Bidder has complied with every requirement of this Article 4, that without exception the Bid is premised upon performing and furnishing the Work required by the Bidding Documents and applying any specific means, methods, techniques, sequences, and procedures of construction that may be shown or indicated or expressly required by the Bidding Documents, that Bidder has given Owner written notice of all conflicts, errors, ambiguities, and discrepancies that Bidder has discovered in the Bidding Documents and the written resolutions thereof by Owner are acceptable to Bidder, and that the Bidding Documents are generally sufficient to indicate and convey understanding of all terms and conditions for performing and furnishing the Work.

ARTICLE 5 - SITE AND OTHER AREAS

- 5.01 The Site is identified in the Bidding Documents. Easements for permanent structures or permanent changes in existing facilities are to be obtained and paid for by Owner unless otherwise provided in the Bidding Documents. All additional land and access thereto required for temporary construction facilities, construction equipment, or storage of materials and equipment to be incorporated in the Work are to be obtained and paid for by Contractor.

ARTICLE 6 - INTERPRETATIONS AND ADDENDA

- 6.01 All questions about the meaning or intent of the Bidding Documents are to be submitted to Owner in writing and submitted by email to; jstieglitz@colletoncounty.org. Interpretations or clarifications considered necessary by Owner in response to such questions will be issued by Addenda. Questions received less than seven (7) days prior to the date for opening of Bids will not be answered. Only questions answered by Addenda will be binding. Oral and other interpretations or clarifications will be without legal effect.
- 6.02 Addenda may be issued to clarify, correct, or change the Bidding Documents as deemed advisable by the Owner. Addenda will be posted on the Colleton County website. It is the responsibility of the bidder to monitor this web site for addendums.
- 6.03 Division 000 and Division 001 shall have authority over all over documents contained within the project manual. Where duplication of titles, articles, standards, requirements and such are found, division 000 and Division 001 govern.

ARTICLE 7 - BID SECURITY

- 7.01 A Bid must be accompanied by Bid security made payable to Colleton County in an amount of five percent (5%) of Bidder's maximum Bid price and in the form of a certified check, bank money order, or a Bid Bond (on the form attached) issued by a surety meeting the requirements of Paragraphs 5.01 and 5.02 of the General Conditions.
- 7.02 The Bid security of the Successful Bidder will be retained until such Bidder has executed the Contract Documents, furnished the required contract security and met the other conditions of the Notice of Award. If the Successful Bidder fails to execute and deliver the Contract Documents and furnish the required contract security within ten (10) days after the Notice of Award, Owner may annul the Notice of Award and the Bid security of that Bidder will be forfeited. The Bid security of other Bidders Whom Owner believes to have a reasonable chance of receiving the award may be retained by Owner until the earlier of seven (7) days after the Effective Date of the Agreement or

sixty (60) days after the Bid opening. Bidders not receiving a contract for will be issued a copy of the Notice of Award to send to their issuing Surety so that the Bid Bond can be canceled. Bidders Bid Bond documents will not be returned. All Certified Checks will be returned to the Bidders.

ARTICLE 8 - CONTRACT TIMES

- 8.01 **Renovation and Expansion of the facility located at 537 Aviation Way, Walterboro South Carolina. Approximately ± 1,618 sf of new construction consisting of a new Conference room and Flight Crew rest area, along with ± 2,270 sf of renovation to the current facility as it stands now, is to be completed within Three Hundred Thirty (330) calendar days after the Notice to Proceed has been issued.**

ARTICLE 9 – LIQUIDATED DAMAGES

9.01 Document Execution

- A. The successful Bidder, upon failure or refusal to execute and deliver the contract and bonds within ten (10) days after they have received the notice of the acceptance of their bid, shall forfeit to the Owner, as liquidated damages, the security deposited with the bid.

9.02 Project Execution

- A. Bidder must agree to commence work on or before a date to be specified in a written “Notice to Proceed” by the Owner and to fully complete the project within the dates specified in the Bid Form, Article 6; Paragraph 6.01. Bidder must agree also to pay as liquidated damages the sum as indicated in the Bid Form, Article 6; Paragraph 6.02 for each consecutive calendar day thereafter as hereinafter provided in the General Conditions.

ARTICLE 10 - SUBSTITUTE AND “OR-EQUAL” ITEMS

- 10.01 The Contract, if awarded, will be on the basis of materials and equipment specified or described in the Bidding Documents. Whenever it is specified or described in the Bidding Documents that a substitute or “or-equal” item of material or equipment may be furnished or used by Contractor if acceptable to the Construction Coordinator, application for such acceptance will not be considered by the Owner until after the Effective Date of the Agreement.

- (a) The use of a “**Brand Name Only**” specification is for the purpose of describing the sole item that will satisfy the county’s requirements. Bids offering alternate products will be declared non-responsive.
- (b) The use of a “**Brand Name or Equal**” specification is for the purpose of describing the standard of quality, performance and characteristics desired and is not intended to limit or restrict competition. An item shall be considered to be substantially equivalent, or “equal” to the specified brand in the opinion of the Purchasing Director, the County can reasonably anticipate sufficiently similar quality, capacity, durability, performance, utility and productivity as provided by the specified brand.

ARTICLE 11 - SUBCONTRACTORS, SUPPLIERS, AND OTHERS

- 11.01 The General Conditions require the identity of certain Subcontractors, Suppliers, individuals, or entities to be submitted to Owner with the bid packet. The bidder shall submit to Owner a list of all such Subcontractors, Suppliers, individuals, or entities proposed for those portions of the Work for which such identification is required. Such list shall be accompanied by an experience statement with pertinent information regarding similar projects and other evidence of qualification for each such Subcontractor, Supplier, individual, or entity if requested by Owner. If Owner or Construction

Coordinator, after due investigation, has reasonable objection to any proposed Subcontractor, Supplier, individual, or entity, Owner may, before the Notice of Award is given, request apparent Successful Bidder to submit a substitute, in which case apparent Successful Bidder shall submit an acceptable substitute, Bidder's Bid price will be increased (or decreased) by the difference in cost occasioned by such substitution, and Owner may consider such price adjustment in evaluating Bids and making the Contract award.

- 11.02 If apparent Successful Bidder declines to make any such substitution, Owner may award the Contract to the next lowest Bidder that proposes to use acceptable Subcontractors, Suppliers, individuals, or entities. Declining to make requested substitutions will not constitute grounds for forfeiture of the Bid security of any Bidder. Any Subcontractor, Supplier, individual, or entity so listed and against which Owner or Construction Coordinator makes no written objection prior to the giving of the Notice of Award will be deemed acceptable to Owner and Construction Coordinator subject to revocation of such acceptance after the Effective Date of the Agreement as provided in Paragraph 6.06 of the General Conditions.
- 11.03 Contractor shall not be required to employ any Subcontractor, Supplier, individual, or entity against whom Contractor has reasonable objection.
- 11.04 Each bidder shall fully acquaint himself with conditions of this Bid. The failure or omission of a bidder to acquaint himself with existing conditions shall in no way relieve him of any obligation with respect to this Bid or to the Contract.
- 11.05 Failure of a sub-contractor to fully acquaint himself with the conditions of this bid when working on behalf of the General Contractor or contract holder shall in no way relieve himself of any obligation with respect to this Bid or to the Contract.

ARTICLE 12 - PREPARATION OF BID

- 12.01 Should a bidder need any reasonable accommodations for any type of disability in order to participate in this procurement, you are asked to contact the Colleton County Capital Projects & Purchasing Department.
- 12.02 The Bid Form is included with the Bidding Documents located on the Owners Web Site.
- 12.03 All blanks on the Bid Form shall be completed by printing in ink or by typewriter and the Bid signed in ink. Erasures or alterations shall be initialed in ink by the person signing the Bid Form. When required a Bid price shall be indicated for each unit price item listed therein, or the words "No Bid," "No Charge," or "Not Applicable" entered. When a unit price is not required, the bid price shall be submitted in words and numbers as indicated on the bid form.
- 12.04 A Bid by an individual shall show the Bidder's name and official address.
- 12.05 A Bid by a joint venture shall be executed by each joint venture in the manner indicated on the Bid Form. The official address of the joint venture shall be shown below the signature.
- 12.06 All names shall be typed or printed in ink below the signatures.
- 12.07 The Bid shall contain an acknowledgment of receipt of all Addenda, the numbers of which shall be filled in on the Bid Form.
- 12.08 The address and telephone number for communications regarding the Bid shall be shown.
- 12.09 The Bid shall contain evidence of Bidder's authority and qualification to do business in the state where the Project is located or covenant to obtain such qualification prior to award of the Contract. Bidder's state contractor license number, if any, shall also be shown on the Bid Form.

- 12.10 Any reports, studies, photographs, negatives or other documents prepared by vendor in the performance of its obligations shall be the exclusive property of the procurer and all such material shall be remitted to the procurer by the vendor upon completion, termination or cancellation of this order. Vendor shall not use, willingly allow or cause to have such material used for any purpose other than performance of its obligations under this order without the prior written consent of the procurer.
- 12.11 The contractor will take affirmative action in complying with all Federal and State requirements concerning fair employment and employment of the handicapped, and concerning the treatment of all employees, without regard or discrimination by reason of age, race, color, religion, sex, national origin or physical handicap. The following are incorporated herein by reference: 41 C.F.R. 60-1.4, 60-250.4 and 60-741.4.
- 12.12 All construction contracts over \$2,000.00 must include a provision for compliance with the Copeland "Anti-Kickback" Act (18 U.S.C. 874) as supplemented in Department of Labor regulations (29 CFR Part 3). This act provides that each Contractor shall be prohibited from inducing, by any means, persons employed in the construction, completion, or repaid of public work to give up any part of their compensation.
- 12.13 The contractor certifies that the vendor(s) will provide a "drug-free workplace" as that term is defined in Section 44-107-30 of the Code of Laws of South Carolina, 1976, as amended, by the complying with the requirements set forth in title 44, Chapter 107
- 12.14 The federally-assisted construction contractor certifies that he will not maintain or provide, for his employees, segregated facilities at any of his establishments and that he will not permit his employees to perform their services at any location under his control where segregated facilities are maintained. The federally assisted construction contractor agrees that a breach of this certification is a violation of the Equal Opportunity Clause in this Contract. As used in this certification, the term "segregated facilities" means any waiting rooms, work areas, restrooms, and washrooms, restaurants and other eating areas, time clocks, locker rooms and other storage or dressing areas, parking lots, drinking fountains, recreation or entertainment areas, transportation, and housing facilities provided for employees which are segregated on the basis of race, color, religion, or national origin because of habit, local custom, or any other reason. The federally assisted construction contractor agrees that (except where he has obtained identical certifications from proposed subcontractors for specific time periods) he will obtain identical certifications from proposed subcontractors prior to the award of subcontracts exceeding \$10,000 which are not exempt from the provisions of the Equal Opportunity Clause and that he will retain such certifications in his files.
- 12.15 By signing this bid or proposal, Contractor certifies that it will (a) comply with the applicable requirements of Title 8, Chapter 14, and (b) include in their contracts with the sub-subcontractor's language requiring the sub-subcontractors to comply with the applicable requirements of Title 8, Chapter 14. (An overview is available at www.procurement.sc.gov)
- 12.16 Bidders must clearly mark as "confidential" each part of their bid which they consider to be proprietary information that could be exempt from disclosure under section 30-4-40, Code of Laws of South Carolina 1976, as amended (Freedom of Information Act). If any part is designated as confidential, there must be attached to that part an explanation of how this information fits within one or more categories listed in section 30-4-40. The County reserves the right to determine whether this information should be exempt from disclosure and no legal action may be brought against the County or its agents for its determination in this regard.
- 12.17 Nothing herein is intended to exclude any responsible vendor, his product or service or in any way restrain or restrict competition. On the contrary, all responsible vendors are encouraged to bid and their bids are solicited.
- 12.18 The successful Bidder must be responsible for obtaining all necessary city, county, and state permits/licenses and must comply with all State and local codes and ordinances. Copies of

such permits/licenses shall be made available to Colleton County upon request. Work within the Walterboro City Limits may require a City Business License.

- 12.19 This Agreement shall be governed by and construed in accordance with the laws of the State of South Carolina, U.S.A.
- 12.20 All claims, disputes and other matters in question between parties arising out of, or relating to, this Agreement, or the breach thereof, shall be decided in the Circuit Court of the Fourteenth Judicial Circuit in Colleton County, South Carolina. By executing this Agreement, all parties specifically consent to venue and jurisdiction in Colleton County, South Carolina and waive any right to contest jurisdiction and venue in said Court.
- 12.21 Colleton County reserves the right to reject all or any part of any bid, waive informalities and award the contract to the lowest responsive and responsible bidder to best serve the interest of Colleton County.
- 12.22 By submitting a bid, the Bidder certifies to the best of its knowledge and belief, that it and its principals, sub-contractors and assigns are not presently debarred, suspended, proposed for debarment, declared ineligible, or voluntarily excluded from covered transactions by any Federal, State or local department or agency. A copy of the County's debarment procedure in accordance with Section 2-68 of Ordinance #2008-09, also known as the Colleton County, South Carolina Purchasing Policy is available upon request.
- 12.23 Federal guidelines require grant recipients to obtain sufficient assurance that bidders are not suspended or debarred from participating in federal programs when contracts exceed \$25,000. By signing the bid submittal form you verify that no party to this agreement is excluded from receiving Federal contracts, certain subcontracts, and certain Federal financial and nonfinancial assistance and benefits, pursuant to the provisions of 31 U.S.C. 6101, note, E.O. 12549, E.O. 12689, 48 CFR 9.404, and each agency's codification of the Common Rule for Non-procurement suspension and debarment. **[See <https://www.epls.gov/> for additional information.]**

ARTICLE 13 - BASIS OF BID; COMPARISON OF BIDS

- 13.01 Base Bid and Unit Price Schedule
 - A. Bidders shall submit a base bid for the project, as listed in the Specifications, General Conditions, Drawings and any Addendums. Failure for the Contractor or Subcontractor(s) to properly perform takeoffs for the project does not relieve the bidder of their obligation to provide a complete, finished product, for the submitted base bid amount. The base bid shall include any owner listed Allowances or contingencies.
 - B. Bidders shall submit a Base Bid as a lump sum.
 - C. Within 48 hours of the lowest responsive bidder being notified by Colleton County, the bidder shall submit to Colleton County for **review and approval**, the attached unit price schedule for each item of work listed. All quantity take offs shall be listed in the form as requested. All requested unit pricing shall have a figure entered into the form. Lumping of unit prices and or divisions will not be allowed. Unit prices shall be totaled to match the lump sum bid. Failure for the bidder to provide this information in the allotted time will result in the bidder being disqualified and shall forfeit their Bid Bond.
 - D. The total of all unit prices will be the sum of the products of the quantity of each item and the corresponding unit price.
 - E. Discrepancies between the indicated sum of any column of figures and the correct sum thereof will be resolved in favor of the correct sum. Discrepancies between words and figures will be resolved in favor of the words.

- 13.02 The Bid price shall include such amounts as the Bidder deems proper for overhead and profit and any account of cash allowances, if any, named in the Contract Documents as provided in Paragraph 11.02 of the General Conditions.
- 13.03 Bid prices will be compared after adjusting for differences in the time designated by Bidders for Substantial Completion. The adjusting amount will be determined at the rate set forth in the Contract Documents for liquidated damages for failing to achieve Substantial Completion for each day before or after the desired date appearing in Article 9.
- 13.04 The contents of the successful IFB/RFP are included as if fully reproduced herein. Therefore, the selected contractor must be prepared to be bound by his/her proposal as submitted.
- 13.05 Whereas the Colleton County Purchasing Ordinance Chapter 3.08 has provisions for Local Vendor preference. Bidders are encouraged to review section 3.08.185 of Chapter 3.08 for their rights under the Local Vendor Preference as this preference could be used in determining the lowest responsible bidder.

ARTICLE 14 - SUBMITTAL OF BID

- 14.01 **A Bidder shall furnish one (1) original separate unbound copy of the “Bid Documents”. Two (2) additional bound copies are to be submitted with the original. The Original Bid Document shall contain the Bid security.**
- 14.02 A Bid shall be submitted no later than the date and the official time prescribed and at the place indicated in the Advertisement or Invitation to Bid and shall be enclosed in an opaque sealed envelope plainly marked with the Project title (and, if applicable, the designated portion of the Project for which the Bid is submitted), the name and address of Bidder, Contractor’s License Number, and shall be accompanied by the Bid security and other required documents. If a Bid is sent by mail or other delivery system, the sealed envelope containing the Bid shall be enclosed in a separate envelope plainly marked on the outside with the notation “**CPST-11**”. A mailed Bid shall be addressed to:

Capital Projects & Purchasing Department
Kaye B. Syfrett, Procurement Manager
113 Mable T. Willis Boulevard
Walterboro, SC 29488
- 14.03 In the case of Inclement Weather/Closure of Colleton County offices; If the Colleton County office is closed for business at the time scheduled for bid opening, for whatever reason, sealed bids will be accepted and opened on the next scheduled business day, at the originally scheduled official time.
- 14.04 The Bid shall be submitted on the Bid Form provided; no other form is acceptable.
- 14.05 The successful Bidder will be required to provide verified unit breakdown of costs of all services and work in a manner acceptable to the Owner.
- 14.06 All blanks on the Bid Form shall be filled in, either typed or printed in ink. The person signing the bid shall initial all corrections or erasures.
- 14.07 Where so indicated on the Bid Form, the Bid Sum shall be expressed in both words and figures; in case of a discrepancy between the two, the Sums expressed in words shall govern.
- 14.08 List unit price on by bidder take offs - extend and show total. In case of errors in extension, unit prices shall govern. Unit pricing shall include all applicable overhead, administrative, profit and other associated cost.

- 14.09 Bidder shall quote all Alternates in the Bidding Documents. If Bidder fails to bid on all Alternates, then his/her Bid may be considered irregular, non-responsive and may be disqualified.
- 14.10 Bids containing qualifications will be considered irregular, non-responsive and may be disqualified.
- 14.11 A Bid Form submitted by a partnership shall list the names of all partners and shall be signed in the partnership name by one of the members of the partnership who is authorized to sign for the partnership.
- 14.12 A Bid Form submitted by a corporation shall be executed in the legal name of the corporation, followed by the state of incorporation and signed by the President or Vice President or another authorized officer. The name of each person signing the Bid Form shall be typed or printed below the signature.
- 14.13 When the person signing for a corporation is other than the President or Vice President and when requested by the Owner, a resolution or other satisfactory evidence of the authority of the officer signing in behalf of the corporation shall be furnished for the Owner's records. The name of each person signing the Bid Form shall be typed or printed below the signature.

ARTICLE 15 - MODIFICATION OF BID -CLAIM OF ERROR

- 15.01 A Bid may be modified or withdrawn by an appropriate document duly executed in the manner that a Bid must be executed and delivered to the place where Bids are to be submitted prior to the date and time for the opening of Bids.
- 15.02 A bidder may request to have their submitted bid withdrawn due to an error. The claim of error must be submitted within 24 hours of the bid submittal deadline. The description of the nature of the error shall accompany the request. The description shall include all original worksheets, demonstrating the error. If an withdrawal request is approved, the bidders Bid Bond will not be forfeited.

ARTICLE 16 - OPENING OF BIDS

- 16.01 Bids will be opened at the time and place indicated in the Advertisement or Invitation to Bid and, unless obviously non-responsive, read aloud publicly. An abstract of the amounts of the base Bids and major alternates, if any, will be made available to Bidders after the opening of Bids in the form of a Bid Tabulation and Bid Comparison to be posted on the County web page.

ARTICLE 17 - BIDS TO REMAIN SUBJECT TO ACCEPTANCE

- 17.01 All Bids will remain subject to acceptance for the period of time stated in the Bid Form, but Owner may, in its sole discretion, release any Bid and return the Bid security prior to the end of this period.

ARTICLE 18 - EVALUATION OF BIDS AND AWARD OF CONTRACT

- 18.01 Owner reserves the right to reject any or all Bids, including without limitation, nonconforming, non-responsive, unbalanced, or conditional Bids. Owner further reserves the right to reject the Bid of any Bidder whom it finds, after reasonable inquiry and evaluation, to not be responsible. Owner may also reject the Bid of any Bidder if Owner believes that it would not be in the best interest of the Project to make an award to that Bidder. Owner also, reserves the right to waive all informalities not involving price, time, or changes in the Work and to negotiate contract terms with the Successful Bidder.

- 18.02 More than one Bid for the same Work from an individual or entity under the same or different names will not be considered. Reasonable grounds for believing that any Bidder has an interest in more than one Bid for the Work may be cause for disqualification of that Bidder and the rejection of all Bids in which that Bidder has an interest.
- 18.03 In evaluating Bids, Owner will consider whether or not the Bids comply with the prescribed requirements, and such alternates, unit prices and other data, as may be requested in the Bid Form or prior to the Notice of Award.
- 18.04 In evaluating Bidders, Owner will consider the qualifications of Bidders and may consider the qualifications and experience of Subcontractors, Suppliers, and other individuals or entities proposed for those portions of the Work for which the identity of Subcontractors, Suppliers, and other individuals or entities must be submitted as provided in the General Conditions.
- 18.05 Owner may conduct such investigations as Owner deems necessary to establish the responsibility, qualifications, and financial ability of Bidders, proposed Subcontractors, Suppliers, individuals, or entities to perform the Work in accordance with the Contract Documents.
- 18.06 If the Contract is to be awarded, Owner will award the Contract to the Bidder whose Bid is in the best interests of the Project.
- 18.07 The Owner reserves the right not to Award the Project.
- 18.08 **The Owner shall have the right to accept Alternates in any order or combination, and to determine the low bidder on the basis of the sum of the Base Bid and alternates accepted.**

ARTICLE 19 - CONTRACT SECURITY AND INSURANCE

- 19.01 Article 5 of the General Conditions sets forth Owner's requirements as to performance and payment bonds and insurance. When the Successful Bidder delivers the executed Agreement to Owner, it shall be accompanied by such bonds.

ARTICLE 20 - SIGNING OF AGREEMENT

- 20.01 When Owner gives a Notice of Award to the Successful Bidder, it shall be accompanied by the required number of unsigned counterparts of the Agreement with the other Contract Documents which are identified in the Agreement as attached thereto. Within ten (10) days thereafter, Successful Bidder shall sign and deliver the required number of counterparts of the Agreement and attached documents to Owner. Within ten (10) days thereafter, Owner shall deliver one (1) fully signed counterpart to Successful Bidder with a complete set of the Drawings with appropriate identification.

ARTICLE 21 - RETAINAGE

- 21.01 Retainage from progress payments to the Contractor shall be **ten percent** (10%) of each payment for work completed and stored materials on site.

ARTICLE 22 – INSURANCE

- 22.01 The successful bidder shall procure, maintain, and provide proof of, insurance coverage for injuries to persons and/or property damage as may arise from or in conjunction with, the work performed on behalf of the County by the bidder, his agents, representatives, employees or subcontractors. Proof of coverage as contained herein shall be submitted fifteen (15) days prior to

the commencement of work and such coverage shall be maintained by the bidder for the duration of the contract period; for occurrence policies.

a. General Liability

Coverage shall be as broad as: Comprehensive General Liability endorsed to include Broad Form, Commercial General Liability form including Products/Completed Operations.

Minimum Limits

General Liability:

\$2,000,000 General Aggregate
\$2,000,000 Products & Completed Operations Aggregate
\$1,000,000 Personal and Advertising Injury
\$1,000,000 Each Occurrence (Bodily Injury and Property Damage)
\$50,000 Fire Damage Limit
\$5,000 Medical Expense Limit

b. Automobile Liability

Coverage sufficient to cover all vehicles owned, used, or hired by the bidder, his agents, representatives, employees or subcontractors.

Minimum Limits

Automobile Liability:

\$1,000,000 Combined Single Limit
\$1,000,000 Each Occurrence
Limit \$5,000 Medical Expense

c. Workers' Compensation

Limits as required by the Workers' Compensation Act of SC. Employers

Liability, \$1,000,000

d. Owners' & Contractors' Protective Liability

Policy will be in name of Colleton County.
Minimum limits required are \$1,000,000

e. Excess or Umbrella Liability

General Aggregate \$2,000,000
Each Occurrence \$2,000,000

f. Contractual Liability

Bodily Injury:

Each Accident	\$2,000,000
Annual Aggregate	\$2,000,000

Property Damage:

Each Accident	\$2,000,000
Annual Aggregate	\$2,000,000

g. Coverage Provisions

1. All deductibles or self-insured retention shall appear on the certificate(s).
2. The County of Colleton, its officers/ officials, employees, agents and volunteers shall be added as "additional insured" as their interest's may appear. This provision does not apply to Professional Liability or Workers' Compensation/ Employers' Liability.
3. The bidder's insurance shall be primary over any applicable insurance or self-insurance maintained by Colleton County.

4. Shall provide 30 days' written notice to Colleton County before any cancellation, suspension, or void of coverage in whole or part, where such provision is reasonable.
5. All coverage for subcontractors of the bidder shall be subject to all of the requirements stated herein.
6. All deductibles or self-insured retention shall appear on the certificate(s) and shall be subject to approval by the County. At the option of Colleton County, either; the insurer shall reduce or eliminate such deductible or self-insured retention; or the bidder shall be required to procure a bond guaranteeing payment of losses and related claims expenses.
7. Failure to comply with any reporting provisions of the policy(s) shall not affect coverage provided Colleton County, its officers/officials, agents, employees and volunteers.
8. The insurer shall agree to waive all rights of subrogation against Colleton County, its officers/officials, agents, employees or volunteers for any act, omission or condition of premises which the parties may be held liable by reason of negligence.
9. The bidder shall furnish Colleton County certificates of insurance including endorsement affecting coverage. The certificates are to be signed by a person authorized by the insurance company(s) to bind coverage on its' behalf, if executed by a broker, notarized copy of authorization to bind, or certify coverage must be attached.
10. All insurance shall be placed with insurers maintaining an A.M. Best rating of no less than an A: VII. If A.M. Best rating is less than A: VII, approval must be received from Colleton County's Risk Officer.

22.02 Colleton County, SC will require each contractor and service provider to maintain on file with the Procurement Manager, a current Certificate of Insurance showing limits as required by the Workers' Compensation Act of SC:

Employers Liability, \$1,000,000.

The law also recognizes "statutory employees." These are employees who work for a subcontractor who may be working for a business or another contractor. Employers should inquire whether or not a subcontractor working for them has workers' compensation insurance, regardless of the number of employees employed by the subcontractor. If the subcontractor does not, the subcontractor's injured employees would be covered under the employer's workers' compensation insurance. If the subcontractor does not carry workers' compensation insurance, then the owner or the principal contractor would be liable just as if the subcontractor's employee was one of their employees. For answers to additional questions, visit the SC Worker's Compensation Commission website at: <http://www.wcc.state.sc.us/Frequently%20Asked%20Questions/FAQ.htm>

22.03 Contractor shall provide and maintain, during the progress of the work and until execution of the Certificate of Contract Completion, a *Builder's Risk Insurance policy* to cover all work in the course of construction including false work, temporary buildings, scaffolding, and materials used in the construction process (including materials designated for the project but stored off site or in transit). The coverage shall equal the total completed value of the work and shall provide recovery at replacement cost.

- a) Such insurance shall be on a special cause of loss form, providing coverage on an open perils basis insuring against the direct physical loss of or damage to covered property, including but not limited to theft, vandalism, malicious mischief, earthquake,

tornado, lightning, explosion, breakage of glass, collapse, water damage, and testing/startup.

- b) Coverage shall include coverage for "soft costs" (costs other than replacement of building materials) including, but not limited to, the reasonable extra costs of the architect/engineer and reasonable Contractor extension or acceleration costs. This coverage shall also include the reasonable extra costs of expediting temporary and permanent repairs to, or permanent replacement of, damaged property. This shall include overtime wages and the extra cost of express or other means for rapidly transporting materials and supplies necessary to the repair or replacement.
- c) The policy shall specifically permit and allow for partial occupancy by the owner prior to execution of the final Certification of Contract Completion, and coverage shall remain in effect until all punch list items are completed.
- d) The Builder's Risk deductible may not exceed \$5,000. The Contractor or subcontractor experiencing any loss claimed under the Builder's Risk policy shall be responsible for that loss up to the amount of the deductible.
- e) If Contractor is involved solely in the installation of material and equipment and not in New building construction, the Contractor shall provide an Installation Floater policy in lieu of a Builder's Risk policy. The policy must comply with the provisions of this paragraph.

ARTICLE 23 – WARRANTY

- 23.01 Warranty of workmanship and products shall be covered for 730 days from the date of the issuance of the Certificate of Substantial Completion. During the 730-day warranty period, all product warranties or workmanship repairs are the sole responsibility of the Contract holder and shall include all parts and labor associated with the repair.
- 23.02 All items repaired or replaced during the initial Warranty period due to workmanship or product failure shall be warranted for 365 days from the date of the repair and or replacement.
- 23.03 All Surety Bonds shall cover the warranty period listed in 23.01 and 23.02. The surety shall be updated to reconcile the date of the warranty period as needed.
- 23.04 Should a product installed during the construction process not have a manufactures warranty period that extends out to one year, it is the responsibility of the Contract holder to cover the product and any resulting expenses related to that product for one year.

Remainder of this page intentionally left blank

CONTRACT

THIS AGREEMENT is by and between Colleton County, 109 Benson Street,
Walterboro, South Carolina

(hereinafter called "Owner") and _____

doing business as an **individual/partnership/corporation/joint venture** (strike out inapplicable terms), with its primary office in the City of _____, County of _____, State of _____.

Owner and Contractor, in consideration of the mutual covenants set forth herein, agree as follows:

ARTICLE 1 - WORK

1.01 Contractor shall complete all Work as specified or indicated in the Contract Documents. The Work is generally described as follows:

Renovation and Expansion of the facility located at 537 Aviation Way, Walterboro South Carolina. Approximately ± 1,618 sf of new construction consisting of a new Conference room and Flight Crew rest area, along with ± 2,270 sf of renovation to the current facility as it stands now.

ARTICLE 2 - THE PROJECT

2.01 The Project for which the Work under the Contract Documents may be the whole or only a part is generally described as follows:

Renovation and Expansion of the facility located at 537 Aviation Way, Walterboro South Carolina. Approximately ± 1,618 sf of new construction consisting of a new Conference room and Flight Crew rest area, along with ± 2,270 sf of renovation to the current facility as it stands now.

ARTICLE 3 - DESIGN

3.01 The Project has been designed by: Watson Tate Savory Inc., The Architect of record, John Mclean, will act as the Construction Coordinator as the Owner's representative, assume all duties and responsibilities, and have the rights and authority assigned to the Construction Coordinator in the Contract Documents in connection with the completion of the Work in accordance with the Contract Documents.

ARTICLE 4 - CONTRACT TIMES

4.01 Time of the Essence

A. All time limits for Milestones for final payment as stated in the Contract Documents are of the essence of the Contract.

4.02 Dates for Substantial Completion and Final Payment

Renovation and Expansion of the facility located at 537 Aviation Way, Walterboro South Carolina. Approximately ± 1,618 sf of new construction consisting of a new Conference room and Flight Crew rest area, along with ± 2,270 sf of renovation to the current facility as it stands now, is to be completed within Three Hundred Thirty (330) calendar days after the Notice to Proceed has been issued.

4.03 Liquidated Damages

- A. Contractor and Owner recognize that time is of the essence of this Agreement and that Owner will suffer financial loss if the Work is not completed within the times specified in Paragraph 4.02 above, plus any extensions thereof allowed in accordance with Article 12 of the General Conditions. The parties also recognize the delays, expense, and difficulties involved in proving in a legal or arbitration proceeding the actual loss suffered by Owner if the Work is not completed on time. Accordingly, instead of requiring any such proof, Owner and Contractor agree that as liquidated damages for delay (but not as a penalty), Contractor shall pay Owner \$500 for each day that expires after the time specified in Paragraph 4.02 for completion and readiness for final payment until the Work is completed and ready for final payment.
- B. Liquidated damages can and will be assessed against the final payment request and any retainage held by Colleton County. Should funding for Liquidated damages exceed the amount held by Colleton County in the form of Payments or Retainage, work shall stop until such time as the Liquidated Damages issue is resolved.

ARTICLE 5 - CONTRACT PRICE

5.01 Owner shall pay Contractor for completion of the Work in accordance with the Contract Documents an amount in current funds equal to the sum of the amounts determined pursuant to Paragraphs 5.01.A below:

- A. For all Unit Price Work, an amount equal to the sum of the established unit price for each separately identified item of Unit Price Work, times the estimated quantity of that item as indicated in the Bid Form attached hereto as part of these Contract Documents.
- B. Allowances to be used at the owner's discretion shall be included in Base Bid Proposal. Allowances will be listed separately in the submitted schedule of values and unit price sheet. All unused allowances shall be credited back to the owner at the completion of the project in the form of a change order.

Signage not in specifications	LS	1	\$ 5,000.00
Irrigation	LS	1	\$ 5,000.00
Unfounded issues	LS	1	\$ 50,000.00
FF&E	LS	1	\$ 15,000.00
Radio Console and Antenna Reinstall not in Specifications	LS	1	\$ 25,000.00

- C. The sum of unit price work to be completed as noted in 5.01(A) and 5.01(B) is, _____ \$ _____

ARTICLE 6 - PAYMENT PROCEDURES

6.01 Submittal and Processing of Payments

- A. Contractor shall submit Applications for Payment in accordance with Article 14 of the General Conditions. Applications for Payment will be processed by the Construction Coordinator as provided in the General Conditions.

6.02 Progress Payments; Retainage

- A. Owner shall make progress payments on account of the Contract Price on the basis of Contractor's Applications for Payment on or about the 15th day of each month during performance of the Work as provided in Paragraphs 6.02.A.1 and 6.02.A.2 below. All such

payments will be measured by the schedule of values established as provided in Paragraph 2.07.A of the General Conditions (and in the case of Unit Price Work based on the number of units completed) or, in the event there is no schedule of values, as provided in the General Requirements:

1. Prior to Substantial Completion, progress payments will be made in an amount equal to the percentage indicated below but, in each case, less the aggregate of payments previously made and less such amounts as the Construction Coordinator may determine or Owner may withhold, including but not limited to liquidated damages, in accordance with Paragraph 14.02 of the General Conditions:
 - a. **90%** of Work completed (with the balance being Retainage).
 - b. **90%** of cost of materials and equipment not incorporated in the Work (with the balance being Retainage).
2. Upon Substantial Completion, Owner shall pay an amount sufficient to increase total payments to Contractor to **90%** of the Work completed, less such amounts as the Construction Coordinator shall determine in accordance with Paragraph 14.02.B.5 of the General Conditions and less **10%** of the Construction Coordinator estimate of the value of Work to be completed or corrected as shown on the tentative list of items to be completed or corrected attached to the certificate of Substantial Completion.

6.03 Final Payment

- A. Upon final completion and acceptance of the Work in accordance with Paragraph 14.07 of the General Conditions, Owner shall pay the remainder of the Contract Price as recommended by the Construction Coordinator as provided in said Paragraph 14.07.

ARTICLE 7 – CONTRACTOR’S REPRESENTATIONS

7.01 In order to induce Owner to enter into this Agreement Contractor makes the following representations:

- A. Contractor has examined and carefully studied the Contract Documents and the other related data identified in the Bidding Documents.
- B. Contractor has visited the Site and become familiar with and is satisfied as to the general, local, and Site conditions that may affect cost, progress, and performance of the Work.
- C. Contractor is familiar with and is satisfied as to all federal, state, and local Laws and Regulations that may affect cost, progress, and performance of the Work.
- D. Contractor has carefully studied all: (1) reports of explorations and tests of subsurface conditions at or contiguous to the Site and all drawings of physical conditions in or relating to existing surface or subsurface structures at or contiguous to the Site (except Underground Facilities) which have been identified in Paragraph 4.02 of the General Conditions and (2) reports and drawings of a Hazardous Environmental Condition, if any, at the Site which has been identified in Paragraph 4.06 of the General Conditions.
- E. Contractor has obtained and carefully studied (or assumes responsibility for doing so) all examinations, investigations, explorations, tests, studies, and data concerning conditions (surface, subsurface, and Underground Facilities) at or contiguous to the Site which may affect cost, progress, or performance of the Work or which relate to any aspect of the means, methods, techniques, sequences, and procedures of construction to be employed by Contractor, including any specific means, methods, techniques, sequences, and procedures

of construction expressly required by the Bidding Documents, and safety precautions and programs incident thereto.

- F. Contractor does not consider that any further examinations, investigations, explorations, tests, studies, or data are necessary for the performance of the Work at the Contract Price, within the Contract Times, and in accordance with the other terms and conditions of the Contract Documents.
- G. Contractor is aware of the general nature of work to be performed by Owner and others at the Site that relates to the Work as indicated in the Contract Documents.
- H. Contractor has correlated the information known to Contractor, information and observations obtained from visits to the Site, reports and drawings identified in the Contract Documents, and all additional examinations, investigations, explorations, tests, studies, and data with the Contract Documents.
- I. Contractor has given the Owner written notice of all conflicts, errors, ambiguities, or discrepancies that Contractor has discovered in the Contract Documents, and the written resolution thereof by the Owner is acceptable to Contractor.
- J. The Contract Documents are generally sufficient to indicate and convey understanding of all terms and conditions for performance and furnishing of the Work.

ARTICLE 8 - CONTRACT DOCUMENTS

- 8.01 A. The Contract Documents shall consist of all sections in the following divisions;

DIVISION 000 - BIDDING AND CONTRACT REQUIREMENTS
DIVISION 001 - GENERAL CONDITIONS
DIVISION 01 - GENERAL REQUIREMENTS
DIVISION 03 - CONCRETE
DIVISION 06 - WOOD & PLASTICS
DIVISION 07 - THERMAL & MOISTURE PROTECTION
DIVISION 08 - OPENINGS
DIVISION 09 - FINISHES
DIVISION 10 - SPECIALTIES
DIVISION 11 - EQUIPMENT
DIVISION 12 - FURNISHING
DIVISION 22 - PLUMBING
DIVISION 23 - HEATING, VENTIATING AND HVAC
DIVISION 26 - ELECTRICAL
DIVISION 27 - COMMUNICATIONS
DIVISION 31 - EARTHWORK
DIVISION 32 - EXTERIOR IMPROVEMENTS
DIVISION 33 - UTILITIES
EXHIBIT "A" - S&ME REPORTS Dated May 2, 2017 & May 10, 2017
EXHIBIT "B" - SOIL CONSULTANTS, INC. ANALYSIS Dated March 9, 2016
EXHIBIT "C" - PLANS

All information contained within these Divisions and the requirements thereof are of the sole responsibility of the bidder.

- B. There are no Contract Documents other than those listed above in this Article 8.
- C. The Contract Documents may only be amended, modified, or supplemented as provided in Paragraph 3.04 of the General Conditions.

ARTICLE 9 - MISCELLANEOUS

9.01 Terms

- A. Terms used in this Agreement will have the meanings stated in the 001, General Conditions.

9.02 Assignment of Contract

- A. No assignment by a party hereto of any rights under or interests in the Contract will be binding on another party hereto without the written consent of the party sought to be bound; and, specifically but without limitation, moneys that may become due and moneys that are due may not be assigned without such consent (except to the extent that the effect of this restriction may be limited by law), and unless specifically stated to the contrary in any written consent to an assignment, no assignment will release or discharge the assignor from any duty or responsibility under the Contract Documents.

9.03 Successors and Assigns

- A. Owner and Contractor each binds itself, its partners, successors, assigns, and legal representatives to the other party hereto, its partners, successors, assigns, and legal representatives in respect to all covenants, agreements, and obligations contained in the Contract Documents.

9.04 Severability

- A. Any provision or part of the Contract Documents held to be void or unenforceable under any Law or Regulation shall be deemed stricken, and all remaining provisions shall continue to be valid and binding upon Owner and Contractor, who agree that the Contract Documents shall be reformed to replace such stricken provision or part thereof with a valid and enforceable provision that comes as close as possible to expressing the intention of the stricken provision.

9.05 Waiver or Forbearance

Any delay or failure of Colleton County to insist upon strict performance of any obligation under this Agreement or to exercise any right or remedy provided under this Agreement shall not be a waiver of Colleton County's right to demand strict compliance, irrespective of the number or duration of any delay(s) or failure(s). No term or condition imposed on Contractor under this Agreement shall be waived and no breach by Contractor shall be excused unless that waiver or excuse of a breach has been put in writing and signed by both parties. No waiver in any instance of any right or remedy shall constitute waiver of any other right or remedy under this Agreement. No consent to or forbearance of any breach or substandard performance of any obligation under this Agreement shall constitute consent to modification or reduction of the other obligations or forbearance of any other breach.

- 9.06 Subject to the provisions below, the contract may be terminated by the County upon fifteen (15) days advance written notice to the other party; but if any work or service hereunder is in progress, but not completed as of the date of termination, then this contract may be extended upon written approval of the County until said work or services are completed and accepted.

- a. Termination for Convenience

- In the event that this contract is terminated or canceled upon request and for the convenience of the County, without the required fifteen (15) days advance written notice, then the County shall negotiate reasonable termination costs, if applicable.

b. Termination for Cause

Termination by the County for cause, default or negligence on the part of the contractor shall be excluded from the foregoing provision; termination costs, if any, shall not apply. The fifteen (15) days advance notice requirement is waived in the event of Termination for Cause.

c. Non-Appropriation:

It is understood and agreed by the parties that in the event funds are not appropriated in the current fiscal year or any subsequent fiscal years, this contract will become null and void and the County will only be required to pay for services completed to the satisfaction of the County.

Remainder of this page intentionally left blank

IN WITNESS, WHEREOF, Owner and Contractor have signed this Agreement. One counterpart each has been delivered to Owner, Contractor, Construction Coordinator and provided to the Contractor for his Bonding Agency. All portions of the Contract Documents have been signed or identified by Owner and Contractor or on their behalf.

This Agreement will be effective on this _____ day of _____, 2018 (which is the Effective Date of the Agreement).

OWNER:

CONTRACTOR:

Colleton County

By: _____

J. Kevin Griffin

Title: **County Administrator**

[CORPORATE SEAL]

Attest: _____

Title: _____

Address for giving notices:

Capital Project and Purchasing Department

Attn: John Stieglitz

113 Mable T. Willis Boulevard

Walterboro, South Carolina, 29488

By: _____

Title: _____

[CORPORATE SEAL]

Attest: _____

Title: _____

Address for giving notices:

License No.: _____

(Where applicable)

Agent for service or process:

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REFERENCE FORMS

1- BOND FORMS

Bond Requirements

- 1.01 All Bonds shall be placed with insurers maintaining an A.M. Best rating of no less than an A: VII. If A.M. Best rating is less than A: VII, approval must be received from Colleton County's Risk or Finance Officer before issuance.
- 1.02 Bonding Companies shall submit as proof of good standing, a copy of the A.M Rating along with the Bond.
- 1.03 Bonding/Surety Companies shall use the Bonds provided in the Bid/Proposal Packet CPST-11.
- 1.04 Bonding/Surety Companies shall issue a new Performance Bond and Payment Bond at such time that the contract has been altered by a change order adjusting the compensation of the contract.
- 1.05 Bonding companies shall note the warranty periods as outlined in the Proposal Document CPST-11 and listed on the reverse side of the bond itself. Should the warranty period be extended past the initial contract period due to a warranty claim, then the bond shall will be re-issued to match the new warranty period as outlined in the proposal documents.

Remainder of this page intentionally left blank

PERFORMANCE BOND

Any singular reference to Contractor, Surety, Owner, or other party shall be considered plural where applicable.

CONTRACTOR: _____ SURETY: _____

OWNER: Colleton County
109 Benson Street
Walterboro, SC 29488

CONTRACT: CPST-09

Date: _____

Amount: _____

Description (Name and Location): **Renovation and Expansion of the facility located at 537 Aviation Way, Walterboro South Carolina. Approximately ± 1,618 sf of new construction consisting of a new Conference room and Flight Crew rest area, along with ± 2,270 sf of renovation to the current facility as it stands now.**

BOND

Bond Number: _____

Date (Not earlier than Contract Date): _____

Amount: _____

Modifications to this Bond Form: _____

Surety and Contractor, intending to be legally bound hereby, subject to the terms printed on the reverse side hereof, do each cause this Performance Bond to be duly executed on its behalf by its authorized officer, agent, or representative.

CONTRACTOR AS PRINCIPAL
Company: _____

Signature: _____ (Seal)
Name and Title:

SURETY

(Seal)
Surety's Name and Corporate Seal

By: _____
Signature and Title
(Attach Power of Attorney)

(Space is provided below for signatures of additional parties, if required.)

Attest: _____
Signature and Title

CONTRACTOR AS PRINCIPAL
Company: _____

Signature: _____ (Seal)

Name and Title:

SURETY

(Seal)
Surety's Name and Corporate Seal

By: _____
Signature and Title
(Attach Power of Attorney)

Attest: _____
Signature and Title:

1. Contractor and Surety, jointly and severally, bind themselves, their heirs, executors, administrators, successors, and assigns to Owner for the performance of the Contract, which is incorporated herein by reference.

2. If Contractor performs the Contract, Surety and Contractor have no obligation under this Bond, except to participate in conferences as provided in Paragraph 3.1.

3. If there is no Owner Default, Surety's obligation under this Bond shall arise after:

3.1. Owner has notified Contractor and Surety, at the addresses described in Paragraph 10 below, that Owner is considering declaring a Contractor Default and has requested and attempted to arrange a conference with Contractor and Surety to be held not later than 15 days after receipt of such notice to discuss methods of performing the Contract. If Owner, Contractor and Surety agree, Contractor shall be allowed a reasonable time to perform the Contract, but such an agreement shall not waive Owner's right, if any, subsequently to declare a Contractor Default; and

3.2. Owner has declared a Contractor Default and formally terminated Contractor's right to complete the Contract. Such Contractor Default shall not be declared earlier than 20 days after Contractor and Surety have received notice as provided in Paragraph 3.1; and

3.3. Owner has agreed to pay the Balance of the Contract Price to:

1. Surety in accordance with the terms of the Contract;
2. Another contractor selected pursuant to Paragraph 4.3 to perform the Contract.
4. When Owner has satisfied the conditions of Paragraph 3, Surety shall promptly and at Surety's expense take one of the following actions:

4.1. Arrange for Contractor, with consent of Owner, to perform and complete the Contract; or

4.2. Undertake to perform and complete the Contract itself, through its agents or through independent contractors; or

4.3. Obtain bids or negotiated proposals from qualified contractors acceptable to Owner for a contract for performance and completion of the Contract, arrange for a contract to be prepared for execution by Owner and Contractor selected with Owner's concurrence, to be secured with performance and payment bonds executed by a qualified surety equivalent to the bonds issued on the Contract, and pay to Owner the amount of damages as described in Paragraph 6 in excess of the Balance of the Contract Price incurred by Owner resulting from Contractor Default; or

4.4. Waive its right to perform and complete, arrange for completion, or obtain a new contractor and with reasonable promptness under the circumstances:

1. After investigation, determine the amount for which it may be liable to Owner and, as soon as practicable after the amount is determined, tender payment therefor to Owner; or

2. Deny liability in whole or in part and notify Owner citing reasons therefor.

5. If Surety does not proceed as provided in Paragraph 4 with reasonable promptness, Surety shall be deemed to be in default on this Bond 15 days after receipt of an additional written notice from Owner to Surety demanding that Surety perform its obligations under this Bond, and Owner shall be entitled to enforce any remedy available to Owner. If Surety proceeds as provided in Paragraph 4.4, and Owner refuses the payment tendered or Surety has denied liability, in whole or in part, without further notice Owner shall be entitled to enforce any remedy available to Owner.

6. After Owner has terminated Contractor's right to complete the Contract, and if Surety elects to act under Paragraph 4.1, 4.2, or 4.3 above, then the responsibilities of Surety to Owner shall not be greater than those of Contractor under the Contract, and the responsibilities of Owner to Surety shall not be greater than those of Owner under the Contract. To a limit of the amount of this Bond, but subject to commitment by Owner of the Balance of the Contract Price to mitigation of costs and damages on the Contract, Surety is obligated without duplication for:

6.1. The responsibilities of Contractor for correction of defective Work and completion of the Contract;

6.2. Additional legal, design professional, and delay costs resulting from Contractor's Default, and resulting from the actions or failure to act of Surety under Paragraph 4; and

6.3. Liquidated damages, or if no liquidated damages are specified in the Contract, actual damages caused by delayed performance or non-performance of Contractor.

7. Surety shall not be liable to Owner or others for obligations of Contractor that are unrelated to the Contract, and the Balance of the Contract Price shall not be reduced or set off on account of any such unrelated obligations. No right of action shall accrue on this Bond to any person or entity other than Owner or its heirs, executors, administrators, or successors.

8. Surety hereby waives notice of any change, including changes of time, to Contract, Contract amount or to related subcontracts, purchase orders, and other obligations.

9. Any proceeding, legal or equitable, under this Bond may be instituted in any court of competent jurisdiction in the location in which the Work or part of the Work is located and shall be instituted within two years after Contractor Default or within two years after Contractor ceased working or within two years after Surety refuses or fails to perform its obligations under this Bond, whichever occurs first. If the provisions of this paragraph are void or prohibited by law, the minimum period of limitation available to sureties as a defense in the jurisdiction of the suit shall be applicable.

10. Notice to Surety, Owner, or Contractor shall be mailed or delivered to the address shown on the signature page.

11. When this Bond has been furnished to comply with a statutory requirement in the location where the Contract was to be performed, any provision in this Bond conflicting with said statutory requirement shall be deemed deleted here from and provisions conforming to such statutory requirement shall be deemed incorporated herein. The intent is that this Bond shall be construed as a statutory bond and not as a common law bond.

12. The Surety will be obligated until such time as the Contractor has faithfully performed all terms of the Contract, which includes a two (2) year warranty coverage period.

12.1 The standard two-year warranty period starts on the date of issuance of the Substantial Completion Certification.

12.2 The standard warranty covers the full cost of Labor, Parts, Shipping, Sales Tax and any and all other associated cost for the warranty repair.

12.3 The surety agrees that should a warranty issue arise within the allotted standard two (2) year warranty period, the item repaired during the warranty period shall be covered for an addition year (365 days) from the completed repair of the warranty issue.

13. Definitions

13.1 Balance of the Contract Price: The total amount payable by Owner to Contractor under the Contract after all proper adjustments have been made, including allowance to Contractor of any amounts received or to be received by Owner in settlement of insurance or other Claims for damages to which Contractor is entitled, reduced by all valid and proper payments made to or on behalf of Contractor under the Contract.

13.2 Contract: The agreement between Owner and Contractor identified on the signature page, including all Contract Documents and changes thereto.

13.3 Contractor Default: Failure of Contractor, which has neither been remedied nor waived, to perform or otherwise to comply with the terms of the Contract.

13.4 Owner Default: Failure of Owner, which has neither been remedied nor waived, to pay Contractor as required by the Contract or to perform and complete or comply with the other terms thereof.

PAYMENT BOND

Any singular reference to Contractor, Surety, Owner, or other party shall be considered plural where applicable.

CONTRACTOR:

SURETY:

OWNER: Colleton County
109 Benson Street
Walterboro, SC 29488

CONTRACT

Date: _____

Amount: _____

Description (Name and Location): **Renovation and Expansion of the facility located at 537 Aviation Way, Walterboro South Carolina. Approximately ± 1,618 sf of new construction consisting of a new Conference room and Flight Crew rest area, along with ± 2,270 sf of renovation to the current facility as it stands now.**

BOND

Bond Number: _____

Date (Not earlier than Contract Date): _____

Amount: _____

Modifications to this Bond Form: _____

Surety and Contractor, intending to be legally bound hereby, subject to the terms printed on the reverse side hereof, do each cause this Payment Bond to be duly executed on its behalf by its authorized officer, agent, or representative.

CONTRACTOR AS PRINCIPAL

SURETY

Company: _____

Signature: _____ (Seal)

Name and Title: _____

(Seal)

Surety's Name and Corporate Seal

By: _____

Signature and Title
(Attach Power of Attorney)

(Space is provided below for signatures of additional parties, if required.)

Attest: _____

Signature and Title

CONTRACTOR AS PRINCIPAL

SURETY

Company: _____

Signature: _____ (Seal)

Name and Title: _____

(Seal)

Surety's Name and Corporate Seal

By: _____

Signature and Title
(Attach Power of Attorney)

Attest: _____

1. Contractor and Surety, jointly and severally, bind themselves, their heirs, executors, administrators, successors, and assigns to Owner to pay for labor, materials, and equipment furnished by Claimants for use in the performance of the Contract, which is incorporated herein by reference.
2. With respect to Owner, this obligation shall be null and void if Contractor:
 - 2.1. Promptly makes payment, directly or indirectly, for all sums due Claimants, and
 - 2.2. Defends, indemnifies, and holds harmless Owner from all claims, demands, liens, or suits alleging non-payment by Contractor by any person or entity who furnished labor, materials, or equipment for use in the performance of the Contract, provided Owner has promptly notified Contractor and Surety (at the addresses described in Paragraph 12) of any claims, demands, liens, or suits and tendered defense of such claims, demands, liens, or suits to Contractor and Surety, and provided there is no Owner Default.
3. With respect to Claimants, this obligation shall be null and void if Contractor promptly makes payment, directly or indirectly, for all sums due.
4. Surety shall have no obligation to Claimants under this Bond until:
 - 4.1. Claimants who are employed by or have a direct contract with Contractor have given notice to Surety (at the addresses described in Paragraph 12) and sent a copy, or notice thereof, to Owner, stating that a claim is being made under this Bond and, with substantial accuracy, the amount of the claim.
 - 4.2. Claimants who do not have a direct contract with Contractor:
 1. Have furnished written notice to Contractor and sent a copy, or notice thereof, to Owner, within 90 days after having last performed labor or last furnished materials or equipment included in the claim stating, with substantial accuracy, the amount of the claim and the name of the party to whom the materials or equipment were furnished or supplied, or for whom the labor was done or performed; and
 2. Have either received a rejection in whole or in part from Contractor, or not received within 30 days of furnishing the above notice any communication from Contractor by which Contractor had indicated the claim will be paid directly or indirectly; and
 3. Not having been paid within the above 30 days, have sent a written notice to Surety and sent a copy, or notice thereof, to Owner, stating that a claim is being made under this Bond and enclosing a copy of the previous written notice furnished to Contractor.
5. If a notice by a Claimant required by Paragraph 4 is provided by Owner to Contractor or to Surety, that is sufficient compliance.
6. When a Claimant has satisfied the conditions of Paragraph 4, the Surety shall promptly and at Surety's expense take the following actions:
 - 6.1. Send an answer to that Claimant, with a copy to Owner, within 45 days after receipt of the claim, stating the amounts that are undisputed and the basis for challenging any amounts that are disputed.
 - 6.2. Pay or arrange for payment of any undisputed amounts.
7. Surety's total obligation shall not exceed the amount of this Bond, and the amount of this Bond shall be credited for any payments made in good faith by Surety.
8. Amounts owed by Owner to Contractor under the Contract shall be used for the performance of the Contract and to satisfy claims, if any, under any performance bond. By Contractor furnishing and Owner accepting this Bond, they agree that all funds earned by Contractor in the performance of the Contract are dedicated to satisfy obligations of Contractor and Surety under this Bond, subject to Owner's priority to use the funds for the completion of the Work.
9. Surety shall not be liable to Owner, Claimants, or others for obligations of Contractor that are unrelated to the Contract. Owner shall not be liable for payment of any costs or expenses of any Claimant under this Bond, and shall have under this Bond no obligations to make payments to, give notices on behalf of, or otherwise have obligations to Claimants under this Bond.
10. Surety hereby waives notice of any change, including changes of time, to the Contract or to related Subcontracts, purchase orders and other obligations.
11. No suit or action shall be commenced by a Claimant under this Bond other than in a court of competent jurisdiction in the location in which the Work or part of the Work is located or after the expiration of one year from the date (1) on which the Claimant gave the notice required by Paragraph 4.1 or Paragraph 4.2.3, or (2) on which the last labor or service was performed by anyone or the last materials or equipment were furnished by anyone under the Construction Contract, whichever of (1) or (2) first occurs. If the provisions of this paragraph are void or prohibited by law, the minimum period of limitation available to sureties as a defense in the jurisdiction of the suit shall be applicable.
12. Notice to Surety, Owner, or Contractor shall be mailed or delivered to the addresses shown on the signature page. Actual receipt of notice by Surety, Owner, or Contractor, however accomplished, shall be sufficient compliance as of the date received at the address shown on the signature page.
13. When this Bond has been furnished to comply with a statutory requirement in the location where the Contract was to be performed, any provision in this Bond conflicting with said statutory requirement shall be deemed deleted here from and provisions conforming to such statutory requirement shall be deemed incorporated herein. The intent is that this Bond shall be construed as a statutory Bond and not as a common law bond.
14. Upon request of any person or entity appearing to be a potential beneficiary of this Bond, Contractor shall promptly furnish a copy of this Bond or shall permit a copy to be made.
15. The Surety will be obligated until such time as the Contractor has faithfully performed all terms of the Contract, which includes a two (2) year warranty coverage period.
 - 15.1 The standard two-year warranty period starts on the date of issuance of the Substantial Completion Certification.
 - 15.2 The standard warranty covers the full cost of Labor, Parts, Shipping, Sales Tax and any and all other associated cost for the warranty repair.
 - 15.3 The surety agrees that should a warranty issue arise within the allotted standard two (2) year warranty period, the item repaired during the warranty period shall be covered for an addition year (365 days) from the completed repair of the warranty issue.
16. DEFINITIONS
 - 16.1. Claimant: An individual or entity having a direct contract with Contractor, or with a first-tier subcontractor of Contractor, to furnish labor, materials, or equipment for use in the performance of the Contract. The intent of this Bond shall be to include without limitation in the terms "labor, materials or equipment" that part of water, gas, power, light, heat, oil, gasoline, telephone service, or rental equipment used in the Contract, architectural and engineering services required for performance of the Work of Contractor and Contractor's Subcontractors, and all other items for which a mechanic's lien may be asserted in the jurisdiction where the labor, materials, or equipment were furnished.
 - 16.2. Contract: The agreement between Owner and Contractor identified on the signature page, including all Contract Documents and changes thereto.
 - 16.3. Owner Default: Failure of Owner, which has neither been remedied nor waived, to pay Contractor as required by the Contract or to perform and complete or comply with the other terms thereof.

Substantial Completion

Project: <u>Renovation and Expansion of the facility located at 537 Aviation Way, Walterboro SC. Approximately ± 1,618 sf of new construction consisting of a new Conference room and Flight Crew rest area, along with ± 2,270 sf of renovation to the current facility as it stands now.</u>	Owner: Colleton County, 113 Mable T. Willis Blvd., Walterboro, South Carolina	Architects Project No.: 13674.00 Owner Project Number: CPST-11
Contract: <u>CPST-11 Renovation and Expansion of the Lowcountry Regional Airport Terminal located at 537 Aviation Way, Walterboro SC</u>		Date of Contract:
Contractor:		

This [tentative] [definitive] Certificate of Substantial Completion applies to:

- All Work under the Contract Documents:
 The following specified portions:

Date of Substantial Completion

The Work to which this Certificate applies has been inspected by authorized representatives of Owner, Contractor and Engineer and or Architect, and found to be substantially complete. The Date of Substantial Completion of the Project or portion thereof designated above is hereby declared and is also the date of commencement of applicable warranties required by the Contract Documents, except as stated below.

A [tentative] [revised tentative] [definitive] list of items to be completed or corrected, is attached hereto. This list may not be all-inclusive, and the failure to include any items on such list does not alter the responsibility of the Contractor to complete all Work in accordance with the Contract Documents.

The responsibilities between OWNER and CONTRACTOR for security, operation, safety, maintenance, heat, utilities, insurance and warranties shall be as provided in the Contract Documents except as amended as follows:

- Amended Responsibilities
 Not Amended

Owner's Amended Responsibilities:

Contractor's Amended Responsibilities:

The following documents are attached to and made part of this Certificate:

This Certificate does not constitute an acceptance of Work not in accordance with the Contract Documents nor is it a release of Contractor's obligation to complete the Work in accordance with the Contract Documents.

Executed by Construction Coordinator: Watson Tate Savory, John McLean

Date

Accepted by Contractor:

Date

Accepted by Owner: John T. Stieglitz III, Capital Project & Purchasing

Date

CONTRACTOR'S AFFIDAVIT

The State of _____ Date _____

The County of _____

The City/Town of _____

(Officer's Name) (Officer's Title)

being duly sworn, deposes and says that _____
(Contractor's Name)

has furnished all labor and material entering into the: **Renovation and Expansion of the Lowcountry Regional Airport Terminal located at 537 Aviation Way, Walterboro South Carolina**

called for in the Contract Documents dated _____ with **Colleton County** states

further that this officer has full knowledge of all obligations for such labor and materials, which have entered into and become part of that certain project known and designated above, and that this officer further deposes and says that all debts and other obligations for such labor and materials have been fully and completely paid for in good and lawful money of the United States of America and that there are no suits for damages against them proceeding, prospective and/or that there are no suits for damages against them proceeding, prospective, or otherwise, in consequence of their operations on the above said project.

The said _____ will hold the Owners,
(Contractor's Name)

Colleton County, South Carolina blameless of any and all mechanic's liens that may be hereafter entered or filed for record, so as to constitute charge against said premises for work or labor done or materials furnished by them.

IN WITNESS HEREOF, this officer has heretofore put his hand and seal: _____ (Seal)
(Officer's Name)

I, _____, Notary Public in and for the above-named County and State do

hereby certify that _____ personally known to me to be the affiant in the
(Officer's Name)

foregoing Affidavit, personally appeared before me this day and, having been duly sworn, deposes and says that the facts set forth in the above Affidavit are true and correct.

WITNESS my hand and seal this _____ day of _____, 2018

_____ (Seal)

Notary Public for the State of _____

My Commission Expires: _____

FIELD ORDER

No. _____

Date of Issuance: _____ Effective Date: _____

<p>Project: <u>Renovation and Expansion of the facility located at 537 Aviation Way, Walterboro SC. Approximately ± 1,618 sf of new construction consisting of a new Conference room and Flight Crew rest area, along with ± 2,270 sf of renovation to the current facility as it stands now.</u></p>	<p>Owner: Colleton County, 113 Mable T. Willis Blvd., Walterboro, South Carolina</p>	<p>Architects Project No.: 13674.00 Owner Project Number: CPST-11</p>
<p>Contract: <u>CPST-11 Renovation and Expansion of the Lowcountry Regional Airport Terminal located at 537 Aviation Way, Walterboro South Carolina</u></p>		<p>Date of Contract:</p>
<p>Contractor:</p>		

Attention:

You are hereby directed to promptly execute this Field Order issued in accordance with General Conditions Paragraph 9.05A., for minor changes in the Work without changes in Contract Price or Contract Times. If you consider that a change in Contract Price or Contract Times is required, please notify the Construction Coordinator immediately and before proceeding with this Work.

Reference: _____ (Specification Section(s)) _____ (Drawing(s) / Detail(s))

Description:

Attachments:

Construction Coordinator: Watson Tate Savory, John McLean

<p>Receipt Acknowledged by (Contractor):</p>	<p>Date:</p>
----------------------------------------------	--------------

WORK CHANGE DIRECTIVE

No. _____

Date of Issuance: _____ Effective Date: _____

<p>Project: <u>Renovation and Expansion of the facility located at 537 Aviation Way, Walterboro, SC. Approximately ± 1,618 sf of new construction consisting of a new Conference room and Flight Crew rest area, along with ± 2,270 sf of renovation to the current facility as it stands now.</u></p>	<p>Owner: Colleton County, 113 Mable T. Willis Blvd., Walterboro, South Carolina</p>	<p>Architects Project No.: 13674.00 Owner Project Number: CPST-11</p>
<p>Contract: <u>CPST-11 Renovation and Expansion of the Lowcountry Regional Airport Terminal located at 537 Aviation Way, Walterboro South Carolina</u></p>		<p>Date of Contract:</p>
<p>Contractor:</p>		

You are directed to proceed promptly with the following change(s):

Item No.	Description

Attachments (list documents supporting change):

Purpose for Work Change Directive:

- Authorization for Work described herein to proceed on the basis of Cost of the Work due to:
 - Non-agreement on pricing of proposed change.
 - Necessity to expedite Work described herein prior to agreeing to changes on Contract Price and Contract Time.

Estimated change in Contract Price and Contract Times:

Contract Price \$ _____ (increase/decrease) Contract Time _____ days (increase/decrease)

If the change involves an increase, the estimated amounts are not to be exceeded without further authorization.

<p>Recommended for Approval by Construction Coordinator: Watson Tate Savory, John McLean</p>	<p>Date</p>
<p>Authorized for Owner by:</p>	<p>Date</p>
<p>Accepted for Contractor by:</p>	<p>Date</p>
<p>Approved by Funding Agency (if applicable):</p>	<p>Date:</p>

CHANGE ORDER No. _____

Date of Issuance: _____ Effective Date: _____

<p>Project Renovation and Expansion of the facility located at 537 Aviation Way, Walterboro SC. Approximately ± 1,618 sf of new construction consisting of a new Conference room and Flight Crew rest area, along with ± 2,270 sf of renovation to the current facility as it stands now.</p>	<p>Owner: Colleton County, 113 Mable T. Willis Blvd., Walterboro, South Carolina</p>	<p>Architects Project No.: 13674.00 Owner Project Number: CPST-11</p>
<p>Contract: CPST-11 Renovation and Expansion of the Lowcountry Regional Airport Terminal located at 537 Aviation Way, Walterboro South Carolina</p>		<p>Date of Contract: _____</p>
<p>Contractor: _____</p>		

The Contract Documents are modified as follows upon execution of this Change Order:

Description: _____

Attachments: (List documents supporting change): _____

CHANGE IN CONTRACT PRICE:	CHANGE IN CONTRACT TIMES:
<p>Original Contract Price: \$ _____</p>	<p>Original Contract Times: <input type="checkbox"/> Working days <input type="checkbox"/> Calendar days Substantial completion (days or date): _____ Ready for final payment (days or date): _____</p>
<p>[Increase] [Decrease] from previously approved Change Orders No. _____ to No. _____: \$ _____</p>	<p>[Increase] [Decrease] from previously approved Change Orders No. _____ to No. _____: Substantial completion (days): _____ Ready for final payment (days): _____</p>
<p>Contract Price prior to this Change Order: \$ _____</p>	<p>Contract Times prior to this Change Order: Substantial completion (days or date): _____ Ready for final payment (days or date): _____</p>
<p>[Increase] [Decrease] of this Change Order: \$ _____</p>	<p>[Increase] [Decrease] of this Change Order: Substantial completion (days or date): _____ Ready for final payment (days or date): _____</p>
<p>Contract Price incorporating this Change Order: \$ _____</p>	<p>Contract Times with all approved Change Orders: Substantial completion (days or date): _____ Ready for final payment (days or date): _____</p>

<p>RECOMMENDED: By: _____ Contractor (Authorized Signature)</p>	<p>APPROVED: By: _____ Colleton County Administrator, J. Kevin Griffin</p>	<p>APPROVED: By: _____ Construction Coordinator: Watson Tate Savory, John McLean</p>
<p>Date: _____</p>	<p>Date: _____</p>	<p>Date: _____</p>
<p>Approved by Funding Agency (if applicable): _____</p>	<p>_____</p>	<p>Date: _____</p>

MATERIAL/PRODUCT SUBSTITUTION REQUEST

Date: _____

We hereby submit for your review, the following PRODUCT SUBSTITUTION of the specified material for the above listed project.

Section: _____

Paragraph: _____

Specified Material: _____

Attached is complete technical data of the PRODUCT SUBSTITUTION. Included is complete information on changes to the Project Manual Documents required by the proposed PRODUCT SUBSTITUTION for its proper installation.

A request constitutes a representation that Trade Contractor:

- Has investigated proposed product and determined that it meets or exceeds quality level of specified product.
- Will provide same warranty for Substitution as for specified product.
- Will coordinate installation and make changes to other work which may be required for the work to be complete with no additional cost to Owner.
- Waives claims for additional costs or time extension which may subsequently become apparent.
- Will reimburse Owner and Architect/Engineer for review or redesign services associated with re-approval by authorities having jurisdiction or additional time expended by Architect/Engineer to review information.

It is understood that if the Architect or Engineer approves an approved substitution prior to receipt of bids in accordance with the project timeline, such approval will be set forth in an addendum. Bidders shall not rely upon approvals made in any other manner. If substitution requests are not addressed in the addendum, the substitution request shall be considered not approved. Architect's or Engineers decision of approval or disapproval of proposed substitution shall be final without dispute.

THE UNDERSIGNED Trade Contractor states that the function, appearance, and quality of the PRODUCT SUBSTITUTION are equivalent or superior to the specified item. In addition, I, as the Trade Contractor will assume all responsibility for any impact or delay the review and evaluation of the alternate product may cause. Your approval of the Substitute Product in no way will relieve me as the Trade Contractor of my responsibilities to conform with all requirements of the Contract Documents.

Submitted by: _____

NOTICE OF AWARD

Dated _____

<p>Project: <u>Renovation and Expansion of the facility located at 537 Aviation Way, Walterboro SC. Approximately ± 1,618 sf of new construction consisting of a new Conference room and Flight Crew rest area, along with ± 2,270 sf of renovation to the current facility as it stands now.</u></p>	<p>Owner: Colleton County, 113 Mable T. Willis Blvd., Walterboro, South Carolina</p>	<p>Architects Project No.: 13674.00 Owner Project Number: CPST-11</p>
<p>Contract: <u>CPST-11 Renovation and Expansion of the Lowcountry Regional Airport Terminal located at 537 Aviation Way, Walterboro South Carolina</u></p>		
<p>Bidder:</p>		
<p>Bidder's Address: (send Certified Mail, Return Receipt Requested):</p>		

You are notified that your Bid dated _____ for the above Contract has been considered. You are the Successful Bidder and are awarded a Contract for the Renovation and Expansion of the Colleton – Walterboro Lowcountry Regional Airport Terminal located at 537 Aviation Way, Walterboro South Carolina

The Contract Price of your Contract is _____ (\$_____).

- ___ copies of each of the Contract Documents (except Drawings) accompany this Notice of Award.
- ___ sets of the Drawings will be delivered separately or otherwise made available to you immediately.

You must comply with the following conditions precedent within ten (0) days of the date you receive this Notice of Award.

1. Deliver to the Owner four (4) fully executed counterparts of the Contract Documents.
2. Deliver with the executed Contract Documents the Contract security [Bonds] as specified.
3. Other conditions precedent:
None

Failure to comply with these conditions within the time specified will entitle Owner to consider you in default, annul this Notice of Award and declare your Bid security forfeited.

Within seven (7) days after you comply with the above conditions, Owner will return to you one (1) fully executed counterpart of the Contract Documents.

Colleton County
Owner

By: _____
Authorized Signature

Title

Acceptance of Notice

Receipt of the above Notice of Award is hereby acknowledged by _____

On this _____ day of _____, 2018.

Contractor

By: _____
Authorized Signature

Title

NOTICE TO PROCEED

Dated _____

<p>Project: <u>Renovation and Expansion of the facility located at 537 Aviation Way, Walterboro SC. Approximately ± 1,618 sf of new construction consisting of a new Conference room and Flight Crew rest area, along with ± 2,270 sf of renovation to the current facility as it stands now.</u></p>	<p>Owner: Colleton County, 113 Mable T. Willis Blvd., Walterboro, South Carolina</p>	<p>Architects Project No.: 13674.00 Owner Project Number: CPST-11</p>
<p>Contract: <u>CPST-11 Renovation and Expansion of the Lowcountry Regional Airport Terminal located at 537 Aviation Way, Walterboro South Carolina</u></p>		

Contractor:

Contractor's Address: [send Certified Mail, Return Receipt Requested]

You are notified that the Contract Times under the above contract will commence to run on _____ or before that date, you are to start performing your obligations under the Contract Documents. In accordance with Article 4 of the Agreement, the date of Substantial Completion is _____ and the date of readiness for final payment is _____.

Before you may start any Work at the Site, Paragraph 2.01.B of the General Conditions provides that you and Owner must each deliver to the other (with copies to the Construction Coordinator and other identified additional insureds) certificates of insurance which each is required to purchase and maintain in accordance with the Contract Documents.

<p>_____</p> <p>Contractor</p>	<p>_____</p> <p>Colleton County Owner</p>
<p>by: _____</p> <p>Authorized Signature</p>	<p>Given by: _____</p> <p>John T. Stieglitz</p>
<p>_____</p> <p>Title</p>	<p>_____</p> <p>Capital Projects & Purchasing Director Title</p>
<p>_____</p> <p>Date</p>	<p>_____</p> <p>Date</p>

Progress Estimate

Contractor's Application

For (contract): CPST-11 Renovation and Expansion of the Lowcountry Regional Airport Terminal located at 537 Aviation Way, Walterboro, SC	Application Number:
-------------------------------------------------------------------------------------------------------------------------------------------------	---------------------

Application Period:	Application Date:
---------------------	-------------------

A		B	Work Completed		E	F		G
Item		Scheduled Value	C	D	Materials Presently Stored (not in C or D)	Total Completed and Stored to Date (C + D + E)	% (F) B	Balance to Finish (B - F)
Specification Section No.	Description		From Previous Application (C + D)	This Period				
	Totals							

Progress Estimate

Contractor's Application

For (contract): <u>CPST-11 Renovation and Expansion of the Lowcountry Regional Airport Terminal located at 537 Aviation Way, Walterboro, SC</u>							Application Number:				
Application Period:							Application Date:				
A				B	C	D	E	F		G	H
Bid Item No.	Description	Bid Quantity	Unit Price	Bid Value	Estimated Quantity Installed	Value	Materials Presently Stored (not in C)	Total Completed and Stored to Date (D + E)	% (F) B	Balance to Finish (B - F)	Retainage
Totals											

Stored Material Summary

Contractor's Application

For (contract): <u>CPST-11 Renovation and Expansion of the Lowcountry Regional Airport Terminal located at 537 Aviation Way, Walterboro, SC</u>							Application Number:			
Application Period:					Application Date:					
A	B	C		D		E		F		G
Invoice No.	Shop Drawing Transmittal No.	Materials Description	Stored Previously		Stored this Month		Incorporated in Work		Materials Remaining in Storage (\$) (D + E - F)	
			Date (Month/Year)	Amount (\$)	Amount (\$)	Subtotal	Date (Month/Year)	Amount (\$)		
		Totals								

CONTRACTOR/SUBCONTRACTOR QUALIFICATIONS

PART 1 - GENERAL

1.01 The following information and completed forms may be requested by the Owner of the three (3) lowest bidders. The request will be made the day of the Bid Opening or within five (5) days following the Bid Opening. If requested, this data must be submitted to the Construction Coordinator or Owner within five (5) days of the request. Failure to provide the data in this section, upon request, will subject bidder to disqualification.

1.02 DESCRIPTION

- A. Information provided will be used by the Construction Coordinator or Owner to determine the competency and ability of the Contractor and/or Subcontractor to perform the scheduled work in a manner that is satisfactory to the Construction Coordinator or Owner. The Construction Coordinator or Owner's decision shall be final.
- B. Any Subcontractor being used by the General Contractor, whose portion of the project exceeds 5% of the total bid price amount, will be required to provide the same information as the General Contractor.
- C. The Contractor and Subcontractor shall include with this section a detailed financial statement indicating the Contractor's or Subcontractor's financial resources. The information on that statement shall be certified by a Certified Public Accountant and shall be submitted on the Associated General Contractors of America form "Standard Questionnaires and Financial Statement for Bidders".
- D. The Contractor and Subcontractor shall certify by attaching his signature to this Section as provided that all information contained herein is complete and all statements and answers are accurate and true. Providing misinformation, incomplete information, inaccurate information, or failure to certify the information, will subject bidder to disqualification.

1.03 QUALIFICATIONS

A. Complete the following for General Contractor and any Subcontractors (attach additional sheets as required):

- 1. Name: _____
- 2. Address: _____
- 3. City, State, Zip: _____
- 4. Principle: _____

B. Number of years the company has been in business: _____

C. List and describe at least five (5) projects that have been completed, that are similar in size and type, and that has been completed within the last ten (10) years:

- 1. _____

- 2. _____

- 3. _____

4. _____

5. _____

D. For the projects listed above provide the following:

1. Project Owner: _____
Contact Name and Title: _____
Telephone Number: _____

2. Project Owner: _____
Contact Name and Title: _____
Telephone Number: _____

3. Project Owner: _____
Contact Name and Title: _____
Telephone Number: _____

4. Project Owner: _____
Contact Name and Title: _____
Telephone Number: _____

5. Project Owner: _____
Contact Name and Title: _____
Telephone Number: _____

E. For each of the projects listed in Items C & D provide the following:

1. Original Bid Amount: _____
Final Construction Cost: _____
Contract Period: _____
Actual Contract Period: _____
Explanation: _____

2. Original Bid Amount: _____
Final Construction Cost: _____
Contract Period: _____
Actual Contract Period: _____
Explanation: _____

3. Original Bid Amount: _____
 Final Construction Cost: _____
 Contract Period: _____
 Actual Contract Period: _____
 Explanation: _____
4. Original Bid Amount: _____
 Final Construction Cost: _____
 Contract Period: _____
 Actual Contract Period: _____
 Explanation: _____
5. Original Bid Amount: _____
 Final Construction Cost: _____
 Contract Period: _____
 Actual Contract Period: _____
 Explanation: _____

F. Provide the following for any portion of the work that is being subcontracted (5% or more of the Bid Amount):

1. Name of Subcontractor: _____
 Address City/State/Zip: _____
 Telephone Number: _____
 Work being Completed: _____
2. Name of Subcontractor: _____
 Address City/State/Zip: _____
 Telephone Number: _____
 Work being Completed: _____
3. Name of Subcontractor: _____
 Address City/State/Zip: _____
 Telephone Number: _____
 Work being Completed: _____
4. Name of Subcontractor: _____
 Address City/State/Zip: _____
 Telephone Number: _____
 Work being Completed: _____
5. Name of Subcontractor: _____
 Address City/State/Zip: _____
 Telephone Number: _____
 Work being Completed: _____

G. Provide a list of equipment that is owned by the Contractor and is available for this project.

H. Provide a list of equipment that will be purchased, leased or rented for this project.

I. Provide a list of the superintendent(s) or others that will be in charge of this project (Provide resumes and qualifications):

J. Provide the following for current projects being completed:

1. Project Name: _____
Owner: _____
Current Status: _____
Estimated Schedule of Completion: _____

2. Project Name: _____
Owner: _____
Current Status: _____
Estimated Schedule of Completion: _____

3. Project Name: _____
Owner: _____
Current Status: _____
Estimated Schedule of Completion: _____

4. Project Name: _____
Owner: _____
Current Status: _____
Estimated Schedule of Completion: _____

5. Project Name: _____
Owner: _____
Current Status: _____
Estimated Schedule of Completion: _____

K. Provide a list of projects that has been completed with the Owner over the past fifteen (15) years:

1. Project Name: _____
Contact Name and Title: _____
Telephone Number: _____

2. Project Name: _____
Contact Name and Title: _____
Telephone Number: _____

3. Project Name: _____
Contact Name and Title: _____
Telephone Number: _____

4. Project Name: _____
Contact Name and Title: _____
Telephone Number: _____

5. Project Name: _____
Contact Name and Title: _____
Telephone Number: _____

L. Provide a list of projects that Bid with the Owner over the past fifteen (15) years:

1. Project Name: _____
Contact Name and Title: _____
Telephone Number: _____

2. Project Name: _____
Contact Name and Title: _____
Telephone Number: _____

3. Project Name: _____
Contact Name and Title: _____
Telephone Number: _____

4. Project Name: _____
Contact Name and Title: _____
Telephone Number: _____

- 5. Project Name: _____
Contact Name and Title: _____
Telephone Number: _____

M. Provide a list of projects completed with the Construction Coordinator over the past fifteen (15) years:

- 1. Project Name: _____
Project Engineer: _____
Original Bid Amount: _____
Final Construction Cost: _____
Contract Period: _____
Actual Contract Period: _____
Explanation: _____
- 2. Project Name: _____
Project Engineer: _____
Original Bid Amount: _____
Final Construction Cost: _____
Contract Period: _____
Actual Contract Period: _____
Explanation: _____
- 3. Project Name: _____
Project Engineer: _____
Original Bid Amount: _____
Final Construction Cost: _____
Contract Period: _____
Actual Contract Period: _____
Explanation: _____
- 4. Project Name: _____
Project Engineer: _____
Original Bid Amount: _____
Final Construction Cost: _____
Contract Period: _____
Actual Contract Period: _____
Explanation: _____

5. Project Name: _____
 Project Engineer: _____
 Original Bid Amount: _____
 Final Construction Cost: _____
 Contract Period: _____
 Actual Contract Period: _____
 Explanation: _____

N. Provide a list of projects involved with litigation, arbitration and/or mediation over the past twenty (20) years:

1. Project Name: _____
 Project Owner: _____
 Project Engineer: _____
 Date: _____
 Explanation: _____
2. Project Name: _____
 Project Owner: _____
 Project Engineer: _____
 Date: _____
 Explanation: _____
3. Project Name: _____
 Project Owner: _____
 Project Engineer: _____
 Date: _____
 Explanation: _____
4. Project Name: _____
 Project Owner: _____
 Project Engineer: _____
 Date: _____
 Explanation: _____
5. Project Name: _____
 Project Owner: _____
 Project Engineer: _____
 Date: _____
 Explanation: _____

O. Attach a rate schedule associated with equipment that includes labor, overhead and profit.

_____ Rate Schedule Attached.

P. Additional information if necessary.

**I HEREBY CERTIFY that as a duly authorized representative of _____
_____(bidder), the information provided is to the
best of my knowledge accurate and that failure to provide accurate information will result in
disqualification of my bid.**

Signature

Name (Please Print)

Title

Date

Notary Public for South Carolina

My Commission Expires: _____

Unit Prices – Lowcountry Regional Airport Renovation and Expansion located at 537 Aviation Way, Walterboro SC

<i>Item</i>	<i>Description</i>	<i>Unit</i>	<i>Quantity</i>	<i>Unit Price</i>	<i>Bid Price</i>
General					
	Mobilization	LS		\$	\$
	Bonds	%		\$	\$
	Insurance	LS		\$	\$
	Permitting	LS		\$	\$
	Utilities	LS		\$	\$
	Rental Equipment	LS		\$	\$
	Site Superintendent/Supervision	HR		\$	\$
	Overhead and Profit	%		\$	\$
	Temporary Facility Rental and Set Up	LS		\$	\$
	Temporary Power	LS		\$	\$
	Temporary Radio Communications in Temp Facilities	LS		\$	\$
	Special Testing	LS		\$	\$
	Warranties	LS		\$	\$
Demolition-General Cost					
	Temporary partitions	SF		\$	\$
	Barricades / signs	LS		\$	\$
	Haul and dump	CY		\$	\$
	Dump charges	CY		\$	\$
	Asbestos abatement	SF		\$	\$
Concrete Prices Include Finishing					
	Footings	SF		\$	\$
	Slab on Grade	SF		\$	\$
	Porches	SF		\$	\$
	Lines and Batters	LF		\$	\$
	Infill/Patch Existing concrete slab	SF		\$	\$
	Wire Fabric	SF		\$	\$
	Rebar	LF		\$	\$
	Hourly Rate	HR	1	\$	XXXXXXXXXXXXXXXXXXXX
Masonry Price Includes Finishing					
	C.M.U.	SF		\$	\$
	Hourly Rate	HR	1	\$	XXXXXXXXXXXXXXXXXXXX
Arch					
	Demo Metal Canopy	LS		\$	\$
	Roof Sheathing	SF		\$	\$
	Asphalt Shingles and Underlayment	SF		\$	\$
	Standing Seam Metal Roof and Underlayment	SF		\$	\$
	Gutters	LF		\$	\$
	Downspouts	LF		\$	\$

Wooden Base Board	LF		\$	\$
Wooden Chair Rail	LF		\$	\$
Dry Wall Ceiling to Trusses	SF		\$	\$
4" Exterior Wood Stud Wall	SF		\$	\$
CF Siding	SF		\$	\$
Exterior Fascia	LF		\$	\$
Exterior Soffit	LF		\$	\$
4" Interior Wood Stud Walls	SF		\$	\$
4x4 ACT Ceiling	SF		\$	\$
Solid Surface countertop	SF		\$	\$
Reception Desk Casework	LF		\$	\$
Vanity	LF		\$	\$
Cabinet Hardware	EA		\$	\$
Hourly Rate	HR	1	\$	XXXXXXXXXXXXXXXXXXXX
Doors and Windows				
Aluminum Clad Exterior Entry Doors, Complete	EA		\$	\$
Wood Interior Doors, Complete	EA		\$	\$
Aluminum Clad Windows, Complete	EA		\$	\$
Door Hardware Includes installation				
Hardware Set 1	EA		\$	\$
Hardware Set 2	EA		\$	\$
Hardware Set 3	EA		\$	\$
Hardware Set 4	EA		\$	\$
Hardware Set 5	EA		\$	\$
Hardware Set 6	EA		\$	\$
Hardware Set 7	EA		\$	\$
Hardware Set 8	EA		\$	\$
Hardware Set 9	EA		\$	\$
Hardware Set 10	EA		\$	\$
Hardware Set 11	EA		\$	\$
Hardware Set 12	EA		\$	\$
Hardware Set 13	EA		\$	\$
Hardware Set 14	EA		\$	\$
Hardware Set 15	EA		\$	\$
Hardware Set 16	EA		\$	\$
Hourly Rate	HR	1		XXXXXXXXXXXXXXXXXXXX
Finishes				
Paint Flat surface	SF		\$	\$
Stain Flat Surface	SF		\$	\$
Paint Doors	SF		\$	\$
Stain Doors	SF		\$	\$
Floors- Resilient	SF		\$	\$
Rubber Base	LF		\$	\$

Porcelain Tile Floor	SF		\$	\$
Porcelain Tile Walls	SF		\$	\$
Terrazzo	SF		\$	\$
Carpet	SF		\$	\$
Wood Floor	SF		\$	\$
Hourly Rate	HR	1	\$	XXXXXXXXXXXXXXXXXXXX
Specialties				
Toilet Partition	SF		\$	\$
Urinal Partition	SF		\$	\$
Grab bar	LF		\$	\$
Toilet Paper Dispenser	EA		\$	\$
Hand dryer	EA		\$	\$
Mirror	SF		\$	\$
Soap dispenser	EA		\$	\$
Sanitary napkin disposal	EA		\$	\$
Changing table	EA		\$	\$
Towel/robe hook	EA		\$	\$
Folding shower seat	EA		\$	\$
Mop holder	EA		\$	\$
Railings-Pickett,	LF		\$	\$
Fire Extinguisher w/cabinet, complete	EA		\$	\$
6ft Gate and Fencing, Complete	LF		\$	\$
Gate Controller, complete	EA		\$	\$
Hourly Rate	HR	1	\$	XXXXXXXXXXXXXXXXXXXX
Equipment				
TV mount	EA		\$	\$
Ice Machine	EA		\$	\$
Special Construction				
Tarmac Art Work and Staining	LS		\$	\$
Horizontal Faux Wood Blinds	EA		\$	\$
Roller Shades	EA		\$	\$
Hourly Rate	HR	1	\$	XXXXXXXXXXXXXXXXXXXX
Plumbing				
1" Water Supply-Complete	LS		\$	\$
New 4" Sanitary sewer supply, Complete	LS		\$	\$
Interior Domestic Water, Complete	LS		\$	\$
Interior Waste Water, Complete	LS		\$	\$
Water Closet, Wall-Hung, w/ FV & Carrier	EA		\$	\$
Urinal, w/ FV & Carrier	EA		\$	\$
Lavatory, w/ Trim	EA		\$	\$
Electric Water Cooler, Dual Bowl	EA		\$	\$
Washing Machine Box	EA		\$	\$
Mop Sink	EA		\$	\$

Shower Valve, Head & Drain	EA		\$	\$
Floor Drain	EA		\$	\$
Shock Absorber - Allowance	EA		\$	\$
Electric Water Heater, w/ Recirc Pump - Allowance	EA		\$	\$
Thermo-Mixing Valve	EA		\$	\$
Wall/ Floor Cleanout	EA		\$	\$
Plumbing Demo	LS		\$	\$
Hourly Rate	HR	1	\$	XXXXXXXXXXXXXXXXXXXX
HVAC				
HVAC Demolition	LS		\$	\$
DOAU; 1535CFM; DX with Electric Heat	EA		\$	\$
ACCU-01 and FCU-01; 1930CFM	EA		\$	\$
ACCU-02 and FCU-02; 2255CFM	EA		\$	\$
ACCU-03 and FCU-03; 1360CFM	EA		\$	\$
EF-01; 210CFM	EA		\$	\$
EF-02; 210CFM	EA		\$	\$
EF-03; 120CFM	EA		\$	\$
EF-04; 400CFM	EA		\$	\$
Airside accessories, air devices, volume dampers	EA		\$	\$
Refrigerant Piping	LF		\$	\$
Condensate Piping	LF		\$	\$
Ductwork-Supply-spiral	LF		\$	\$
Ductwork-Round-Flex	LF		\$	\$
Ductwork-Rectangular-Supply	LF		\$	\$
Ductwork-Rectangular-Return	LF		\$	\$
Ductwork-Rectangular-Exhaust	LF		\$	\$
Hangers and Supports	EA		\$	\$
Controls	LS		\$	\$
Test, Adjust and Balance	LS		\$	\$
Hourly Rate	HR	1	\$	XXXXXXXXXXXXXXXXXXXX
Electrical				
Generator Conduit	LF		\$	\$
225A MLO 120/208V Panelboard	EA		\$	\$
600A MLO 120/208V Panelboard	EA		\$	\$
CATV Empty Raceway System	LS		\$	\$
Outlet Empty	EA		\$	\$
3/4" EMT	LF		\$	\$
Pull String	LF		\$	\$
Outlet Empty	EA		\$	\$
3/4" EMT	LF		\$	\$
3" PVC	LF		\$	\$
Pull String	LF		\$	\$
Trench Small	LF		\$	\$

Telephone/Data Outlet Empty	EA		\$	\$
J Hook	LF		\$	\$
Ceiling Fan	EA		\$	\$
Fixture Type P1	EA		\$	\$
Fixture Type P2	EA		\$	\$
Fixture Type P2E	EA		\$	\$
Fixture Type P3	EA		\$	\$
Fixture Type R1	EA		\$	\$
Fixture Type R2	EA		\$	\$
Fixture Type R3	EA		\$	\$
Fixture Type R3E	EA		\$	\$
Fixture Type S1	EA		\$	\$
Fixture Type SL1	EA		\$	\$
Fixture Type UC1	EA		\$	\$
Fixture Type W1	EA		\$	\$
Fixture Type W1	EA		\$	\$
Switch	EA		\$	\$
Switch 3 way	EA		\$	\$
Occupancy Sensor	EA		\$	\$
Power Pack	EA		\$	\$
Lighting Control System	EA		\$	\$
125W Lighting converter	EA		\$	\$
Branch Circuit	EA		\$	\$
Grounding System	EA		\$	\$
Hourly Rate	HR	1	\$	XXXXXXXXXXXXXXXXXXXX
Special Systems				
Projector Lift	LS		\$	\$
Projector Screen	LS		\$	\$
Site Work				
Demo Fencing, Aluminum 6ft	LF		\$	\$
Demo Sidewalk	SF		\$	\$
Demo Parking Block (store)	EA		\$	\$
Demo Radio Tower	EA		\$	\$
Demo Asphalt	SF		\$	\$
Unsuitable Soil Removal	CY		\$	\$
Fillable Soil	CY		\$	\$
Concrete Paving Sidewalks	CY		\$	\$
Concrete stain	SF		\$	\$
Brick Sidewalk border	LF		\$	\$
Silt Fencing	LF		\$	\$
Top Soil strip and store	CY		\$	\$
Site Survey-Layout & Elevations	LS		\$	\$
Fine Grading	LS		\$	\$

Asphalt Striping/Painting	LS		\$	\$
Asphalt Paving	CY		\$	\$
Asphalt Seal Coat	SY		\$	\$
Pre-Cast Wheel Stops	EA		\$	\$
Parking Signage w/post	LS		\$	\$
Tree & Stump Removal	EA		\$	\$
Sodding	SF		\$	\$
Conduit Sleeves under Sidewalk	LF		\$	\$
Site Utilities				
- water / fire line - connect to existing	LF		\$	\$
Storm drain system				
8" h.d.p.e.	LF		\$	\$
12" c.p.p.	LF		\$	\$
yard inlets	EA		\$	\$
Site Mechanical Systems:				
Connect to Existing Water Main	EA		\$	\$
Fire Main, 4" - 6" - Allowance	LS		\$	\$
Fire Hydrant Assembly	EA		\$	\$
Detector Check Valve/ BFP Assembly, 4" - 6"	EA		\$	\$
Site Electrical Systems				
Concrete Pad	SF		\$	\$
Meter Pedestal	EA		\$	\$
Pull Box	EA		\$	\$
5/8" X 8' Cu. Ground Rod	LF		\$	\$
Cad weld	EA		\$	\$
#12 Wire	LF		\$	\$
#4/0 Bare Wire	LF		\$	\$
600A Service PVC	LF		\$	\$
3" PVC	LF		\$	\$
3" GRC	LF		\$	\$
Pull String	LF		\$	\$
Trench Large	LF		\$	\$
Concrete	SF		\$	\$
Sand Fill	SF		\$	\$
Cut & Patch	SF		\$	\$
600A Automatic Transfer Switch	EA		\$	\$
600A 120/208V Main Circuit Breaker	EA		\$	\$
Overhead Wire Relocation	LF		\$	\$
Radio Conduit	LF		\$	\$
Demo not listed in a division	LS		\$	\$
Hourly Rate	HR	1	\$	XXXXXXXXXXXXXXXXXXXX

Allowances					
Construction Allowances					
Lump Sum Carpet	LS			\$12,000.00	\$12,000.00
Unit Cost- Face Bick	Per 1000			\$350.00	
Unit Cost -Tile					
Floor 12x24 Porcelain Tile	SF			\$6.17	
Typical Wall 12x24 Porcelain Tile	SF			\$4.65	
Accent Wall Tile 2x6 stone tile	SF			\$14.40	
Generator	LS	1		\$15,000.00	\$15,000.00
FF&E	LS	1		\$100,000.00	\$100,000.00
Owners Allowances at Owners Discretion					
Irrigation	LS	1		\$5,000.00	\$5,000.00
Unfounded issues	LS	1		\$50,000.00	\$50,000.00
Signage not in Specification	LS	1		\$5,000.0	\$5,000.00
Radon Console and Antenna Re-install not in specs	LS	1		\$25,000.00	\$25,000.00
<i>* Total should match the bid price*</i>				Total:	\$

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CPST-11 BID SUBMITTAL

Bids are to be mailed or delivered to: **Capital Projects & Purchasing Department**
Kaye B. Syfrett, Procurement Manager
113 Mable T. Willis Boulevard
Walterboro, SC 29488

Bidder/Proposer

Company

Address

City, State, Zip

Telephone number

Toll Free number

Fax number

Email address

Federal Tax ID Number

Contractor's license number

Remainder of this page intentionally left blank

ACKNOWLEDGMENT OF PRINCIPAL, IF A PARTNERSHIP

State of: (_____)

County of: (_____)

On this _____ day of _____ 20 _____ , before me personally, came and appeared _____ to me known and known to me to described in and who executed the foregoing instrument and he acknowledged to me that he executed the same as and for the act and deed of said firm.

(Seal) _____
Notary Public

ACKNOWLEDGMENT OF PRINCIPAL, IF AN INDIVIDUAL

State of: (_____)

County of: (_____)

On this _____ day of _____ 20 _____ , before me personally, came and appeared _____ to me known and known to me to be the person described in and who executed the forgoing instrument and acknowledged that he executed the same.

(Seal) _____
Notary Public

Remainder of this page intentionally left blank

ACKNOWLEDGMENT OF PRINCIPAL, IF A CORPORATION

State of: (_____)

County of: (_____)

On this _____ day of _____, 20 _____, before me personally came and appeared _____ to me Known, who, being by me duly sworn, did depose and say to me that he resides at _____, that he/she is the _____ of _____ the corporation described in and which executed the foregoing instrument is an impression of such seal; that it was so affixed by the order of the directors of said corporation, and that he signed his name thereto by like order.

(Seal) _____
Notary Public

ADDENDA ACKNOWLEDGMENT

The vendor has examined and carefully studied the Request for Bids and the following Addenda, receipt of all of which is hereby acknowledged:

Addendum No. _____

Addendum No _____

Addendum No. _____

Addendum No. _____

By signing the Bid Submittal Form the Vendor(s) acknowledges any and all issued addenda. Proposals which fail to acknowledge the vendor's receipt of any addendum will result in the rejection of the offer if the addendum contained information which substantively changes the Owner's requirements or pricing.

REFERENCES

The vendor must list a minimum of three (3) references along with pictures of the completed work.

1. Organization: _____

Address: _____

Contact: _____

Phone Number: _____ Email address: _____

Services provided: _____

Years of Service: _____

2. Organization: _____

Address: _____

Contact: _____

Phone Number: _____ Email address: _____

Services provided: _____

Years of Service: _____

3. Organization: _____

Address: _____

Contact: _____

Phone Number: _____ Email address: _____

Services provided: _____

Years of Service: _____

DEBARMENT

The undersigned Bidder/Proposer is certifying that they are not currently debarred from responding to any request for qualifications by any agency or subdivision of the State of South Carolina or the United States Federal Government, nor are they an agent of any person or entity that is currently debarred from submitting qualifications on contracts by any agency or subdivision of the State of South Carolina or the United States Federal Government.

SAM's No. _____

Cage Code. _____

DUN's No. _____

Remainder of this page intentionally left blank

MINORITY BUSINESS CERTIFICATE:

Are you a minority business?

▶ **Yes** ____ (Women-owner _____ / _____ Disadvantaged) If yes, please submit a copy of your certificate with your response.

▶ **No** ____

MAILING ADDRESS

Mailing Address

Printed Name

City, State, Zip

Title

Date

Phone Number/Fax Number

REMITTANCE ADDRESS

Company Name

Authorized Signature

Address

Email Address

City, State, Zip

Phone Number

Federal Tax ID Number

SC Sales Tax Number

Remainder of this page intentionally left blank

INDEMNIFICATION

The undersigned Bidder/Proposer will indemnify and hold harmless the Owner, Colleton County and their agents and employees from and against all claims, damages, losses and expenses, including attorney’s fees, arising out of or resulting from the performance of the Work provided that any such claims, damages, loss, or expense is attributable to bodily injury, sickness, disease or death, injury to or destruction of tangible property, including the loss of use resulting there from, and is caused by any negligent or willful act or omission of the Bidder/Proposer, and anyone directly or indirectly employed by him/her or anyone for whose acts any of them may be liable.

In any and all claims against the Owner, Colleton County or any of their agents and / or employees by an employee of the Bidder/Proposer, and anyone directly or indirectly employed by any of them, or anyone for whose acts any of them may be liable, the indemnification obligation shall not be limited in any way to the amount or type of damages, compensation or benefits payable by or for the Bidder / Proposer under the Worker’s Compensation Acts, Disability Benefit Acts, or other employee benefit acts.

The obligation of the Bidder/Proposer under this paragraph shall not extend to the liability of Colleton County or its agents and/or employees arising out of the reports, surveys, Change Orders, designs or Technical Specifications.

LIST OF PRIME AND SUBCONTRACTORS

The undersigned Bidder/Proposer states that the following is a full and complete list of proposed prime contractors and subcontractors on this Project and the class of work to be performed by each, and that such list will not be added to nor altered without the written consent of the Owner.

	Class of Work to be Performed	Subcontractor
1)	Site Work	_____
2)	Electrical	_____
3)	Mechanical	_____
4)	Plumbing	_____
5)	Architectural	_____
6)	Roofing	_____
7)	Masonry	_____
8)	Cement	_____
9)	Paving	_____

Listed subcontractors must meet all qualifications including documented experience set forth in specifications, including those sections specifying single source contractor requirements.

BID BOND

Any singular reference to Bidder, Surety, Owner, or other party shall be considered plural where applicable.

BIDDER (Name and Address): _____

SURETY (Name and Address of Principal Place of Business): _____

OWNER (Name and Address): Colleton County
109 Benson Street
Walterboro, SC 29488

Bid Number: **CPST-11**

Bid Due Date: **Wednesday, March 21, 2017 at 2:00pm**

Project (Brief Description Including Location): **Renovation and Expansion of the facility located at 537 Aviation Way, Walterboro SC. Approximately ± 1,618 sf of new construction consisting of a new Conference room and Flight Crew rest area, along with ± 2,270 sf of renovation to the current facility as it stands now.**

Bond Number: _____

Date (Not later than Bid due date): _____

Penal sum _____ (Words) _____ (Figures)

Surety and Bidder, intending to be legally bound hereby, subject to the terms printed on the reverse side hereof, do each because this Bid Bond to be duly executed on its behalf by its authorized officer, agent, or representative.

BIDDER

SURETY

(Seal)
Bidder's Name and Corporate Seal

(Seal)
Surety's Name and Corporate Seal

By: _____
Signature and Title

By: _____
Signature and Title
(Attach Power of Attorney)

Attest: _____
Signature and Title

Attest: _____
Signature and Title

1. Bidder and Surety, jointly and severally, bind themselves, their heirs, executors, administrators, successors and assigns to pay to Owner upon default of Bidder the penal sum set forth on the face of this Bond. Payment of the penal sum is the extent of Surety's liability.
2. Default of Bidder shall occur upon the failure of Bidder to deliver within the time required by the Bidding Documents (or any extension thereof agreed to in writing by Owner) the executed Agreement required by the Bidding Documents and any performance and payment bonds required by the Bidding Documents.
3. This obligation shall be null and void if:
 - 3.1. Owner accepts Bidder's Bid and Bidder delivers within the time required by the Bidding Documents (or any extension thereof agreed to in writing by Owner) the executed Agreement required by the Bidding Documents and any performance and payment bonds required by the Bidding Documents, or
 - 3.2. All Bids are rejected by Owner, or
 - 3.3. Owner fails to issue a Notice of Award to Bidder within the time specified in the Bidding Documents (or any extension thereof agreed to in writing by Bidder and, if applicable, consented to by Surety when required by Paragraph 5 hereof).
4. Payment under this Bond will be due and payable upon default by Bidder and within 30 calendar days after receipt by Bidder and Surety of written notice of default from Owner, which notice will be given with reasonable promptness, identifying this Bond and the Project and including a statement of the amount due.
5. Surety waives notice of any and all defenses based on or arising out of any time extension to issue Notice of Award agreed to in writing by Owner and Bidder, provided that the total time for issuing Notice of Award including extensions shall not in the aggregate exceed 120 days from Bid due date without Surety's written consent.
6. No suit or action shall be commenced under this Bond prior to 30 calendar days after the notice of default required in Paragraph 4 above is received by Bidder and Surety and in no case later than one year after Bid due date.
7. Any suit or action under this Bond shall be commenced only in a court of competent jurisdiction located in the state in which the Project is located.
8. Notices required hereunder shall be in writing and sent to Bidder and Surety at their respective addresses shown on the face of this Bond. Such notices may be sent by personal delivery, commercial courier, or by United States Registered or Certified Mail, return receipt requested, postage pre-paid, and shall be deemed to be effective upon receipt by the party concerned.
9. Surety shall cause to be attached to this Bond a current and effective Power of Attorney evidencing the authority of the officer, agent, or representative who executed this Bond on behalf of Surety to execute, seal, and deliver such Bond and bind the Surety thereby.
10. This Bond is intended to conform to all applicable statutory requirements. Any applicable requirement of any applicable statute that has been omitted from this Bond shall be deemed to be included herein as if set forth at length. If any provision of this Bond conflicts with any applicable statute, then the provision of said statute shall govern and the remainder of this Bond that is not in conflict therewith shall continue in full force and effect.
11. The term "Bid" as used herein includes a Bid, offer, or proposal as applicable.

1 - BIDDER'S ACKNOWLEDGEMENTS

- 1.01 The undersigned Bidder/Proposer, proposes and agrees, if this Bid is accepted, to enter into an Agreement/Contract with Owner as stated in the form included in the Bidding Documents to perform all Work as specified or indicated in the Bidding Documents for the prices and within the times indicated in this Bid and in accordance with the other terms and conditions of the Bidding Documents.
- 1.02 The undersigned Bidder/Proposer, having fully familiarized him/her with the information contained within this entire solicitation and applicable amendments, submits the attached response, and other applicable information to the County, which I verify to be true and correct to the best of my knowledge. I further certify that this response is made without prior understanding, agreement, or connection with any corporation, Offeror or person submitting a response for the same materials, supplies or equipment, and is in all respects, fair and without collusion or fraud. I agree to abide by all conditions set forth in this solicitation and certify that I have signature authority to bind the company listed herein.
- 1.03 Bidder accepts all of the terms and conditions of the Instructions to Bidders, including without limitation those dealing with the disposition of Bid security. This Bid will remain subject to acceptance for **ninety (90) days** after the Bid opening, or for such longer period of time that Bidder may agree to in writing upon request of Owner.
- 1.04 For additional work authorized after signing the Contract, the amount of overhead and the amount of profit to be added to base costs of labor and materials as noted in the unit price sheet shall be (10%) total for overhead and profit on work performed by the General Contractor's own forces and (15%) total on work by Subcontractors. Request of additional charges for site supervision, utilities, rentals, or administrative services will not be approved unless the additional requested work warrants adding additional days to the contract term. All request for additional work authorization shall have as an attachment, an **itemized breakdown** of the subcontractor and/or General Contractors work to be performed to include the actual quote for supplies from the general contractor or sub-contractor's suppliers. The General Contractor and sub-contractors itemized list shall have the Labor Hours, Rates, Overhead and Profit itemized. The Sub-contractor shall list as an itemized unit cost any additional labor to include the labor hours and rates associated with the requested work. The itemized list shall be shown on the subcontractor or General Contractors letter head and signed by the head officer or owner of the said company.
- 1.05 Bidder acknowledges the requirements of the Performance Bonds and Payment Bonds.

2 - BIDDER'S REPRESENTATIONS

- 2.01 In submitting this Bid, Bidder represents that:
- A. Bidder has examined and carefully studied the Bidding Documents, the other related data identified in the Bidding Documents, and the any issued Addenda, which is hereby acknowledged with the attached Addendum form.
 - B. Bidder has visited the Site and become familiar with and is satisfied as to the general, local and Site conditions that may affect cost, progress, and performance of the Work.
 - C. Bidder is familiar with and is satisfied as to all federal, state and local Laws and Regulations that may affect cost, progress and performance of the Work.
 - D. Bidder has carefully studied all: (1) reports of explorations and tests of subsurface conditions at or contiguous to the Site and all drawings of physical conditions in or relating to existing surface or subsurface structures at or contiguous to the Site (except Underground Facilities), which have been identified in Paragraph 4.02 of General Conditions, and (2) reports and drawings of Hazardous Environmental Conditions that have been identified in Paragraph 4.06

of General Conditions.

- E. Bidder has obtained and carefully studied (or accepts the consequences for not doing so) all additional or supplementary examinations, investigations, explorations, tests, studies and data concerning conditions (surface, subsurface and Underground Facilities) at or contiguous to the Site, which may affect cost, progress, or performance of the Work or which relate to any aspect of the means, methods, techniques, sequences, and procedures of construction to be employed by Bidder, including applying the specific
- F. Means, methods, techniques, sequences, and procedures of construction expressly required by the Bidding Documents to be employed by Bidder, and safety precautions and programs incident thereto.
- G. Bidder does not consider that any further examinations, investigations, explorations, tests, studies, or data are necessary for the determination of this Bid for performance of the Work at the price(s) bid and within the times and in accordance with the other terms and conditions of the Bidding Documents.
- H. Bidder is aware of the general nature of work to be performed by Owner and others at the Site that relates to the Work as indicated in the Bidding Documents.
- I. Bidder has correlated the information known to Bidder, information and observations obtained from visits to the Site, reports and drawings identified in the Bidding Documents, and all additional examinations, investigations, explorations, tests, studies, and data with the Bidding Documents.
- J. Bidder has given the Owner written notice of all conflicts, errors, ambiguities, or discrepancies that Bidder has discovered in the Bidding Documents, and the written resolution thereof by the Owner is acceptable to Bidder.
- K. The Bidding Documents are generally sufficient to indicate and convey understanding of all terms and conditions for the performance of the Work for which this Bid is submitted.
- L. Bidder will submit written evidence of its authority to do business in the state where the Project is located not later than the date of its execution of the Agreement.

3 - FURTHER REPRESENTATIONS

3.01 Bidder further represents that:

- A. This Bid is genuine and not made in the interest of or on behalf of any undisclosed individual or entity and is not submitted in conformity with any agreement or rules of any group, association, organization or corporation.
- B. Bidder has not directly or indirectly induced or solicited any other Bidder to submit a false or sham Bid.
- C. Bidder has not solicited or induced any individual or entity to refrain from bidding.
- D. The bidder affirms that in making such Bid, neither he/she nor any company that they may represent, nor anyone in behalf of him/her or their company, directly or indirectly, has entered into any combination, collusion, undertaking or agreement with any other Bidder or Bidders to maintain the prices of said work, or any compact to prevent any other Bidder or Bidders from Bidding on said Contract or work and further affirms that such bid is made without regard or reference to any other Bidder or Proposer and without any agreement or understanding or combination either directly or indirectly with any other person or persons with reference to such Bidding in any way or manner whatsoever.
- E. Any attempt by the vendor to influence the opinion of Colleton County Staff or Colleton County Council by discussion, promotion, advertising, or misrepresentation of the submittal or purchasing process or any procedure to promote their offer will constitute a violation of the

vendor submittal conditions and will cause the vendor's submittal to be declared null and void.

4 - TIME OF COMPLETION

4.01 **Renovation and Expansion of the facility located at 537 Aviation Way, Walterboro South Carolina. Approximately ± 1,618 sf of new construction consisting of a new Conference room and Flight Crew rest area, along with ± 2,270 sf of renovation to the current facility as it stands now, is to be completed within Three Hundred Thirty (330) calendar days after the Notice to Proceed has been issued.**

4.02 Bidder accepts the provisions of the Agreement as to liquidated damages, in the event of failure to complete the Work within the Contract dates in the amount of \$500 per day for each calendar day required to complete the work in the manner and within the dates as stated in Paragraph 4.01 above.

5 - BID SUBMITTAL

5.01 This Bid submitted by:

An Individual

Name (typed or printed): _____

By: _____ (SEAL)

(Individual's signature)

Title: _____

Doing business as: _____

A Partnership

Partnership Name: _____

By: _____ (SEAL)

(Signature of general partner -- attach evidence of authority to sign)

Title: _____

Name (typed or printed): _____

A Corporation

Corporation Name: _____ (SEAL)

State of Incorporation: _____

Type (General Business, Professional, Service, Limited Liability): _____

By: _____

(Signature -- attach evidence of authority to sign)

Name (typed or printed): _____

Title: _____ (CORPORATE SEAL)

Attest _____

Date of Authorization to do business in [South Carolina] is ____/____/____.

A Joint Venture

Name of Joint Venture: _____

First Joint Ventures Name: _____ (SEAL)

By: _____

(Signature of first joint venture partner -- attach evidence of authority to sign)

Name (typed or printed): _____

Title: _____

Second Joint Ventures Name: _____ (SEAL)

By: _____

(Signature of second joint venture partner -- attach evidence of authority to sign)

Name (typed or printed): _____

Title: _____

(Each joint venture must sign. The manner of signing for each individual, partnership, and corporation that is a party to the joint venture should be in the manner indicated above.)

Bidder's Business Address _____

Telephone No.: _____ Fax No.: _____

SUBMITTED on _____, 2017.

State Contractor License No. _____

Remainder of this page intentionally left blank

6 – BASIS OF BID

BASE BID & ALTERNATE BID UNIT PRICE

Base Bid price and Alternate Bid Prices shall be for the Work as specified, and shall include all labor, supervision, administrative support, materials, equipment, accessories, shipping, preparation, insurance, testing, overhead, profit, applicable taxes, permits, fees, supervision, warranties and all other associated costs for the finished and completed Work. Bid shall include the prices for undercut soils shall include material in place, surveyed and compacted pursuant to the Contract Documents.

Contractor shall make quantity take-offs using drawings and specifications to determine quantities to his satisfaction, reporting promptly any discrepancies which may affect bidding.

The Owner shall have the right to accept Alternates in any order or combination, and to determine the low bidder on the basis of the sum of the Base Bid and Alternates accepted.

6.01 Bidder will complete the Work in accordance with the Contract Documents and the following allowances are established for this project.

Owner's Allowances-- Lowcountry Regional Airport Renovation and Expansion located at 537 Aviation Way, Walterboro SC; to be included in the base bid			
Signage not in specifications	LS	1	\$ 5,000.00
Irrigation	LS	1	\$ 5,000.00
Unfounded issues	LS	1	\$ 50,000.00
FF&E not in specifications	LS	1	\$ 15,000.00
Radio Console and Antenna Reinstall not in Specifications	LS	1	\$ 25,000.00

7 - BASE BID ALTERNATES

7.01 Bidder will complete the Work in accordance with the Contract Documents for the following unit price(s). These unit prices shall be for the Work as specified, including all labor, supervision, administrative support, materials, equipment, accessories, shipping, preparation, insurance, testing, overhead, profit, applicable taxes, permits, fees, warranties and all other associated costs for the finished and completed Work. All unit prices for utility conduits shall include sweeps, bends, couplings, caps, fittings, etc. which shall be included in the unit price per linear foot. Unit prices for undercut soils shall include material in place, surveyed and compacted pursuant to the Contract Documents.

Bidder acknowledges that estimated quantities are not guaranteed, and are solely for the purpose of comparison of Bids.

Remainder of this page intentionally left blank

Alternates		Unit	Quantity	Unit Price	Bid Price
Alternate 1: Brick Borders					
#1	<u>Description:</u> PROVIDE 12" WIDE BRICK BORDERS AT PORCH PAVING IN LIEU OF 12" WIDE STAINED CONCRETE BORDERS.			\$	\$
Alternate 2: Solid Doors					
#2	<u>Description:</u> PROVIDE STAINED, SOLID WOOD EXTERIOR DOORS IN LIEU OF ALUMINUM CLAD WOOD EXTERIOR DOORS.			\$	\$
Alternate 3: Clear Stories & Asphalt Shingles					
#3	<u>Description:</u> PROVIDE CLERESTORIES AT EAST & WEST ADDITIONS WITH ASPHALT SHINGLE ROOFING.			\$	\$
Alternate 4: Roof Extension South Porch					
#4	<u>Description:</u> EXTEND OVERHANG AT SOUTH PORCH OF EAST ADDITION FOR CARPORT WITH ASPHALT SHINGLE ROOFING.			\$	\$
Alternate 5: Roof Extension North Porch					
#5	<u>Description:</u> EXTEND OVERHANG AT NORTH PORCH OF EAST ADDITION WITH ASPHALT SHINGLE ROOFING.			\$	\$
Alternate 6: Transparant Finish					
#6	<u>Description:</u> PROVIDE TRANSPARANT FINISH AT ALL EXPOSED INTERIOR WOOD IN LIEU OF OPAQUE FINISH			\$	\$
Alternate 7: 5/8 Fiber Cement Lap Siding					
#7	<u>Description:</u> PROVIDE 5/8" FIBER CEMENT LAP SIDING & CORRESPONDING TRIM ALL BASE BID AREAS IN LIEU OF 5/16" LAP SIDING & CORRESPONDING TRIM			\$	\$
Alternate 8: 5/16 Fiber Cement Lap Siding					
#8	<u>Description:</u> PROVIDE 5/16" FIBER CEMENT LAP SIDING & CORRESPONDING TRIM ON DETAILED BACKUP AT EXISTING NORTH, EAST & WEST ELEVATIONS IN LIEU OF PAINTING EXISTING BRICK			\$	\$
Alternate 9: Standing Seam Metal Roof					
#9	<u>Description:</u> PROVIDE STANDING SEAM METAL ROOFING IN LIEU OF ASPHALT SHINGLES, BASE BID ROOF AREA ONLY			\$	\$
NOTE:					
1. ROOFING UNIT PRICES SHALL BE APPLIED TO COORDINATE ALTERNATES 3, 4 & 5 SO OWNER MAY SELECT ANY COMBINATION OF ALTERNATES					
2. FIBER CEMENT LAP SIDING & CORRESPONDING TRIM UNIT PRICES SHALL BE APPLIED TO COORDINATE ALTERNATE 7 SO OWNER MAY SELECT ANY COMBINATION OF ALTERNATES					

8 - Base Bid

8.01 BASE BID PROPOSAL: Bidder/Proposer agrees to perform all of the work described in the solicitation document CPST-11 to include the Specifications, General Conditions, including allowances, and items shown on the drawings, for the sum of:

_____ \$ _____
(amount in words) (numerical)

Submitted by: _____
Name (print) Signature

Company Date

End of Base Bid

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END OF SECTION

DIVISION 001 – GENERAL CONDITIONS

STANDARD GENERAL CONDITIONS OF THE CONSTRUCTION CONTRACT

PART 1 - DEFINITIONS AND TERMINOLOGY

1.01 Defined Terms

- A. Wherever used in the Bidding Requirements or Contract Documents and printed with initial capital letters, the terms listed below will have the meanings indicated which are applicable to both the singular and plural thereof. In addition to terms specifically defined, terms with initial capital letters in the Contract Documents include references to identified Parts and paragraphs, and the titles of other documents or forms.
1. Addenda – Written or graphic instruments issued prior to the opening of Bids which clarify, correct, or change the Bidding Requirements or the proposed Contract Documents.
 2. Agreement – The written instrument which is evidence of the agreement between Owner and Contractor covering the Work.
 3. Application for Payment – The form acceptable to the Construction Coordinator which is to be used by Contractor during the course of the Work in requesting progress or final payments and which is to be accompanied by such supporting documentation as is required by the Contract Documents.
 4. Asbestos – Any material that contains more than one percent asbestos and is friable or is releasing asbestos fibers into the air above current action levels established by the United States Occupational Safety and Health Administration.
 5. Bid – The offer or proposal of a Bidder submitted on the prescribed form setting forth the prices for the Work to be performed.
 6. Bidder – The individual or entity who submits a Bid directly to Owner.
 7. Bidding Documents – The Bidding Requirements, Contract Documents and the General Conditions (including all Addenda).
 8. Bidding Requirements – The Advertisement or Invitation to Bid, Instructions to Bidders, bid security of acceptable form, if any, and the Bid Form with any supplements.
 9. Change Order – A document recommended by the Construction Coordinator which is signed by Contractor and Owner and authorizes an addition, deletion, or revision in the Work or an adjustment in the Contract Price or the Contract Times, issued on or after the Effective Date of the Agreement.
 10. Claim – A demand or assertion by Owner or Contractor seeking an adjustment of Contract Price or Contract Times, or both, or other relief with respect to the terms of the Contract. A demand for money or services by a third party is not a Claim.
 11. Construction Coordinator - The person or firm in charge of the project. The person or firm will be selected by the owner and in some instances, the owner will self-perform, acting as the Construction Coordinator. The firm could be an Architectural Firm, Engineering Firm, or third party as so designated by the owner.

12. Contract – The entire and integrated written agreement between the Owner and Contractor including the General Conditions concerning the Work. The Contract supersedes prior negotiations, representations, or agreements, whether written or oral.
13. Contract Documents – Those items so designated in the Agreement. Only printed or hard copies of the items listed in the Agreement Are Contract Documents. Approved Shop Drawings, other Contractor's submittals, and the reports and drawings of subsurface and physical conditions are not Contract Documents.
14. Contract Price – The moneys payable by Owner to Contractor for completion of the Work in accordance with the Contract Documents as stated in the Agreement (subject to the provisions of Paragraph 11.03 in the case of Unit Price Work).
15. Contract Times – The number of days or the dates stated in the Agreement to: (i) achieve Milestones, if any, (ii) achieve Substantial Completion; and (iii) complete the Work so that it is ready for final payment as evidenced by Engineer's written recommendation of final payment.
16. Contractor – The individual or entity with whom Owner has entered into the Agreement.
17. Cost of the Work – See Paragraph 11.01.A for definition.
18. Drawings – That part of the Contract Documents prepared or approved by the Construction Coordinator which graphically shows the scope, extent, and character of the Work to be performed by Contractor. Shop Drawings and other Contractor submittals are not Drawings as so defined.
19. Effective Date of the Agreement – The date indicated in the Agreement on which it becomes effective, but if no such date is indicated, it means the date on which the Agreement is signed and delivered by the last of the two parties to sign and deliver.
20. Field Order – A written order issued by the Construction Coordinator which requires minor changes in the Work but which does not involve a change in the Contract Price or the Contract Times.
21. General Requirements – Sections of Division 1 of the Specifications. The General Requirements pertain to all sections of the Specifications.
22. Hazardous Environmental Condition – The presence at the Site of Asbestos, PCBs, Petroleum, Hazardous Waste, or Radioactive Material in such quantities or circumstances that may present a substantial danger to persons or property exposed thereto in connection with the Work.
23. Hazardous Waste – The term Hazardous Waste shall have the meaning provided in Section 1004 of the Solid Waste Disposal Act (42 USC Section 6903) as amended from time to time.
24. Laws and Regulations; Laws or Regulations – Any and all applicable laws, rules, regulations, ordinances, codes, and orders of any and all governmental bodies, agencies, authorities, and courts having jurisdiction.
25. Liens – Charges, security interests, or encumbrances upon Project funds, real property, or personal property.
26. Milestone – A principal event specified in the Contract Documents relating to an intermediate completion date or time prior to Substantial Completion of all the Work.

27. Notice of Award – The written notice by Owner to the Successful Bidder stating that upon timely compliance by the Successful Bidder with the conditions precedent listed therein, Owner will sign and deliver the Agreement.
28. Notice to Proceed – A written notice given by Owner or Construction Coordinator to Contractor fixing the date on which the Contract Times will commence to run and on which Contractor shall start to perform the Work under the Contract Documents.
29. Owner – The individual or entity with whom Contractor has entered into the Agreement and for whom the Work is to be performed.
30. PCBs – Polychlorinated biphenyls.
31. Petroleum – Petroleum, including crude oil or any fraction thereof which is liquid at standard conditions of temperature and pressure (60 degrees Fahrenheit and 14.7 pounds per square inch absolute), such as oil, petroleum, fuel oil, oil sludge, oil refuse, gasoline, kerosene, and oil mixed with other non-Hazardous Waste and crude oils.
32. Progress Schedule – A schedule, prepared and maintained by Contractor, describing the sequence and duration of the activities comprising the Contractor's plan to accomplish the Work within the Contract Times.
33. Project – The total construction of which the Work to be performed under the Contract Documents may be the whole, or a part.
34. Project Manual – The bound documentary information prepared for bidding and constructing the Work. A listing of the contents of the Project Manual, which may be bound in one or more volumes, is contained in the table(s) of contents.
35. Radioactive Material – Source, special nuclear, or byproduct material as defined by the Atomic Energy Act of 1954 (42 USC Section 2011 et seq.) as amended from time to time.
36. Related Entity – An officer, director, partner, employee, agent, consultant, or subcontractor.
37. Resident Project Representative – The authorized representative of the Construction Coordinator who may be assigned to the Site or any part thereof.
38. Samples – Physical examples of materials, equipment, or workmanship that are representative of some portion of the Work and which establish the standards by which such portion of the Work will be judged.
39. Schedule of Submittals – A schedule, prepared and maintained by Contractor, of required submittals and the time requirements to support scheduled performance of related construction activities.
40. Schedule of Values – A schedule, prepared and maintained by Contractor, allocating portions of the Contract Price to various portions of the Work and used as the basis for reviewing Contractor's Applications for Payment.
41. Shop Drawings – All drawings, diagrams, illustrations, schedules, and other data or information which are specifically prepared or assembled by or for Contractor and submitted by Contractor to illustrate some portion of the Work.
42. Site – Lands or areas indicated in the Contract Documents as being furnished by Owner upon which the Work is to be performed, including rights-of-way and easements for

access thereto, and such other lands furnished by Owner which are designated for the use of Contractor.

43. Specifications – That part of the Contract Documents consisting of written requirements for materials, equipment, systems, standards and workmanship as applied to the Work, and certain administrative requirements and procedural matters applicable thereto.
44. Subcontractor – An individual or entity having a direct contract with Contractor or with any other Subcontractor for the performance of a part of the Work at the Site.
45. Substantial Completion – The time at which the Work (or a specified part thereof) has progressed to the point where, in the opinion of the Construction Coordinator, the Work (or a specified part thereof) is sufficiently complete, in accordance with the Contract Documents, so that the Work (or a specified part thereof) can be utilized for the purposes for which it is intended. The terms “substantially complete” and “substantially completed” as applied to all or part of the Work refer to Substantial Completion thereof.
46. Successful Bidder – The Bidder submitting a responsive Bid to whom Owner makes an award.
47. Supplementary Conditions – That part of the Contract Documents which amends or supplements these General Conditions.
48. Supplier – A manufacturer, fabricator, supplier, distributor, material man, or vendor having a direct contract with Contractor or with any Subcontractor to furnish materials or equipment to be incorporated in the Work by Contractor or any Subcontractor.
49. Underground Facilities – All underground pipelines, conduits, ducts, cables, wires, manholes, vaults, tanks, tunnels, or other such facilities or attachments, and any encasements containing such facilities, including those that convey electricity, gases, steam, liquid petroleum products, telephone or other communications, cable television, water, wastewater, storm water, other liquids or chemicals, or traffic or other control systems.
50. Unit Price Work – Work to be paid for on the basis of unit prices.
51. Work – The entire construction or the various separately identifiable parts thereof required to be provided under the Contract Documents. Work includes and is the result of performing or providing all labor, services, and documentation necessary to produce such construction, and furnishing, installing, and incorporating all materials and equipment into such construction, all as required by the Contract Documents.
52. Work Change Directive – A written statement to Contractor issued on or after the Effective Date of the Agreement and signed by Owner and recommended by the Construction Coordinator ordering an addition, deletion, or revision in the Work, or responding to differing or unforeseen subsurface or physical conditions under which the Work is to be performed or to emergencies. A Work Change Directive will not change the Contract Price or the Contract Times but is evidence that the parties expect that the change ordered or documented by a Work Change Directive will be incorporated in a subsequently issued Change Order following negotiations by the parties as to its effect, if any, on the Contract Price or Contract Times.
53. Warranty- Such time period as stated in the contract, which shall cover all workmanship and products installed under the contract requirements.

1.02 Terminology

- A. The following words or terms are not defined but, when used in the Bidding Requirements or Contract Documents, have the following meaning.
- B. Intent of Certain Terms or Adjectives
1. The Contract Documents include the terms “as allowed,” “as approved,” “as ordered,” “as directed” or terms of like effect or import to authorize an exercise of professional judgment by the Construction Coordinator. In addition, the adjectives “reasonable,” “suitable,” “acceptable,” “proper,” “satisfactory,” or adjectives of like effect or import are used to describe an action or determination of the Construction Coordinator as to the Work. It is intended that such exercise of professional judgment, action or determination will be solely to evaluate, in general, the Work for compliance with the requirements of and information in the Contract Documents and conformance with the design concept of the completed Project as a functioning whole as shown or indicated in the Contract Documents (unless there is a specific statement indicating otherwise). The use of any such term or adjective is not intended to and shall not be effective to assign to the Construction Coordinator any duty or authority to supervise or direct the performance of the Work or any duty or authority to undertake responsibility contrary to the provisions of Paragraph 9.09 or any other provision of the Contract Documents.
- C. Day
1. The word “day” means a calendar day of 24 hours measured from midnight to the next midnight.
 2. The wording “business day” means any day Monday thru Friday.
- D. Defective
1. The word “defective,” when modifying the word “Work,” refers to Work that is unsatisfactory, faulty, or deficient in that it:
 - a. does not conform to the Contract Documents, or
 - b. does not meet the requirements of any applicable inspection, reference standard, test, or approval referred to in the Contract Documents, or
 - c. has been damaged prior to the Construction Coordinator recommendation of final payment (unless responsibility for the protection thereof has been assumed by Owner at Substantial Completion in accordance with Paragraph 14.04 or 14.05).
- E. Furnish, Install, Perform, Provide
1. The word “furnish,” when used in connection with services, materials, or equipment, shall mean to supply and deliver said services, materials, or equipment to the Site (or some other specified location) ready for use or installation and in usable or operable condition.

2. The word “install,” when used in connection with services, materials, or equipment, shall mean to put into use or place in final position said services, materials, or equipment complete and ready for intended use.
 3. The words “perform” or “provide,” when used in connection with services, materials, or equipment, shall mean to furnish and install said services, materials, or equipment complete and ready for intended use.
 4. When “furnish,” “install,” “perform,” or “provide” is not used in connection with services, materials, or equipment in a context clearly requiring an obligation of Contractor, “provide” is implied.
- F. Unless stated otherwise in the Contract Documents, words or phrases which have a well-known technical or construction industry or trade meaning are used in the Contract Documents in accordance with such recognized meaning.

PART 2 - PRELIMINARY MATTERS

2.01 Delivery of Bonds and Evidence of Insurance

- A. When Contractor delivers the executed counterparts of the Agreement to Owner, Contractor shall also deliver to Owner such bonds as Contractor may be required to furnish.
- B. Evidence of Insurance: Before any Work at the Site is started, Contractor and Owner shall each deliver to the other, with copies to each additional insured identified in the General Conditions, certificates of insurance (and other evidence of insurance which either of them or any additional insured may reasonably request) which Contractor and Owner respectively are required to purchase and maintain in accordance with Part 5.

2.02 Copies of Documents

- A. Owner shall furnish to Contractor up to two (2) printed or hard copies of the Drawings and Project Manual. Additional copies will be furnished upon request at the cost of reproduction.

2.03 Commencement of Contract Times; Notice to Proceed

- A. The Contract Times will commence to run on the thirtieth day after the Effective Date of the Agreement or, if a Notice to Proceed is given, on the day indicated in the Notice to Proceed. A Notice to Proceed may be given at any time within 30 days after the Effective Date of the Agreement. In no event, will the Contract Times commence to run later than the thirtieth day after the Effective Date of the Agreement.

2.04 Starting the Work

- A. Contractor shall start to perform the Work on the date when the Contract Times commence to run. No Work shall be done at the Site prior to the date on which the Contract Times commence to run.

2.05 Before Starting Construction

- A. *Preliminary Schedules:* Within ten (10) days after the Effective Date of the Agreement (unless otherwise specified in the General Requirements), Contractor shall submit to the Construction Coordinator for timely review:

1. a preliminary Progress Schedule; indicating the times (numbers of days or dates) for starting and completing the various stages of the Work, including any Milestones specified in the Contract Documents;
2. a preliminary Schedule of Submittals; and
3. a preliminary Schedule of Values for all of the Work which includes quantities and prices of items which when added together equal the Contract Price and subdivides the Work into component parts in sufficient detail to serve as the basis for progress payments during performance of the Work. Such prices will include an appropriate amount of overhead and profit applicable to each item of Work.

2.06 Preconstruction Conference

- A. Before any Work at the Site is started, a conference attended by Owner, Contractor, the Construction Coordinator, and others as appropriate will be held to establish a working understanding among the parties as to the Work and to discuss the schedules referred to in Paragraph 2.05.A, procedures for handling Shop Drawings and other submittals, processing Applications for Payment, and maintaining required records.

2.07 Initial Acceptance of Schedules

- A. At least ten (10) days before submission of the first Application for Payment a conference attended by Contractor, the Construction Coordinator, and others as appropriate will be held to review for acceptability to the Construction Coordinator as provided below the schedules submitted in accordance with Paragraph 2.05.A. Contractor shall have an additional ten (10) days to make corrections and adjustments and to complete and resubmit the schedules. No progress payment shall be made to Contractor until acceptable schedules are submitted to the Construction Coordinator.
 1. The Progress Schedule will be acceptable to the Construction Coordinator if it provides an orderly progression of the Work to completion within the Contract Times. Such acceptance will not impose on the Construction Coordinator responsibility for the Progress Schedule, for sequencing, scheduling, or progress of the Work nor interfere with or relieve Contractor from Contractor's full responsibility therefor.
 2. Contractor's Schedule of Submittals will be acceptable to the Construction Coordinator if it provides a workable arrangement for reviewing and processing the required submittals.
 3. Contractor's Schedule of Values will be acceptable to the Construction Coordinator as to form and substance if it provides a reasonable allocation of the Contract Price to component parts of the Work.

PART 3 – CONTRACT DOCUMENTS: INTENT, AMENDING, REUSE

3.01 Intent

- A. The Contract Documents are complementary; what is required by one is as binding as if required by all.
- B. It is the intent of the Contract Documents to describe a functionally complete Project (or part thereof) to be constructed in accordance with the Contract Documents. Any labor, documentation, services, materials, or equipment that may reasonably be inferred from the Contract Documents or from prevailing custom or trade usage as being required to produce the intended result will be provided whether or not specifically called for at no additional cost to Owner.

- C. Clarifications and interpretations of the Contract Documents shall be issued by the Construction Coordinator as provided in Part 9.

3.02 Reference Standards

- A. Standards, Specifications, Codes, Laws, and Regulations
 - 1. Reference to standards, specifications, manuals, or codes of any technical society, organization, or association, or to Laws or Regulations, whether such reference be specific or by implication, shall mean the standard, specification, manual, code, or Laws or Regulations in effect at the time of opening of Bids (or on the Effective Date of the Agreement if there were no Bids), except as may be otherwise specifically stated in the Contract Documents.
 - 2. No provision of any such standard, specification, manual or code, or any instruction of a Supplier shall be effective to change the duties or responsibilities of Owner, Contractor, or the Construction Coordinator, or any of their subcontractors, consultants, agents, employees from those set forth in the Contract Documents. No such provision or instruction shall be effective to assign to Owner, or the Construction Coordinator, or any of, their Related Entities, any duty or authority to supervise or direct the performance of the Work or any duty or authority to undertake responsibility inconsistent with the provisions of the Contract Documents.

3.03 Reporting and Resolving Discrepancies

- A. Reporting Discrepancies
 - 1. *Contractor's Review of Contract Documents Before Starting Work:* Before undertaking each part of the Work, Contractor shall carefully study and compare the Contract Documents and check and verify pertinent figures therein and all applicable field measurements. Contractor shall promptly report in writing to the Construction Coordinator any conflict, error, ambiguity, or discrepancy which Contractor may discover and shall obtain a written interpretation or clarification from the Construction Coordinator before proceeding with any Work affected thereby.
 - 2. *Contractor's Review of Contract Documents During Performance of Work:* If, during the performance of the Work, Contractor discovers any conflict, error, ambiguity, or discrepancy within the Contract Documents or between the Contract Documents and any provision of any Law or Regulation applicable to the performance of the Work or of any standard, specification, manual or code, or of any instruction of any Supplier, Contractor shall promptly report it to the Construction Coordinator in writing. Contractor shall not proceed with the Work affected thereby (except in an emergency as required by Paragraph 6.16.A) until an amendment or supplement to the Contract Documents has been issued by one of the methods indicated in Paragraph 3.04.
 - 3. Contractor shall not be liable to Owner or the Construction Coordinator for failure to report any conflict, error, ambiguity, or discrepancy in the Contract Documents unless Contractor knew or reasonably should have known thereof.
- B. Resolving Discrepancies
 - 1. Except as may be otherwise specifically stated in the Contract Documents, the provisions of the Contract Documents shall take precedence in resolving any conflict, error, ambiguity, or discrepancy between the provisions of the Contract Documents and:
 - a. the provisions of any standard, specification, manual, code, or instruction (whether or not specifically incorporated by reference in the Contract Documents); or

- b. the provisions of any Laws or Regulations applicable to the performance of the Work (unless such an interpretation of the provisions of the Contract Documents would result in violation of such Law or Regulation).

3.04 Amending and Supplementing Contract Documents

- A. The Contract Documents may be amended to provide for additions, deletions, and revisions in the Work or to modify the terms and conditions thereof by either a Change Order or a Work Change Directive.
- B. The requirements of the Contract Documents may be supplemented and minor variations and deviations in the Work may be authorized, by one or more of the following ways:
 - 1. A Field Order;
 - 2. Construction Coordinator approval of a Shop Drawing or Sample; (Subject to the provisions of Paragraph 6.17.D.3); or
 - 3. Construction Coordinator written interpretation or clarification.

3.05 Reuse of Documents

- A. Contractor and any Subcontractor or Supplier or other individual or entity performing or furnishing all of the Work under a direct or indirect contract with Contractor, shall not:
 - 1. Have or acquire any title to or ownership rights in any of the Drawings, Specifications, or other documents (or copies of any thereof) prepared by or bearing the seal of Architects, Engineer or Architects and or Engineer's consultants, including electronic media editions; or
 - 2. Reuse any of such Drawings, Specifications, other documents, or copies thereof on extensions of the Project or any other project without written consent of Owner and Architect or Engineer and specific written verification or adaption by Architect or Engineer.
- B. The prohibition of this Paragraph 3.05 will survive final payment, or termination of the Contract. Nothing herein shall preclude Contractor from retaining copies of the Contract Documents for record purposes.

3.06 Electronic Data

- A. Copies of data furnished by Owner or the Construction Coordinator to Contractor or Contractor to Owner or the Construction Coordinator that may be relied upon are limited to the printed copies (also known as hard copies). Files in electronic media format of text, data, graphics, or other types are furnished only for the convenience of the receiving party. Any conclusion or information obtained or derived from such electronic files will be at the user's sole risk. If there is a discrepancy between the electronic files and the hard copies, the hard copies govern.
- B. Because data stored in electronic media format can deteriorate or be modified inadvertently or otherwise without authorization of the data's creator, the party receiving electronic files agrees that it will perform acceptance tests or procedures within 60 days, after which the receiving party shall be deemed to have accepted the data thus transferred. Any errors detected within the 60-day acceptance period will be corrected by the transferring party.

- C. When transferring documents in electronic media format, the transferring party makes no representations as to long term compatibility, usability, or readability of documents resulting from the use of software application packages, operating systems, or computer hardware differing from those used by the data's creator.

PART 4 - AVAILABILITY OF LANDS; SUBSURFACE AND PHYSICAL CONDITIONS; HAZARDOUS ENVIRONMENTAL CONDITIONS; REFERENCE POINTS

4.01 Availability of Lands

- A. Owner shall furnish the Site. Owner shall notify Contractor of any encumbrances or restrictions not of general application but specifically related to use of the Site with which Contractor must comply in performing the Work. Owner will obtain in a timely manner and pay for easements for permanent structures or permanent changes in existing facilities. If Contractor and Owner are unable to agree on entitlement to or on the amount or extent, if any, of any adjustment in the Contract Price or Contract Times, or both, as a result of any delay in Owner's furnishing the Site or a part thereof, Contractor may make a Claim therefor as provided in Paragraph 10.05.
- B. Upon reasonable written request, Owner shall furnish Contractor with a current statement of record legal title and legal description of the lands upon which the Work is to be performed and Owner's interest therein as necessary for giving notice of or filing a mechanic's or construction lien against such lands in accordance with applicable Laws and Regulations.
- C. Contractor shall provide for all additional lands and access thereto that may be required for temporary construction facilities or storage of materials and equipment.

4.02 Subsurface and Physical Conditions

- A. Reports and Drawings: Reports of explorations and tests of subsurface conditions at or contiguous to the Site have not been conducted. The contractor should insure that capable soils are found for any and all compacted surfaces.

4.03 Differing Subsurface or Physical Conditions

- A. Notice: If Contractor believes that any subsurface or physical condition at or contiguous to the Site that is uncovered or revealed either:
 - 1. is of such a nature as to establish that any "technical data" on which Contractor is entitled to rely as provided in Paragraph 4.02 is materially inaccurate; or
 - 2. is of such a nature as to require a change in the Contract Documents; or
 - 3. differs materially from that shown or indicated in the Contract Documents; or
 - 4. is of an unusual nature, and differs materially from conditions ordinarily encountered and generally recognized as inherent in work of the character provided for in the Contract Documents; then Contractor shall, promptly after becoming aware thereof and before further disturbing the subsurface or physical conditions or performing any Work in connection therewith (except in an emergency as required by Paragraph 6.16.A), notify Owner and the Construction Coordinator in writing about such condition. Contractor shall not further disturb such condition or perform any Work in connection therewith (except as aforesaid) until receipt of written order to do so.
- B. Construction Coordinator Review: After receipt of written notice as required by Paragraph 4.03.A, Construction Coordinator will promptly review the pertinent condition, determine the

necessity of Owner's obtaining additional exploration or tests with respect thereto, and advise Owner in writing (with a copy to Contractor) of the Construction Coordinator findings and conclusions.

C. Possible Price and Times Adjustments

1. The Contract Price or the Contract Times, or both, will be equitably adjusted to the extent that the existence of such differing subsurface or physical condition causes an increase or decrease in Contractor's cost of, or time required for, performance of the Work; subject, however, to the following:
 - a. such condition must meet any one or more of the categories described in Paragraph 4.03.A; and
 - b. with respect to Work that is paid for on a Unit Price Basis, any adjustment in Contract Price will be subject to the provisions of Paragraphs 9.07 and 11.03.
2. Contractor shall not be entitled to any adjustment in the Contract Price or Contract Times if:
 - a. Contractor knew of the existence of such conditions at the time Contractor made a final commitment to Owner with respect to Contract Price and Contract Times by the submission of a Bid or becoming bound under a negotiated contract; or
 - b. the existence of such condition could reasonably have been discovered or revealed as a result of any examination, investigation, exploration, test, or study of the Site and contiguous areas required by the Bidding Requirements or Contract Documents to be conducted by or for Contractor prior to Contractor's making such final commitment; or
 - c. Contractor failed to give the written notice as required by Paragraph 4.03.A.
3. If Owner and Contractor are unable to agree on entitlement to or on the amount or extent, if any, of any adjustment in the Contract Price or Contract Times, or both, a Claim may be made therefor as provided in Paragraph 10.05. However, Owner and the Construction Coordinator, and any of their Related Entities shall not be liable to Contractor for any claims, costs, losses, or damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) sustained by Contractor on or in connection with any other project or anticipated project.

4.04 Underground Facilities

- A. Shown or Indicated: The information and data shown or indicated in the Contract Documents with respect to existing Underground Facilities at or contiguous to the Site is based on information and data furnished to Owner or the Construction Coordinator by the owners of such Underground Facilities, including Owner, or by others:
 1. Owner and Construction Coordinator shall not be responsible for the accuracy or completeness of any such information or data; and
 2. The cost of all of the following will be included in the Contract Price, and Contractor shall have full responsibility for:
 - a. reviewing and checking all such information and data,
 - b. locating all Underground Facilities shown or indicated in the Contract Documents,

- c. coordination of the Work with the owners of such Underground Facilities, including Owner, during construction, and
- d. the safety and protection of all such Underground Facilities and repairing any damage thereto resulting from the Work.

B. Not Shown or Indicated

1. If an Underground Facility is uncovered or revealed at or contiguous to the Site which was not shown or indicated, or not shown or indicated with reasonable accuracy in the Contract Documents, Contractor shall, promptly after becoming aware thereof and before further disturbing conditions affected thereby or performing any Work in connection therewith (except in an emergency as required by Paragraph 6.16.A), identify the owner of such Underground Facility and give written notice to that owner and to Owner and the Construction Coordinator. Construction Coordinator will promptly review the Underground Facility and determine the extent, if any, to which a change is required in the Contract Documents to reflect and document the consequences of the existence or location of the Underground Facility. During such time, Contractor shall be responsible for the safety and protection of such Underground Facility.
2. If the Construction Coordinator concludes that a change in the Contract Documents is required, a Work Change Directive or a Change Order will be issued to reflect and document such consequences. An equitable adjustment shall be made in the Contract Price or Contract Times, or both, to the extent that they are attributable to the existence or location of any Underground Facility that was not shown or indicated or not shown or indicated with reasonable accuracy in the Contract Documents and that Contractor did not know of and could not reasonably have been expected to be aware of or to have anticipated. If Owner and Contractor are unable to agree on entitlement to or on the amount or extent, if any, of any such adjustment in Contract Price or Contract Times, Owner or Contractor may make a Claim therefor as provided in Paragraph 10.05.

4.05 Reference Points

- A. Owner shall provide engineering surveys to establish reference points for construction which in the Construction Coordinator judgment are necessary to enable Contractor to proceed with the Work. Contractor shall be responsible for laying out the Work, shall protect and preserve the established reference points and property monuments, and shall make no changes or relocations without the prior written approval of Owner. Contractor shall report to the Construction Coordinator whenever any reference point or property monument is lost or destroyed or requires relocation because of necessary changes in grades or locations, and shall be responsible for the accurate replacement or relocation of such reference points or property monuments by professionally qualified personnel.

4.06 Hazardous Environmental Condition at Site

- A. Reports: See S&ME report attached as exhibit "A".

PART 5 - BONDS AND INSURANCE

5.01 Performance, Payment, and Other Bonds

- A. Contractor shall furnish performance and payment bonds, each in an amount at least equal to the Contract Price as security for the faithful performance and payment of all of Contractor's obligations under the Contract Documents. These bonds shall remain in effect until one year after the date when final payment becomes due or until completion of the correction period

specified in Paragraph 13.07, whichever is later, except as provided otherwise by Laws or Regulations or by the Contract Documents. Contractor shall also furnish such other bonds as are required by the Contract Documents.

- B. All bonds shall be in the form prescribed by the Contract Documents except as provided otherwise by Laws or Regulations, and shall be executed by such sureties as are named in the current list of "Companies Holding Certificates of Authority as Acceptable Sureties on Federal Bonds and as Acceptable Reinsuring Companies" as published in Circular 570 (amended) by the Financial Management Service, Surety Bond Branch, U.S. Department of the Treasury. All bonds signed by an agent must be accompanied by a certified copy of the agent's authority to act.
- C. If the surety on any bond furnished by Contractor is declared bankrupt or becomes insolvent or its right to do business is terminated in any state where any part of the Project is located or it ceases to meet the requirements of Paragraph 5.01.B, Contractor shall promptly notify Owner and the Construction Coordinator and shall, within 20 days after the event giving rise to such notification, provide another bond and surety, both of which shall comply with the requirements of Paragraphs 5.01.B and 5.02.

5.02 Licensed Sureties and Insurers

- A. All bonds and insurance required by the Contract Documents to be purchased and maintained by Owner or Contractor shall be obtained from surety or insurance companies that are duly licensed or authorized in the jurisdiction in which the Project is located to issue bonds or insurance policies for the limits and coverages so required. Such surety and insurance companies shall also meet such additional requirements and qualifications.

5.03 Certificates of Insurance

- A. Contractor shall deliver to Owner, with copies to each additional insured, certificates of insurance (and other evidence of insurance requested by Owner or any other additional insured) which Contractor is required to purchase and maintain.
- B. Owner shall deliver to Contractor, with copies to each additional insured, certificates of insurance (and other evidence of insurance requested by Contractor or any other additional insured) which Owner is required to purchase and maintain.
- C. Failure of Owner to demand such certificates or other evidence of full compliance with these insurance requirements or failure of Owner to identify a deficiency from evidence provided shall not be construed as a waiver of Contractor's obligation to maintain such insurance.
- D. By requiring such insurance and insurance limits herein, Owner does not represent that coverage and limits will necessarily be adequate to protect contractor and such coverage and limits shall not be deemed as a limitation on Contractor's liability or the indemnities granted to Owner in the Contract Documents.

5.04 Contractor's Liability Insurance

- A. Contractor shall purchase and maintain such liability and other insurance as is appropriate for the Work being performed and as will provide protection from claims set forth below which may arise out of or result from Contractor's performance of the Work and Contractor's other obligations under the Contract Documents, whether it is to be performed by Contractor, any Subcontractor or Supplier, or by anyone directly or indirectly employed by any of them to perform any of the Work, or by anyone for whose acts any of them may be liable:

1. claims under workers' compensation, disability benefits, and other similar employee benefit acts;
 2. claims for damages because of bodily injury, occupational sickness or disease, or death of Contractor's employees;
 3. claims for damages because of bodily injury, sickness or disease, or death of any person other than Contractor's employees;
 4. claims for damages insured by reasonably available personal injury liability coverage which are sustained:
 - a. by any person as a result of an offense directly or indirectly related to the employment of such person by Contractor, or
 - b. by any other person for any other reason;
 5. claims for damages, other than to the Work itself, because of injury to or destruction of tangible property wherever located, including loss of use resulting therefrom; and
 6. claims for damages because of bodily injury or death of any person or property damage arising out of the ownership, maintenance or use of any motor vehicle.
- B. The policies of insurance required by this Paragraph 5.04 shall:
1. with respect to insurance required by Paragraphs 5.04.A.3 through 5.04.A.6 inclusive, include as additional insured (subject to any customary exclusion regarding professional liability) Owner and Construction Coordinator, and any other individuals or entities, all of whom shall be listed as additional insureds, and include coverage for the respective officers, directors, partners, employees, agents, consultants and subcontractors of each and any of all such additional insureds, and the insurance afforded to these additional insureds shall provide primary coverage for all claims covered thereby;
 2. include at least the specific coverages and be written for not less than the limits of liability provided or required by Laws or Regulations, whichever is greater;
 3. include completed operations insurance;
 4. include contractual liability insurance covering Contractor's indemnity obligations under Paragraphs 6.11 and 6.20;
 5. contain a provision or endorsement that the coverage afforded will not be canceled, materially changed or renewal refused until at least 30 days' prior written notice has been given to Owner and Contractor and to each other additional insured to whom a certificate of insurance has been issued (and the certificates of insurance furnished by the Contractor pursuant to Paragraph 5.03 will so provide);
 6. remain in effect at least until final payment and at all times thereafter when Contractor may be correcting, removing, or replacing defective Work in accordance with Paragraph 13.07; and
 7. with respect to completed operations insurance, and any insurance coverage written on a claims-made basis, remain in effect for at least two years after final payment.
 - a. Contractor shall furnish Owner and each other additional insured to whom a certificate of insurance has been issued, evidence satisfactory to Owner and any

such additional insured of continuation of such insurance at final payment and one year thereafter.

C. The limits of liability for the insurance required by Paragraph 5.04 of the General Conditions shall provide coverage for not less than the following amounts or greater where required by Laws and Regulations:

1. Workers' Compensation, and related coverages under Paragraphs 5.04.A.1 and A.2 of the General Conditions:

- a. State: South Carolina
Statutory Benefits
- b. Applicable Federal (e.g., Longshoreman's): Statutory
- c. Employer's Liability:

Each Accident	\$1,000,000
Disease-Policy Limit	\$500,000
Disease-Each Employee	\$500,000

2. Contractor's General Liability under Paragraphs 5.04.A.3 through A.6 of the General Conditions which shall include completed operations and product liability coverages and eliminate the exclusion with respect to property under the care, custody and control of Contractor and for this project only:

- a. General Aggregate \$2,000,000
- b. Products - Completed Operations Aggregate \$2,000,000
- c. Personal and Advertising Injury \$1,000,000
- d. Each Occurrence (Bodily Injury and Property Damage) \$1,000,000
- e. Fire Damage (any one (1) fire) \$50,000
- f. Medical Expense (any one (1) person) \$5,000
- g. Property Damage liability insurance will provide Explosion, Collapse, and Under-ground coverages where applicable.
- h. Excess or Umbrella Liability
 - 1) General Aggregate \$2,000,000
 - 2) Each Occurrence \$2,000,000

3. Automobile Liability under Paragraph 5.04.A.6 of the General Conditions:

- a. Include coverage for all owned, hired and non-owned automobiles.
- b. Combined Single Limit of \$1,000,000
- c. Each Occurrence \$1,000,000
- d. Limits Medical Expense \$5,000

4. The Contractual Liability coverage required by Paragraph 5.04.B.4 of the General Conditions shall provide coverage for not less than the following amounts:
 - a. Bodily Injury:

Each Accident	\$2,000,000
Annual Aggregate	\$2,000,000
 - b. Property Damage:

Each Accident	\$2,000,000
Annual Aggregate	\$2,000,000
5. Flood Insurance: The Contractor is required to carry flood insurance for projects located in designated flood hazard areas in which Federal Flood Insurance is available.

5.05 Owner’s Liability Insurance

- A. In addition to the insurance required to be provided by Contractor under Paragraph 5.04, Owner, at Owner’s option, may purchase and maintain at Owner’s expense Owner’s own liability insurance as will protect Owner against claims which may arise from operations under the Contract Documents.

5.06 Property Insurance

- A. Contractor shall purchase and maintain property insurance upon the Work at the Site in the amount of the full replacement cost thereof.
 1. This insurance shall:
 - a. includes the interests of Owner, Contractor, Subcontractors, Construction Coordinator and any other individuals or entities identified herein, and the officers, directors, partners, employees, agents and other consultants and subcontractors of any of them each of whom is deemed to have an insurable interest and shall be listed as an insured or additional insured;
 - b. in addition to the individuals and entities specified, include as additional insureds, the following:
 - c. be written on a Builder’s Risk “all-risk” or open peril or special causes of loss policy form that shall at least include insurance for physical loss and damage to the Work, temporary buildings, falsework, and materials and equipment in transit and shall insure against at least the following perils or causes of loss: fire, lightning, extended coverage, theft, vandalism and malicious mischief, earthquake, collapse, debris removal, demolition occasioned by enforcement of Laws and Regulations, water damage (other than that caused by flood), and such other perils or causes of loss as may be specifically required;
 - d. includes expenses incurred in the repair or replacement of any insured property (including but not limited to fees and charges of engineers and architects);
 - e. cover materials and equipment stored at the Site or at another location that was agreed to in writing by Owner prior to being incorporated in the Work, provided that such materials and equipment have been included in an Application for Payment recommended by the Construction Coordinator;
 - f. allows for partial utilization of the Work by Owner;
 - g. includes testing and startup; and

payment of any such loss, damage, or consequential loss, the insurers will have no rights of recovery against Contractor, Subcontractors, or the Construction Coordinator, and the officers, directors, partners, employees, agents, consultants and subcontractors of each and any of them.

5.08 Receipt and Application of Insurance Proceeds

- A. Any insured loss under the policies of insurance required by Paragraph 5.06 will be adjusted with Owner and made payable to Owner as fiduciary for the insureds, as their interests may appear, subject to the requirements of any applicable mortgage clause and of Paragraph 5.08.B. Owner shall deposit in a separate account any money so received and shall distribute it in accordance with such agreement as the parties in interest may reach. If no other special agreement is reached, the damaged Work shall be repaired or replaced, the moneys so received applied on account thereof, and the Work and the cost thereof covered by an appropriate Change Order.
- B. Owner as fiduciary shall have power to adjust and settle any loss with the insurers unless one of the parties in interest shall object in writing within 15 days after the occurrence of loss to Owner's exercise of this power. If such objection be made, Owner as fiduciary shall make settlement with the insurers in accordance with such agreement as the parties in interest may reach. If no such agreement among the parties in interest is reached, Owner as fiduciary shall adjust and settle the loss with the insurers and, if required in writing by any party in interest, Owner as fiduciary shall give bond for the proper performance of such duties.

5.09 Acceptance of Bonds and Insurance; Option to Replace

- A. If either Owner or Contractor has any objection to the coverage afforded by or other provisions of the bonds or insurance required to be purchased and maintained by the other party in accordance with Part 5 on the basis of nonconformance with the Contract Documents, the objecting party shall so notify the other party in writing within ten (10) days after receipt of the certificates (or other evidence requested) required by Paragraph 2.01.B. Owner and Contractor shall each provide to the other such additional information in respect of insurance provided as the other may reasonably request. If either party does not purchase or maintain all of the bonds and insurance required of such party by the Contract Documents, such party shall notify the other party in writing of such failure to purchase prior to the start of the Work, or of such failure to maintain prior to any change in the required coverage. Without prejudice to any other right or remedy, the other party may elect to obtain equivalent bonds or insurance to protect such other party's interests at the expense of the party who was required to provide such coverage, and a Change Order shall be issued to adjust the Contract Price accordingly.

5.10 Partial Utilization, Acknowledgment of Property Insurer

- A. If Owner finds it necessary to occupy or use a portion or portions of the Work prior to Substantial Completion of all the Work as provided in Paragraph 14.05, no such use or occupancy shall commence before the insurers providing the property insurance pursuant to Paragraph 5.06 have acknowledged notice thereof and in writing effected any changes in coverage necessitated thereby. The insurers providing the property insurance shall consent by endorsement on the policy or policies, but the property insurance shall not be canceled or permitted to lapse on account of any such partial use or occupancy.

PART 6 - CONTRACTOR'S RESPONSIBILITIES

6.01 Supervision and Superintendence

- A. **When working is being performed on site the superintendent must be present, without exception.**

- B. Contractor shall supervise, inspect, and direct the Work competently and efficiently, devoting such attention thereto and applying such skills and expertise as may be necessary to perform the Work in accordance with the Contract Documents. Contractor shall be solely responsible for the means, methods, techniques, sequences, and procedures of construction. Contractor shall not be responsible for the negligence of Owner or the Construction Coordinator in the design or specification of a specific means, method, technique, sequence, or procedure of construction which is shown or indicated in and expressly required by the Contract Documents.
- C. At all times during the progress of the Work, Contractor shall assign a competent resident superintendent who shall not be replaced without written notice to Owner and the Construction Coordinator except under extraordinary circumstances. The superintendent will be Contractor's representative at the Site and shall have authority to act on behalf of Contractor. All communications given to or received from the superintendent shall be binding on Contractor.

6.02 Labor; Working Hours

- A. Contractor shall provide competent, suitably qualified personnel to survey and lay out the Work and perform construction as required by the Contract Documents. Contractor shall at all times maintain good discipline and order at the Site.
- B. Except as otherwise required for the safety or protection of persons or the Work or property at the Site or adjacent thereto, and except as otherwise stated in the Contract Documents, all Work at the Site shall be performed on business days during regular working hours. Contractor will not permit the performance of Work on a Saturday, Sunday, or any legal holiday without Owner's written consent (which will not be unreasonably withheld) given after prior written notice to the Construction Coordinator.

6.03 Services, Materials, and Equipment

- A. Unless otherwise specified in the Contract Documents, Contractor shall provide and assume full responsibility for all services, materials, equipment, labor, transportation, construction equipment and machinery, tools, appliances, fuel, power, light, heat, telephone, water, sanitary facilities, temporary facilities, and all other facilities and incidentals necessary for the performance, testing, startup, and completion of the Work.
- B. All materials and equipment incorporated into the Work shall be as specified or, if not specified, shall be of good quality and new, except as otherwise provided in the Contract Documents. All special warranties and guarantees required by the Specifications shall expressly run to the benefit of Owner. If required by the Construction Coordinator, Contractor shall furnish satisfactory evidence (including reports of required tests) as to the source, kind, and quality of materials and equipment.
- C. All materials and equipment shall be stored, applied, installed, connected, erected, protected, used, cleaned, and conditioned in accordance with instructions of the applicable Supplier, except as otherwise may be provided in the Contract Documents.

6.04 Progress Schedule

- A. Contractor shall adhere to the Progress Schedule established in accordance with Paragraph 2.07 as it may be adjusted from time to time as provided below.
 - 1. Contractor shall submit to the Construction Coordinator for acceptance (to the extent indicated in Paragraph 2.07) proposed adjustments in the Progress Schedule that will not

result in changing the Contract Times. Such adjustments will comply with any provisions of the General Requirements applicable thereto.

2. Proposed adjustments in the Progress Schedule that will change the Contract Times shall be submitted in accordance with the requirements of Part 12. Adjustments in Contract Times may only be made by a Change Order.

6.05 Substitutes and “Or-Equals”

A. Whenever an item of material or equipment is specified or described in the Contract Documents by using the name of a proprietary item or the name of a particular Supplier, the specification or description is intended to establish the type, function, appearance, and quality required. Unless the specification or description contains or is followed by words reading that no like, equivalent, or “or-equal” item or no substitution is permitted, other items of material or equipment or material or equipment of other Suppliers may be submitted to the Construction Coordinator for review under the circumstances described below.

1. “Or-Equal” Items: If in the Construction Coordinators sole discretion an item of material or equipment proposed by Contractor is functionally equal to that named and sufficiently similar so that no change in related Work will be required, it may be considered by Engineer as an “or-equal” item, in which case review and approval of the proposed item may, in Engineer’s sole discretion, be accomplished without compliance with some or all of the requirements for approval of proposed substitute items. For the purposes of this Paragraph 6.05.A.1, a proposed item of material or equipment will be considered functionally equal to an item so named if:

a. in the exercise of reasonable judgment Engineer determines that:

- 1) it is at least equal in materials of construction, quality, durability, appearance, strength, and design characteristics;
- 2) it will reliably perform at least equally well the function and achieve the results imposed by the design concept of the completed Project as a functioning whole,
- 3) it has a proven record of performance and availability of responsive service; and

b. Contractor certifies that, if approved and incorporated into the Work:

- 1) there will be no increase in cost to the Owner or increase in Contract Times, and
- 2) it will conform substantially to the detailed requirements of the item named in the Contract Documents.

2. Substitute Items

a. If in the Construction Coordinators sole discretion an item of material or equipment proposed by Contractor does not qualify as an “or-equal” item under Paragraph 6.05.A.1, it will be considered a proposed substitute item.

b. Contractor shall submit sufficient information as provided below to allow the Construction Coordinator to determine that the item of material or equipment proposed is essentially equivalent to that named and an acceptable substitute therefor. Requests for review of proposed substitute items of material or equipment will not be accepted by the Construction Coordinator from anyone other than Contractor.

- c. The requirements for review by the Construction Coordinator will be as set forth in Paragraph 6.05.A.2.d, as supplemented in the General Requirements and as the Construction Coordinator may decide is appropriate under the circumstances.
 - d. Contractor shall make written application to the Construction Coordinator for review of a proposed substitute item of material or equipment that Contractor seeks to furnish or use. The application:
 - 1) shall certify that the proposed substitute item will:
 - a) perform adequately the functions and achieve the results called for by the general design,
 - b) be similar in substance to that specified, and
 - c) be suited to the same use as that specified;
 - 2) will state:
 - a) the extent, if any, to which the use of the proposed substitute item will prejudice Contractor's achievement of Substantial Completion on time;
 - b) whether or not use of the proposed substitute item in the Work will require a change in any of the Contract Documents (or in the provisions of any other direct contract with Owner for other work on the Project) to adapt the design to the proposed substitute item; and
 - c) whether or not incorporation or use of the proposed substitute item in connection with the Work is subject to payment of any license fee or royalty;
 - 3) will identify:
 - a) all variations of the proposed substitute item from that specified, and
 - b) available engineering, sales, maintenance, repair, and replacement services;
 - 4) and shall contain an itemized estimate of all costs or credits that will result directly or indirectly from use of such substitute item, including costs of redesign and claims of other contractors affected by any resulting change,
- B. Substitute Construction Methods or Procedures: If a specific means, method, technique, sequence, or procedure of construction is expressly required by the Contract Documents, Contractor may furnish or utilize a substitute means, method, technique, sequence, or procedure of construction approved by the Construction Coordinator. Contractor shall submit sufficient information to allow the Construction Coordinator, in the Construction Coordinator's sole discretion, to determine that the substitute proposed is equivalent to that expressly called for by the Contract Documents. The requirements for review by the Construction Coordinator will be similar to those provided in Paragraph 6.05.A 2.
- C. Construction Coordinator Evaluation: The Construction Coordinator will be allowed a reasonable time within which to evaluate each proposal or submittal made pursuant to Paragraphs 6.05.A and 6.05.B. The Construction Coordinator may require Contractor to furnish additional data about the proposed substitute item. The Construction Coordinator will be the sole judge of acceptability. No "or equal" or substitute will be ordered, installed or utilized until the Construction Coordinator's review is complete, which will be evidenced by either a Change Order for a substitute or an approved Shop Drawing for an "or-equal." The Construction Coordinator will advise Contractor in writing of any negative determination.

- D. Special Guarantee: Owner may require Contractor to furnish at Contractor's expense a special performance guarantee or other surety with respect to any substitute.
- E. Cost Reimbursement: The Construction Coordinator will record the Architect or Engineer's costs in evaluating a substitute proposed or submitted by Contractor pursuant to Paragraphs 6.05.A.2 and 6.05.B Whether or not the Construction Coordinator approves a substitute item so proposed or submitted by Contractor, Contractor shall reimburse Owner for the charges of the Architect or Engineer for evaluating each such proposed substitute. Contractor shall also reimburse Owner for the charges of the Architect or Engineer for making changes in the Contract Documents (or in the provisions of any other direct contract with Owner) resulting from the acceptance of each proposed substitute.
- F. Contractor's Expense: Contractor shall provide all data in support of any proposed substitute or "or-equal" at Contractor's expense.

6.06 Concerning Subcontractors, Suppliers, and Others

- A. Contractor shall not employ any Subcontractor, Supplier, or other individual or entity (including those acceptable to Owner as indicated in Paragraph 6.06.B), whether initially or as a replacement, against whom Owner may have reasonable objection. Contractor shall not be required to employ any Subcontractor, Supplier, or other individual or entity to furnish or perform any of the Work against whom Contractor has reasonable objection.
- B. The identity of certain Subcontractors, Suppliers, or other individuals or entities to be submitted to Owner in advance for acceptance by Owner by a specified date prior to the Effective Date of the Agreement, and if Contractor has submitted a list thereof, Owner's acceptance (either in writing or by failing to make written objection thereto by the date indicated for acceptance or objection in the Bidding Documents or the Contract Documents) of any such Subcontractor, Supplier, or other individual or entity so identified may be revoked on the basis of reasonable objection after due investigation. Contractor shall submit an acceptable replacement for the rejected Subcontractor, Supplier, or other individual or entity, and the Contract Price will be adjusted by the difference in the cost occasioned by such replacement, and an appropriate Change Order will be issued. No acceptance by Owner of any such Subcontractor, Supplier, or other individual or entity, whether initially or as a replacement, shall constitute a waiver of any right of Owner or the Construction Coordinator to reject defective Work.
- C. Contractor shall be fully responsible to Owner and the Construction Coordinator for all acts and omissions of the Subcontractors, Suppliers, and other individuals or entities performing or furnishing any of the Work just as Contractor is responsible for Contractor's own acts and omissions. Nothing in the Contract Documents:
 - 1. shall create for the benefit of any such Subcontractor, Supplier, or other individual or entity any contractual relationship between Owner or the Construction Coordinator and any such Subcontractor, Supplier or other individual or entity, nor
 - 2. shall anything in the Contract Documents create any obligation on the part of Owner or the Construction Coordinator to pay or to see to the payment of any moneys due any such Subcontractor, Supplier, or other individual or entity except as may otherwise be required by Laws and Regulations.
- D. Contractor shall be solely responsible for scheduling and coordinating the Work of Subcontractors, Suppliers, and other individuals or entities performing or furnishing any of the Work under a direct or indirect contract with Contractor.

- E. Contractor shall require all Subcontractors, Suppliers, and such other individuals or entities performing or furnishing any of the Work to communicate with the Construction Coordinator through Contractor.
- F. The divisions and sections of the Specifications and the identifications of any Drawings shall not control Contractor in dividing the Work among Subcontractors or Suppliers or delineating the Work to be performed by any specific trade.
- G. All Work performed for Contractor by a Subcontractor or Supplier will be pursuant to an appropriate agreement between Contractor and the Subcontractor or Supplier which specifically binds the Subcontractor or Supplier to the applicable terms and conditions of the Contract Documents for the benefit of Owner and Construction Coordinator. Whenever any such agreement is with a Subcontractor or Supplier who is listed as an additional insured on the property insurance provided in Paragraph 5.06, the agreement between the Contractor and the Subcontractor or Supplier will contain provisions whereby the Subcontractor or Supplier waives all rights against Owner, Contractor, and Construction Coordinator,, and all other individuals or entities to be listed as insureds or additional insureds (and the officers, directors, partners, employees, agents, consultants and subcontractors of each and any of them) for all losses and damages caused by, arising out of, relating to, or resulting from any of the perils or causes of loss covered by such policies and any other property insurance applicable to the Work. If the insurers on any such policies require separate waiver forms to be signed by any Subcontractor or Supplier, Contractor will obtain the same.
- H. Owner or Construction Coordinator may furnish to any Subcontractor or Supplier, to the extent practicable, information about amounts paid to Contractor on account of Work performed for Contractor by a particular Subcontractor or Supplier.

6.07 Patent Fees and Royalties

- A. Contractor shall pay all license fees and royalties and assume all costs incident to the use in the performance of the Work or the incorporation in the Work of any invention, design, process, product, or device which is the subject of patent rights or copyrights held by others. If a particular invention, design, process, product, or device is specified in the Contract Documents for use in the performance of the Work and if to the actual knowledge of Owner or Construction Coordinator its use is subject to patent rights or copyrights calling for the payment of any license fee or royalty to others, the existence of such rights shall be disclosed by Owner in the Contract Documents.
- B. To the fullest extent permitted by Laws and Regulations, Contractor shall indemnify and hold harmless Owner and Construction Coordinator, and the officers, directors, partners, employees, agents, consultants and subcontractors of each and any of them from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to any infringement of patent rights or copyrights incident to the use in the performance of the Work or resulting from the incorporation in the Work of any invention, design, process, product, or device not specified in the Contract Documents.

6.08 Permits

- A. Contractor shall obtain and pay for all construction permits and licenses. Contractor shall pay all governmental charges and inspection fees necessary for the Work which are applicable at the time of opening of Bids, or, if there are no Bids, on the Effective Date of the Agreement.

6.09 Laws and Regulations

- A. Contractor shall give all notices required by and shall comply with all Laws and Regulations applicable to the performance of the Work. Except where otherwise expressly required by applicable Laws and Regulations, neither Owner nor Construction Coordinator shall be responsible for monitoring Contractor's compliance with any Laws or Regulations.
- B. If Contractor performs any Work knowing or having reason to know that it is contrary to Laws or Regulations, Contractor shall bear all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to such Work. However, it shall not be Contractor's primary responsibility to make certain that the Specifications and Drawings are in accordance with Laws and Regulations, but this shall not relieve Contractor of Contractor's obligations under Paragraph 3.03.
- C. Changes in Laws or Regulations not known at the time of opening of Bids (or, on the Effective Date of the Agreement if there were no Bids) having an effect on the cost or time of performance of the Work shall be the subject of an adjustment in Contract Price or Contract Times. If Owner and Contractor are unable to agree on entitlement to or on the amount or extent, if any, of any such adjustment, a Claim may be made therefor as provided in Paragraph 10.05.

6.10 Taxes

- A. Contractor shall pay all sales, consumer, use, and other similar taxes required to be paid by Contractor in accordance with the Laws and Regulations of the place of the Project which are applicable during the performance of the Work.

6.11 Use of Site and Other Areas

- A. Limitation on Use of Site and Other Areas
 - 1. Contractor shall confine construction equipment, the storage of materials and equipment, and the operations of workers to the Site and other areas permitted by Laws and Regulations, and shall not unreasonably encumber the Site and other areas with construction equipment or other materials or equipment. Contractor shall assume full responsibility for any damage to any such land or area, or to the owner or occupant thereof, or of any adjacent land or areas resulting from the performance of the Work.
 - 2. Should any claim be made by any such owner or occupant because of the performance of the Work, Contractor shall promptly settle with such other party by negotiation or otherwise resolve the claim by arbitration or other dispute resolution proceeding or at law.
 - 3. To the fullest extent permitted by Laws and Regulations, Contractor shall indemnify and hold harmless Owner and Construction Coordinator, and the officers, directors, partners, employees, agents, consultants and subcontractors of each and any of them from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to any claim or action, legal or equitable, brought by party against Owner, Construction Coordinator, or any other party indemnified hereunder to the extent caused by or based upon Contractor's performance of the Work.
- B. *Removal of Debris During Performance of the Work:* During the progress of the Work Contractor shall keep the Site and other areas free from accumulations of waste materials, rubbish, and other debris. Removal and disposal of such waste materials, rubbish, and other debris shall conform to applicable Laws and Regulations.

- C. *Cleaning*: Prior to Substantial Completion of the Work, Contractor shall clean the Site and the Work and make it ready for utilization by Owner. At the completion of the Work, Contractor shall remove from the Site all tools, appliances, construction equipment and machinery, and surplus materials and shall restore to original condition all property not designated for alteration by the Contract Documents.
- D. *Loading Structures*: Contractor shall not load nor permit any part of any structure to be loaded in any manner that will endanger the structure, nor shall Contractor subject any part of the Work or adjacent property to stresses or pressures that will endanger it.

6.12 Record Documents

- A. Contractor shall maintain in a safe place at the Site one record copy of all Drawings, Specifications, Addenda, Change Orders, Work Change Directives, Field Orders, and written interpretations and clarifications in good order and annotated to show changes made during construction. These record documents together with all approved Samples and a counterpart of all approved Shop Drawings will be available to Construction Coordinator for reference. Upon completion of the Work, these record documents, Samples, and Shop Drawings will be delivered to Construction Coordinator for Owner in digital format as an as-built file.

6.13 Safety and Protection

- A. Contractor shall be solely responsible for initiating, maintaining and supervising all safety precautions and programs in connection with the Work. Contractor shall take all necessary precautions for the safety of, and shall provide the necessary protection to prevent damage, injury or loss to:
 - 1. all persons on the Site or who may be affected by the Work;
 - 2. all the Work and materials and equipment to be incorporated therein, whether in storage on or off the Site; and
 - 3. other property at the Site or adjacent thereto, including trees, shrubs, lawns, walks, pavements, roadways, structures, utilities, and Underground Facilities not designated for removal, relocation, or replacement in the course of construction.
- B. Contractor shall comply with all applicable Laws and Regulations relating to the safety of persons or property, or to the protection of persons or property from damage, injury, or loss; and shall erect and maintain all necessary safeguards for such safety and protection. Contractor shall notify owners of adjacent property and of Underground Facilities and other utility owners when prosecution of the Work may affect them, and shall cooperate with them in the protection, removal, relocation, and replacement of their property.
- C. All damage, injury, or loss to any property referred to in Paragraph 6.13.A.2 or 6.13.A.3 caused, directly or indirectly, in whole or in part, by Contractor, any Subcontractor, Supplier, or any other individual or entity directly or indirectly employed by any of them to perform any of the Work, or anyone for whose acts any of them may be liable, shall be remedied by Contractor (except damage or loss attributable to the fault of Drawings or Specifications or to the acts or omissions of Owner or Construction Coordinator or , or anyone employed by any of them, or anyone for whose acts any of them may be liable, and not attributable, directly or indirectly, in whole or in part, to the fault or negligence of Contractor or any Subcontractor, Supplier, or other individual or entity directly or indirectly employed by any of them).
- D. Contractor's duties and responsibilities for safety and for protection of the Work shall continue until such time as all the Work is completed and Construction Coordinator has issued a notice

to Owner and Contractor in accordance with Paragraph 14.07.B that the Work is acceptable (except as otherwise expressly provided in connection with Substantial Completion).

6.14 Safety Representative

- A. Contractor shall designate a qualified and experienced safety representative at the Site whose duties and responsibilities shall be the prevention of accidents and the maintaining and supervising of safety precautions and programs.

6.15 Hazard Communication Programs

- A. Contractor shall be responsible for coordinating any exchange of material safety data sheets or other hazard communication information required to be made available to or exchanged between or among employers at the Site in accordance with Laws or Regulations. All MSDS Sheets shall be kept on site in good order as outlined in OSHA, laws, rules and regulations.

6.16 Emergencies

- A. In emergencies affecting the safety or protection of persons or the Work or property at the Site or adjacent thereto, Contractor is obligated to act to prevent threatened damage, injury, or loss. Contractor shall give Construction Coordinator prompt written notice if Contractor believes that any significant changes in the Work or variations from the Contract Documents have been caused thereby or are required as a result thereof. If Engineer determines that a change in the Contract Documents is required because of the action taken by Contractor in response to such an emergency, a Work Change Directive or Change Order will be issued.

6.17 Shop Drawings and Samples

- A. Contractor shall submit Shop Drawings and Samples to Construction Coordinator for review and approval in accordance with the acceptable Schedule of Submittals (as required by Paragraph 2.07). Each submittal will be identified as Construction Coordinator may require.
 - 1. Shop Drawings
 - a. Submit number of copies specified in the General Requirements.
 - b. Data shown on the Shop Drawings will be complete with respect to quantities, dimensions, specified performance and design criteria, materials, and similar data to show Construction Coordinator the services, materials, and equipment Contractor proposes to provide and to enable Engineer to review the information for the limited purposes required by Paragraph 6.17.D.
 - 2. Samples: Contractor shall also submit Samples to Construction Coordinator for review and approval in accordance with the acceptable schedule of Shop Drawings and Sample submittals.
 - a. Submit number of Samples specified in the Specifications.
 - b. Clearly identify each Sample as to material, Supplier, pertinent data such as catalog numbers, the use for which intended and other data as Construction Coordinator may require to enable Construction Coordinator to review the submittal for the limited purposes required by Paragraph 6.17.D.
- B. Where a Shop Drawing or Sample is required by the Contract Documents or the Schedule of Submittals, any related Work performed prior to Construction Coordinator's review and approval of the pertinent submittal will be at the sole expense and responsibility of Contractor.

C. Submittal Procedures

1. Before submitting each Shop Drawing or Sample, Contractor shall have determined and verified:
 - a. all field measurements, quantities, dimensions, specified performance and design criteria, installation requirements, materials, catalog numbers, and similar information with respect thereto;
 - b. the suitability of all materials with respect to intended use, fabrication, shipping, handling, storage, assembly, and installation pertaining to the performance of the Work;
 - c. all information relative to Contractor's responsibilities for means, methods, techniques, sequences, and procedures of construction, and safety precautions and programs incident thereto; and
 - d. shall also have reviewed and coordinated each Shop Drawing or Sample with other Shop Drawings and Samples and with the requirements of the Work and the Contract Documents.
2. Each submittal shall bear a stamp or specific written certification that Contractor has satisfied Contractor's obligations under the Contract Documents with respect to Contractor's review and approval of that submittal.
3. With each submittal, Contractor shall give Construction Coordinator specific written notice of any variations, that the Shop Drawing or Sample may have from the requirements of the Contract Documents. This notice shall be both a written communication separated from the Shop Drawing's or Sample Submittal; and, in addition, by a specific notation made on each Shop Drawing or Sample submitted to Construction Coordinator for review and approval of each such variation.

D. Construction Coordinator's Review

1. Construction Coordinator will provide timely review of Shop Drawings and Samples in accordance with the Schedule of Submittals acceptable to Construction Coordinator. Construction Coordinator's review and approval will be only to determine if the items covered by the submittals will, after installation or incorporation in the Work, conform to the information given in the Contract Documents and be compatible with the design concept of the completed Project as a functioning whole as indicated by the Contract Documents.
2. Construction Coordinator's review and approval will not extend to means, methods, techniques, sequences, or procedures of construction (except where a particular means, method, technique, sequence, or procedure of construction is specifically and expressly called for by the Contract Documents) or to safety precautions or programs incident thereto. The review and approval of a separate item as such will not indicate approval of the assembly in which the item functions.

3. Construction Coordinator's review and approval shall not relieve Contractor from responsibility for any variation from the requirements of the Contract Documents unless Contractor has complied with the requirements of Paragraph 6.17.C.3 and Construction Coordinator has given written approval of each such variation by specific written notation thereof incorporated in or accompanying the Shop Drawing or Sample. Construction Coordinator's review and approval shall not relieve Contractor from responsibility for complying with the requirements of Paragraph 6.17.C 1.

E. Resubmittal Procedures

1. Contractor shall make corrections required by Construction Coordinator and shall return the required number of corrected copies of Shop Drawings and submit, as required, new Samples for review and approval. Contractor shall direct specific attention in writing to revisions other than the corrections called for by the Construction Coordinator on previous submittals.
- F. Contractor shall furnish required submittals with sufficient information and accuracy in order to obtain required approval of an item with no more than three (3) submittals. Construction Coordinator will record the Architect or Engineer's time for reviewing subsequent submittals of Shop Drawings, samples or other items requiring approval and Contractor shall reimburse Owner for the Architect or Engineer's charges for such time.
- G. In the event that Contractor requests a substitution for a previously approved item, Contractor shall reimburse Owner for the Architect or Engineer's charges for such time unless the need for such substitution is beyond the control of Contractor.

6.18 Continuing the Work

- A. Contractor shall carry on the Work and adhere to the Progress Schedule during all disputes or disagreements with Owner. No Work shall be delayed or postponed pending resolution of any disputes or disagreements, except as permitted by Paragraph 15.04 or as Owner and Contractor may otherwise agree in writing.

6.19 Contractor's General Warranty and Guarantee

- A. Contractor warrants and guarantees to Owner that all Work will be in accordance with the Contract Documents and will not be defective. Construction Coordinator and its Related Entities shall be entitled to rely on representation of Contractor's warranty and guarantee.
- B. Contractor's warranty and guarantee hereunder excludes defects or damage caused by:
 1. abuse, modification, or improper maintenance or operation by persons other than Contractor, Subcontractors, Suppliers, or any other individual or entity for whom Contractor is responsible; or
 2. normal wear and tear under normal usage.
- C. Contractor's obligation to perform and complete the Work in accordance with the Contract Documents shall be absolute. None of the following will constitute an acceptance of Work that is not in accordance with the Contract Documents or a release of Contractor's obligation to perform the Work in accordance with the Contract Documents:
 1. observations by Construction Coordinator;
 2. recommendation by Construction Coordinator or payment by Owner of any progress or final payment;

3. the issuance of a certificate of Substantial Completion by Construction Coordinator or any payment related thereto by Owner;
 4. use or occupancy of the Work or any part thereof by Owner;
 5. any review and approval of a Shop Drawing or Sample submittal or the issuance of a notice of acceptability by Construction Coordinator;
 6. any inspection, test, or approval by others; or
 7. any correction of defective Work by Owner.
- D. The Contractor's General Warranty and Guarantee shall be for a period of one (1) year after work has been accepted and final payment made to the Contractor. In the case of Water and Wastewater lines, the warranty period will start after acceptance of these lines into the utility provider's system for ownership, operation, and maintenance. The Contractor accepts the transference of all warranties and guarantees to the utility provider owning and operating the new lines.

6.20 Indemnification

- A. To the fullest extent permitted by Laws and Regulations, Contractor shall indemnify and hold harmless Owner and Construction Coordinator, and the officers, directors, partners, employees, agents, consultants and subcontractors of each and any of them from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to the performance of the Work, provided that any such claim, cost, loss, or damage is attributable to bodily injury, sickness, disease, or death, or to injury to or destruction of tangible property (other than the Work itself), including the loss of use resulting therefrom but only to the extent caused by any negligent act or omission of Contractor, any Subcontractor, any Supplier, or any individual or entity directly or indirectly employed by any of them to perform any of the Work or anyone for whose acts any of them may be liable .
- B. In any and all claims against Owner or Construction Coordinator or any of their respective consultants, agents, officers, directors, partners, or employees by any employee (or the survivor or personal representative of such employee) of Contractor, any Subcontractor, any Supplier, or any individual or entity directly or indirectly employed by any of them to perform any of the Work, or anyone for whose acts any of them may be liable, the indemnification obligation under Paragraph 6.20.A shall not be limited in any way by any limitation on the amount or type of damages, compensation, or benefits payable by or for Contractor or any such Subcontractor, Supplier, or other individual or entity under workers' compensation acts, disability benefit acts, or other employee benefit acts.
- C. The indemnification obligations of Contractor under Paragraph 6.20.A shall not extend to the liability of Construction Coordinator and Construction Coordinator's officers, directors, partners, employees, agents, consultants and subcontractors arising out of:
 1. the preparation or approval of, or the failure to prepare or approve, maps, Drawings, opinions, reports, surveys, Change Orders, designs, or Specifications; or
 2. giving directions or instructions, or failing to give them, if that is the primary cause of the injury or damage.

6.21 Delegation of Professional Design Services

- A. Contractor will not be required to provide professional design services unless such services are specifically required by the Contract Documents for a portion of the Work or unless such services are required to carry out Contractor's responsibilities for construction means, methods, techniques, sequences and procedures. Contractor shall not be required to provide professional services in violation of applicable law.
- B. If professional design services or certifications by a design professional related to systems, materials or equipment are specifically required of Contractor by the Contract Documents, Owner and Construction Coordinator will specify all performance and design criteria that such services must satisfy. Contractor shall cause such services or certifications to be provided by a properly licensed professional, whose signature and seal shall appear on all drawings, calculations, specifications, certifications, Shop Drawings and other submittals prepared by such professional. Shop Drawings and other submittals related to the Work designed or certified by such professional, if prepared by others, shall bear such professional's written approval when submitted to Construction Coordinator.
- C. Owner and Construction Coordinator shall be entitled to rely upon the adequacy, accuracy and completeness of the services, certifications or approvals performed by such design professionals, provided Owner and Construction Coordinator have specified to Contractor all performance and design criteria that such services must satisfy.
- D. Pursuant to this Paragraph 6.21, Construction Coordinator's review and approval of design calculations and design drawings will be only for the limited purpose of checking for conformance with performance and design criteria given and the design concept expressed in the Contract Documents. Construction Coordinator's review and approval of Shop Drawings and other submittals (except design calculations and design drawings) will be only for the purpose stated in Paragraph 6.17.D 1.
- E. Contractor shall not be responsible for the adequacy of the performance or design criteria required by the Contract Documents.

PART 7 - OTHER WORK AT THE SITE

7.01 Related Work at Site

- A. Owner may perform other work related to the Project at the Site with Owner's employees or via other direct contracts therefor, or have other work performed by utility owners. If such other work is not noted in the Contract Documents.
- B. Contractor shall afford each other contractor who is a party to such a direct contract, each utility owner and Owner, if Owner is performing other work with Owner's employees, proper and safe access to the Site, a reasonable opportunity for the introduction and storage of materials and equipment and the execution of such other work, and shall properly coordinate the Work with theirs. Contractor shall do all cutting, fitting, and patching of the Work that may be required to properly connect or otherwise make its several parts come together and properly integrate with such other work. Contractor shall not endanger any work of others by cutting, excavating, or otherwise altering their work and will only cut or alter their work with the written consent of Construction Coordinator and the others whose work will be affected. The duties and responsibilities of Contractor under this Paragraph are for the benefit of such utility owners and other contractors to the extent that there are comparable provisions for the benefit of Contractor in said direct contracts between Owner and such utility owners and other contractors.
- C. If the proper execution or results of any part of Contractor's Work depends upon work performed by others under this Part 7, Contractor shall inspect such other work and promptly report to Construction Coordinator in writing any delays, defects, or deficiencies in such other work that render it unavailable or unsuitable for the proper execution and results of

Contractor's Work. Contractor's failure to so report will constitute an acceptance of such other work as fit and proper for integration with Contractor's Work except for latent defects and deficiencies in such other work.

7.02 Coordination

- A. If Owner intends to contract with others for the performance of other work on the Project at the Site, the following will be set forth:
 - 1. the individual or entity who will have authority and responsibility for coordination of the activities among the various contractors will be identified;
 - 2. the specific matters to be covered by such authority and responsibility will be itemized; and
 - 3. the extent of such authority and responsibilities will be provided.
- B. Owner shall have sole authority and responsibility for such coordination.

7.03 Legal Relationships

- A. Paragraphs 7.01.A and 7.02 are not applicable for utilities not under the control of Owner.
- B. Each other direct contract of Owner under Paragraph 7.01.A shall provide that the other contractor is liable to Owner and Contractor for the reasonable direct delay and disruption costs incurred by Contractor as a result of the other contractor's actions or inactions.
- C. Contractor shall be liable to Owner and any other contractor for the reasonable direct delay and disruption costs incurred by such other contractor as a result of Contractor's action or inactions.

7.04 Claims Between Contractors

- A. Should Contractor cause damage to the work or property of any other contractor at the Site, or should any claim arising out of Contractor's performance of the Work at the Site be made by any other contractor against Contractor, Owner, Construction Coordinator, or Contractor shall promptly attempt to settle with such other contractor by agreement, or to otherwise resolve the dispute by arbitration or at law.
- B. Contractor shall, to the fullest extent permitted by Laws and Regulations, indemnify and hold harmless Owner, the Construction Coordinator and the officers, directors, partners, employees, agents and other consultants and subcontractors of each and any of them from and against all claims, costs, losses and damages (including, but not limited to, fees and charges of engineers, architects, attorneys, and other professionals and court and arbitration costs) arising directly, indirectly or consequentially out of any action, legal or equitable, brought by any other contractor against Owner, Construction Coordinator, Construction Coordinator's Consultants to the extent said claim is based on or arises out of Contractor's performance of the Work. Should another contractor cause damage to the Work or property of Contractor or should the performance of work by any other contractor at the Site give rise to any other Claim, Contractor shall not institute any action, legal or equitable, against Owner, or the Construction Coordinator or permit any action against any of them to be maintained and continued in its name or for its benefit in any court or before any arbiter which seeks to impose liability on or to recover damages from Owner, or the Construction Coordinator on account of any such damage or Claim.
- C. If Contractor is delayed at any time in performing or furnishing Work by any act or neglect of another contractor, and Owner and Contractor are unable to agree as to the extent of any adjustment in Contract Times attributable thereto, Contractor may make a Claim for an

extension of times in accordance with Part 12. An extension of the Contract Times shall be Contractor's exclusive remedy with respect to Owner, and construction coordinator for any delay, disruption, interference, or hindrance caused by any other contractor. This paragraph does not prevent recovery from Owner, or construction coordinator for activities that are their respective responsibilities.

PART 8 - OWNER'S RESPONSIBILITIES

8.01 Communications to Contractor

- A. Except as otherwise provided in these General Conditions, Owner shall issue all communications to Contractor through the Construction Coordinator.

8.02 Replacement of Construction Coordinator

- A. In case of termination of the employment of the Construction Coordinator, Owner shall appoint a Construction Coordinator to whose status under the Contract Documents shall be that of the former Construction Coordinator.

8.03 Furnish Data

- A. Owner shall promptly furnish the data required of Owner under the Contract Documents.

8.04 Pay When Due

- A. Owner shall make payments to Contractor when they are due as provided in Paragraphs 14.02.C and 14.07.C.

8.05 Lands and Easements; Reports and Tests

- A. Owner's duties in respect of providing lands and easements and providing engineering surveys to establish reference points are set forth in Paragraphs 4.01 and 4.05. Paragraph 4.02 refers to Owner's identifying and making available to Contractor copies of reports of explorations and tests of subsurface conditions and drawings of physical conditions in or relating to existing surface or subsurface structures at or contiguous to the Site that have been utilized by the Architect or Engineer in preparing the Contract Documents.

8.06 Insurance

- A. Owner's responsibilities, if any, in respect to purchasing and maintaining liability and property insurance are set forth in Part 5.

8.07 Change Orders

- A. Owner is obligated to execute Change Orders as indicated in Paragraph 10.03.

8.08 Inspections, Tests, and Approvals

- A. Owner's responsibility in respect to certain inspections, tests, and approvals is set forth in Paragraph 13.03.B.

8.09 Limitations on Owner's Responsibilities

- A. The Owner shall not supervise, direct, or have control or authority over, nor be responsible for, Contractor's means, methods, techniques, sequences, or procedures of construction, or the safety precautions and programs incident thereto, or for any failure of Contractor to comply with Laws and Regulations applicable to the performance of the Work. Owner will not

be responsible for Contractor's failure to perform the Work in accordance with the Contract Documents.

8.10 Undisclosed Hazardous Environmental Condition

- A. Owner's responsibility in respect to an undisclosed Hazardous Environmental Condition is set forth in Paragraph 4.06.

8.11 Evidence of Financial Arrangements

- A. If and to the extent Owner has agreed to furnish Contractor reasonable evidence that financial arrangements have been made to satisfy Owner's obligations under the Contract Documents, Owner's responsibility in respect thereof will be as set forth.

PART 9 - Construction Coordinator's STATUS DURING CONSTRUCTION

9.01 Owner's Representative

- A. Construction Coordinator will be Owner's representative during the construction period. The duties and responsibilities and the limitations of authority of Construction Coordinator as Owner's representative during construction are set forth in the Contract Documents and will not be changed without written consent of Owner and Construction Coordinator.

9.02 Visits to Site

- A. Construction Coordinator will make visits to the Site at intervals appropriate to the various stages of construction as Engineer deems necessary in order to observe as an experienced and qualified design professional the progress that has been made and the quality of the various aspects of Contractor's executed Work. Based on information obtained during such visits and observations, Construction Coordinator, for the benefit of Owner, will determine, in general, if the Work is proceeding in accordance with the Contract Documents. Construction Coordinator will not be required to make exhaustive or continuous inspections on the Site to check the quality or quantity of the Work. Construction Coordinator's efforts will be directed toward providing for Owner a greater degree of confidence that the completed Work will conform generally to the Contract Documents. On the basis of such visits and observations, Construction Coordinator will keep Owner informed of the progress of the Work and will endeavor to guard Owner against defective Work.
- B. Construction Coordinator's visits and observations are subject to all the limitations on Construction Coordinator's authority and responsibility set forth in Paragraph 9.09. Particularly, but without limitation, during or as a result of Construction Coordinator's visits or observations of Contractor's Work Construction Coordinator will not supervise, direct, control, or have authority over or be responsible for Contractor's means, methods, techniques, sequences, or procedures of construction, or the safety precautions and programs incident thereto, or for any failure of Contractor to comply with Laws and Regulations applicable to the performance of the Work.

9.03 Project Representative

- A. If Owner and Construction Coordinator agree; Construction Coordinator will furnish a Resident Project Representative to assist Construction Coordinator in providing more extensive observation of the Work. The authority and responsibilities of any such Resident Project Representative and assistants will be as provided, and limitations on the responsibilities thereof will be as provided in Paragraph 9.09. If Owner designates another representative or agent to represent Owner at the Site who is not Construction Coordinator's consultant, agent or employee, the responsibilities and authority and limitations thereon of such other individual or entity will be as provided in Paragraph 9.09.

9.04 Authorized Variations in Work

- A. Construction Coordinator may authorize minor variations in the Work from the requirements of the Contract Documents which do not involve an adjustment in the Contract Price or the Contract Times and are compatible with the design concept of the completed Project as a functioning whole as indicated by the Contract Documents. These may be accomplished by a Field Order and will be binding on Owner and also on Contractor, who shall perform the Work involved promptly. If Owner or Contractor believes that a Field Order justifies an adjustment in the Contract Price or Contract Times, or both, and the parties are unable to agree on entitlement to or on the amount or extent, if any, of any such adjustment, a Claim may be made therefor as provided in Paragraph 10.05.

9.05 Rejecting Defective Work

- A. Construction Coordinator will have authority to reject Work, which Construction Coordinator believes to be defective, or that Construction Coordinator believes will not produce a completed Project that conforms to the Contract Documents or that will prejudice the integrity of the design concept of the completed Project as a functioning whole as indicated by the Contract Documents. Construction Coordinator will also have authority to require special inspection or testing of the Work as provided in Paragraph 13.04, whether or not the Work is fabricated, installed, or completed.

9.06 Shop Drawings, Change Orders and Payments

- A. In connection with Construction Coordinator's authority, and limitations thereof, as to Shop Drawings and Samples, see Paragraph 6.17.
- B. In connection with Construction Coordinator's authority, and limitations thereof, as to design calculations and design drawings submitted in response to a delegation of professional design services, if any, see Paragraph 6.21.
- C. In connection with Construction Coordinator's authority as to Change Orders, see Parts 10, 11, and 12.
- D. In connection with Construction Coordinator's authority as to Applications for Payment, see Part 14.

9.07 Determinations for Unit Price Work

- A. Construction Coordinator will determine the actual quantities and classifications of Unit Price Work performed by Contractor. Construction Coordinator will review with Contractor the Construction Coordinator's preliminary determinations on such matters before rendering a written decision thereon (by recommendation of an Application for Payment or otherwise). Construction Coordinator's written decision thereon will be final and binding (except as modified by Construction Coordinator to reflect changed factual conditions or more accurate data) upon Owner and Contractor, subject to the provisions of Paragraph 10.05.

9.08 Decisions on Requirements of Contract Documents and Acceptability of Work

- A. Construction Coordinator will be the initial interpreter of the requirements of the Contract Documents and judge of the acceptability of the Work thereunder. All matters in question and other matters between Owner and Contractor arising prior to the date final payment is due relating to the acceptability of the Work, and the interpretation of the requirements of the Contract Documents pertaining to the performance of the Work, will be referred initially to the Construction Coordinator in writing within 30 days of the event giving rise to the question

- B. Construction Coordinator will, with reasonable promptness, render a written decision on the issue referred. If Owner or Contractor believe that any such decision entitles them to an adjustment in the Contract Price or Contract Times or both, a Claim may be made under Paragraph 10.05. The date of Construction Coordinator's decision shall be the date of the event giving rise to the issues referenced for the purposes of Paragraph 10.05.B.
- C. Construction Coordinator's written decision on the issue referred will be final and binding on Owner and Contractor, subject to the provisions of Paragraph 10.05.
- D. When functioning as interpreter and judge under this Paragraph 9.08, Construction Coordinator will not show partiality to Owner or Contractor and will not be liable in connection with any interpretation or decision rendered in good faith in such capacity.

9.09 Limitations on Construction Coordinator's Authority and Responsibilities

- A. Neither Construction Coordinator's authority or responsibility under this Part 9 or under any other provision of the Contract Documents nor any decision made by Construction Coordinator in good faith either to exercise or not exercise such authority or responsibility or the undertaking, exercise, or performance of any authority or responsibility by Construction Coordinator shall create, impose, or give rise to any duty in contract, tort, or otherwise owed by Construction Coordinator to Contractor, any Subcontractor, any Supplier, any other individual or entity, or to any surety for or employee or agent of any of them.
- B. Construction Coordinator will not supervise, direct, control, or have authority over or be responsible for Contractor's means, methods, techniques, sequences, or procedures of construction, or the safety precautions and programs incident thereto, or for any failure of Contractor to comply with Laws and Regulations applicable to the performance of the Work. Construction Coordinator will not be responsible for Contractor's failure to perform the Work in accordance with the Contract Documents.
- C. Construction Coordinator will not be responsible for the acts or omissions of Contractor or of any Subcontractor, any Supplier, or of any other individual or entity performing any of the Work.
- D. Construction Coordinator's review of the final Application for Payment and accompanying documentation and all maintenance and operating instructions, schedules, guarantees, bonds, certificates of inspection, tests and approvals, and other documentation required to be delivered by Paragraph 14.07.A will only be to determine generally that their content complies with the requirements of, and in the case of certificates of inspections, tests, and approvals that the results certified indicate compliance with the Contract Documents.
- E. The limitations upon authority and responsibility set forth in this Paragraph 9.09 shall also apply to, the Resident Project Representative, if any, and assistants, if any.

PART 10 - CHANGES IN THE WORK; CLAIMS

10.01 Authorized Changes in the Work

- A. Without invalidating the Contract and without notice to any surety, Owner may, at any time or from time to time, order additions, deletions, or revisions in the Work by a Change Order, or a Work Change Directive. Upon receipt of any such document, Contractor shall promptly proceed with the Work involved which will be performed under the applicable conditions of the Contract Documents (except as otherwise specifically provided).
- B. If Owner and Contractor are unable to agree on entitlement to, or on the amount or extent, if any, of an adjustment in the Contract Price or Contract Times, or both, that should be allowed

as a result of a Work Change Directive, a Claim may be made therefor as provided in Paragraph 10.05.

10.02 Unauthorized Changes in the Work

- A. Contractor shall not be entitled to an increase in the Contract Price or an extension of the Contract Times with respect to any work performed that is not required by the Contract Documents as amended, modified, or supplemented as provided in Paragraph 3.04, except in the case of an emergency as provided in Paragraph 6.16 or in the case of uncovering Work as provided in Paragraph 13.04.B.

10.03 Execution of Change Orders

- A. Owner and Contractor shall execute appropriate Change Orders recommended by Construction Coordinator covering:
 - 1. changes in the Work which are: (i) ordered by Owner pursuant to Paragraph 10.01.A, required because of acceptance of defective Work under Paragraph 13.08.A or Owner's correction of defective Work under Paragraph 13.09, or (iii) agreed to by the parties;
 - 2. changes in the Contract Price or Contract Times which are agreed to by the parties, including any undisputed sum or amount of time for Work actually performed in accordance with a Work Change Directive; and
 - 3. changes in the Contract Price or Contract Times which embody the substance of any written decision rendered by Construction Coordinator pursuant to Paragraph 10.05; provided that, in lieu of executing any such Change Order, an appeal may be taken from any such decision in accordance with the provisions of the Contract Documents and applicable Laws and Regulations, but during any such appeal, Contractor shall carry on the Work and adhere to the Progress Schedule as provided in Paragraph 6.18.A.

10.04 Notification to Surety

- A. If notice of any change affecting the general scope of the Work or the provisions of the Contract Documents (including, but not limited to, Contract Price or Contract Times and Warranty Requirements) is required by the provisions of any bond to be given to a surety, the giving of any such notice will be Contractor's responsibility. The amount of each applicable bond will be adjusted to reflect the effect of any such change.

10.05 Claims

- A. Construction Coordinator's Decision Required: All Claims, except those waived pursuant to Paragraph 14.09, shall be referred to the Construction Coordinator for decision. A decision by Construction Coordinator shall be required as a condition precedent to any exercise by Owner or Contractor of any rights or remedies either may otherwise have under the Contract Documents or by Laws and Regulations in respect of such Claims.
- B. Notice: Written notice stating the general nature of each Claim shall be delivered by the claimant to Construction Coordinator and the other party to the Contract promptly (but in no event, later than 30 days) after the start of the event giving rise thereto. The responsibility to substantiate a Claim shall rest with the party making the Claim. Notice of the amount or extent of the Claim, with supporting data shall be delivered to the Construction Coordinator and the other party to the Contract within 60 days after the start of such event (unless Construction Coordinator allows additional time for claimant to submit additional or more accurate data in support of such Claim). A Claim for an adjustment in Contract Price shall be prepared in accordance with the provisions of Paragraph 12.01.B. A Claim for an adjustment in Contract Time shall be prepared in accordance with the provisions of Paragraph 12.02.B.

Each Claim shall be accompanied by claimant's written statement that the adjustment claimed is the entire adjustment to which the claimant believes it is entitled as a result of said event. The opposing party shall submit any response to Construction Coordinator and the claimant within 30 days after receipt of the claimant's last submittal (unless Construction Coordinator allows additional time).

- C. Construction Coordinator's Action: Construction Coordinator will review each Claim and, within 30 days after receipt of the last submittal of the claimant or the last submittal of the opposing party, if any, take one of the following actions in writing:
 - 1. deny the Claim in whole or in part,
 - 2. approve the Claim, or
 - 3. notify the parties that the Construction Coordinator is unable to resolve the Claim if, in the Construction Coordinator's sole discretion, it would be inappropriate for the Construction Coordinator to do so. For purposes of further resolution of the Claim, such notice shall be deemed a denial.
- D. In the event that Construction Coordinator does not take action on a Claim within said 30 days, the Claim shall be deemed denied.
- E. Non-withstanding anything herein final approval rests with the Owner.
- F. No Claim for an adjustment in Contract Price or Contract Times will be valid if not submitted in accordance with this Paragraph 10.05.

PART 11 - COST OF THE WORK; ALLOWANCES; UNIT PRICE WORK

11.01 Cost of the Work

- A. Costs Included: The term Cost of the Work means the sum of all costs, except those excluded in Paragraph 11.01.B, necessarily incurred and paid by Contractor in the proper performance of the Work. When the value of any Work covered by a Change Order or when a Claim for an adjustment in Contract Price is determined on the basis of Cost of the Work, the costs to be reimbursed to Contractor will be only those additional or incremental costs required because of the change in the Work or because of the event giving rise to the Claim. Except as otherwise may be agreed to in writing by Owner, such costs shall be in amounts no higher than those prevailing in the locality of the Project, shall include only the following items, and shall not include any of the costs itemized in Paragraph 11.01.B.
 - 1. Payroll costs for employees in the direct employ of Contractor in the performance of the Work under schedules of job classifications agreed upon by Owner and Contractor. Such employees shall include, without limitation, superintendents, foremen, and other personnel employed full time at the Site. Payroll costs for employees not employed full time on the Work shall be apportioned on the basis of their time spent on the Work. Payroll costs shall include, but not be limited to, salaries and wages plus the cost of fringe benefits, which shall include social security contributions, unemployment, excise, and payroll taxes, workers' compensation, health and retirement benefits, bonuses, sick leave, vacation and holiday pay applicable thereto. The expenses of performing Work outside of regular working hours, on Saturday, Sunday, or legal holidays, shall be included in the above to the extent authorized by Owner.
 - 2. Cost of all materials and equipment furnished and incorporated in the Work, including costs of transportation and storage thereof, and Suppliers' field services required in connection therewith. All cash discounts shall accrue to Contractor unless Owner

deposits funds with Contractor with which to make payments, in which case the cash discounts shall accrue to Owner. All trade discounts, rebates and refunds and returns from sale of surplus materials and equipment shall accrue to Owner, and Contractor shall make provisions so that they may be obtained.

3. Payments made by Contractor to Subcontractors for Work performed by Subcontractors. If required by Owner, Contractor shall obtain competitive bids from subcontractors acceptable to Owner and Contractor and shall deliver such bids to Owner, who will then determine, with the advice of Construction Coordinator, which bids, if any, will be acceptable. If any subcontract provides that the Subcontractor is to be paid on the basis of Cost of the Work plus a fee, the Subcontractor's Cost of the Work and fee shall be determined in the same manner as Contractor's Cost of the Work and fee as provided in this Paragraph 11.01.
4. Costs of special consultants (including but not limited to Engineers, Architects, testing laboratories, surveyors, attorneys, and accountants) employed for services specifically related to the Work.
5. Supplemental costs including the following:
 - a. The proportion of necessary transportation, travel, and subsistence expenses of Contractor's employees incurred in discharge of duties connected with the Work.
 - b. Cost, including transportation and maintenance, of all materials, supplies, equipment, machinery, appliances, office, and temporary facilities at the Site, and hand tools not owned by the workers, which are consumed in the performance of the Work, and cost, less market value, of such items used but not consumed which remain the property of Contractor.
 - c. Rentals of all construction equipment and machinery, and the parts thereof whether rented from Contractor or others in accordance with rental agreements approved by Owner with the advice of Construction Coordinator, and the costs of transportation, loading, unloading, assembly, dismantling, and removal thereof. All such costs shall be in accordance with the terms of said rental agreements. The rental of any such equipment, machinery, or parts shall cease when the use thereof is no longer necessary for the Work.
 - d. Sales, consumer, use, and other similar taxes related to the Work, and for which Contractor is liable, imposed by Laws and Regulations.
 - e. Deposits lost for causes other than negligence of Contractor, any Subcontractor, or anyone directly or indirectly employed by any of them or for whose acts any of them may be liable, and royalty payments and fees for permits and licenses.
 - f. Losses and damages (and related expenses) caused by damage to the Work, not compensated by insurance or otherwise, sustained by Contractor in connection with the performance of the Work (except losses and damages within the deductible amounts of property insurance established in accordance with Paragraph 5.06.D), provided such losses and damages have resulted from causes other than the negligence of Contractor, any Subcontractor, or anyone directly or indirectly employed by any of them or for whose acts any of them may be liable. Such losses shall include settlements made with the written consent and approval of Owner. No such losses, damages, and expenses shall be included in the Cost of the Work for the purpose of determining Contractor's fee.
 - g. The cost of utilities, fuel, and sanitary facilities at the Site.

- b. Contractor's costs for unloading and handling on the Site, labor, installation, overhead, profit, and other expenses contemplated for the cash allowances have been included in the Contract Price and not in the allowances, and no demand for additional payment on account of any of the foregoing will be valid.
- C. Contingency Allowance
 - 1. Contractor agrees that a contingency allowance, if any, is for the sole use of Owner to cover unanticipated costs.
- D. Prior to final payment, an appropriate Change Order will be issued as recommended by Construction Coordinator to reflect actual amounts due Contractor on account of Work covered by allowances, and the Contract Price shall be correspondingly adjusted.

11.03 Unit Price Work

- A. Initially the Contract Price will be deemed to include for all Unit Price Work an amount equal to the sum of the unit price for each separately identified item of Unit Price Work times the estimated quantity of each item as indicated in the Agreement.
- B. The estimated quantities of items of Unit Price Work are not guaranteed and are solely for the purpose of comparison of Bids and determining an initial Contract Price. Determinations of the actual quantities and classifications of Unit Price Work performed by Contractor will be made by the Owner subject to the provisions of Paragraph 9.07.
- C. Each unit price will be deemed to include an amount considered by Contractor to be adequate to cover Contractor's overhead and profit for each separately identified item.
- D. Owner or Contractor may make a Claim for an adjustment in the Contract Price in accordance with Paragraph 10.05 if:
 - 1. the quantity of any item of Unit Price Work performed by Contractor differs materially and significantly from the estimated quantity of such item indicated in the Agreement; and
 - 2. there is no corresponding adjustment with respect any other item of Work; and
 - 3. Contractor believes that Contractor is entitled to an increase in Contract Price as a result of having incurred additional expense or Owner believes that Owner is entitled to a decrease in Contract Price and the parties are unable to agree as to the amount of any such increase or decrease.

PART 12 - CHANGE OF CONTRACT PRICE; CHANGE OF CONTRACT TIMES

12.01 Change of Contract Price

- A. The Contract Price may only be changed by a Change Order. Any Claim for an adjustment in the Contract Price shall be based on written notice submitted by the party making the Claim to the Construction Coordinator and the other party to the Contract in accordance with the provisions of Paragraph 10.05. Final approval of all change orders rests with the owner.
- B. The value of any Work covered by a Change Order or of any Claim for an adjustment in the Contract Price will be determined as follows:

1. where the Work involved is covered by unit prices contained in the Contract Documents, by application of such unit prices to the quantities of the items involved (subject to the provisions of Paragraph 11.03); or
 2. where the Work involved is not covered by unit prices contained in the Contract Documents, by a mutually agreed lump sum (which may include an allowance for overhead and profit not necessarily in accordance with Paragraph 12.01.C.2); or
 3. where the Work involved is not covered by unit prices contained in the Contract Documents and agreement to a lump sum is not reached under Paragraph 12.01.B.2, on the basis of the Cost of the Work (determined as provided in Paragraph 11.01) plus a Contractor's fee for overhead and profit (determined as provided in Paragraph 12.01.C).
- C. Contractor's Fee: The Contractor's fee for overhead and profit shall be determined as follows:
1. a mutually acceptable fixed fee; or
 2. if a fixed fee is not agreed upon, then a fee based on the following percentages of the various portions of the Cost of the Work:
 - a. for costs incurred under Paragraphs 11.01.A.1 and 11.01.A.2, the Contractor's fee shall be 15 percent;
 - b. for costs incurred under Paragraph 11.01.A.3, the Contractor's fee shall be five percent;
 - c. where one or more tiers of subcontracts are on the basis of Cost of the Work plus a fee and no fixed fee is agreed upon, the intent of Paragraph 12.01.C.2.a is that the Subcontractor who actually performs the Work, at whatever tier, will be paid a fee of 15 percent of the costs incurred by such Subcontractor under Paragraphs 11.01.A.1 and 11.01.A.2 and that any higher tier Subcontractor and Contractor will each be paid a fee of five percent of the amount paid to the next lower tier Subcontractor;
 - d. no fee shall be payable on the basis of costs itemized under Paragraphs 11.01.A.4, 11.01.A.5, and 11.01.B;
 - e. the amount of credit to be allowed by Contractor to Owner for any change which results in a net decrease in cost will be the amount of the actual net decrease in cost plus a deduction in Contractor's fee by an amount equal to five percent of such net decrease; and
 - f. when both additions and credits are involved in any one change, the adjustment in Contractor's fee shall be computed on the basis of the net change in accordance with Paragraphs 12.01.C.2.a through 12.01.C.2.e, inclusive.

12.02 Change of Contract Times

- A. The Contract Times may only be changed by a Change Order. Any Claim for an adjustment in the Contract Times shall be based on written notice submitted by the party making the Claim to the Construction Coordinator and the other party to the Contract in accordance with the provisions of Paragraph 10.05. Final approval of all change orders rests with the owner.
- B. Any adjustment of the Contract Times covered by a Change Order or any Claim for an adjustment in the Contract Times will be determined in accordance with the provisions of this Part 12.

12.03 Delays

- A. Where Contractor is prevented from completing any part of the Work within the Contract Times due to delay beyond the control of Contractor, the Contract Times will be extended in an amount equal to the time lost due to such delay if a Claim is made therefor as provided in Paragraph 12.02.A. Delays beyond the control of Contractor shall include, but not be limited to, acts or neglect by Owner, acts or neglect of utility owners or other contractors performing other work as contemplated by Part 7, fires, floods, epidemics, abnormal weather conditions, or acts of God.
- B. If Owner, Construction Coordinator, or other contractors or utility owners performing other work for Owner as contemplated by Part 7, or anyone for whom Owner is responsible, delays, disrupts, or interferes with the performance or progress of the Work, then Contractor shall be entitled to an equitable adjustment in the Contract Price or the Contract Times, or both. Contractor's entitlement to an adjustment of the Contract Times is conditioned on such adjustment being essential to Contractor's ability to complete the Work within the Contract Times.
- C. If Contractor is delayed in the performance or progress of the Work by fire, flood, epidemic, abnormal weather conditions, acts of God, acts or failures to act of utility owners not under the control of Owner, or other causes not the fault of and beyond control of Owner and Contractor, then Contractor shall be entitled to an equitable adjustment in Contract Times, if such adjustment is essential to Contractor's ability to complete the Work within the Contract Times. Such an adjustment shall be Contractor's sole and exclusive remedy for the delays described in this Paragraph 12.03.C.
- D. Owner, Construction Coordinator and the Related Entities of each of them shall not be liable to Contractor for any claims, costs, losses, or damages (including but not limited to all fees and charges of Engineers, Architects, Attorneys, and other professionals and all court or arbitration or other dispute resolution costs) sustained by Contractor on or in connection with any other project or anticipated project.
- E. Contractor shall not be entitled to an adjustment in Contract Price or Contract Times for delays within the control of Contractor. Delays attributable to and within the control of a Subcontractor or Supplier shall be deemed to be delays within the control of Contractor.
- F. All claims for delays shall be submitted at the submission of any application for payment or within fifteen (15) days of the event causing the delay. Any claims made after the allowable time shall be denied.

PART 13 - TESTS AND INSPECTIONS; CORRECTION, REMOVAL OR ACCEPTANCE OF DEFECTIVE WORK

13.01 Notice of Defects

- A. Prompt notice of all defective Work of which Owner or Construction Coordinator has actual knowledge will be given to Contractor. All defective Work may be rejected, corrected, or accepted as provided in this Part 13.

13.02 Access to Work

- A. Owner, Construction Coordinator, their consultants and other representatives and personnel of Owner, independent testing laboratories, and governmental agencies with jurisdictional interests will have access to the Site and the Work at reasonable times for their observation, inspecting, and testing. Contractor shall provide them proper and safe conditions for such access and advise them of Contractor's Site safety procedures and programs so that they may comply therewith as applicable.

13.03 Tests and Inspections

- A. Contractor shall give Construction Coordinator timely notice of readiness of the Work for all required inspections, tests, or approvals and shall cooperate with inspection and testing personnel to facilitate required inspections or tests.
- B. Contractor shall employ and pay for the services of an independent testing laboratory to perform all inspections, tests, or approvals required by the Contract Documents.
- C. If Laws or Regulations of any public body having jurisdiction require any Work (or part thereof) specifically to be inspected, tested, or approved by an employee or other representative of such public body, Contractor shall assume full responsibility for arranging and obtaining such inspections, tests, or approvals, pay all costs in connection therewith, and furnish Construction Coordinator the required certificates of inspection or approval.
- D. Contractor shall be responsible for arranging and obtaining and shall pay all costs in connection with any inspections, tests, or approvals required for Owner's and Construction Coordinator's acceptance of materials or equipment to be incorporated in the Work; or acceptance of materials, mix designs, or equipment submitted for approval prior to Contractor's purchase thereof for incorporation in the Work. Such inspections, tests, or approvals shall be performed by third party organizations acceptable to Owner and Construction Coordinator.
- E. If any Work (or the work of others) that is to be inspected, tested, or approved is covered by Contractor without written concurrence of Construction Coordinator, it must, if requested by Construction Coordinator, be uncovered for observation.
- F. Uncovering Work as provided in Paragraph 13.03.E shall be at Contractor's expense unless Contractor has given Construction Coordinator timely notice of Contractor's intention to cover the same and Construction Coordinator has not acted with reasonable promptness in response to such notice.

13.04 Uncovering Work

- A. If any Work is covered contrary to the written request of Construction Coordinator, it must, if requested by Construction Coordinator, be uncovered for Construction Coordinator's observation and replaced at Contractor's expense.
- B. If Construction Coordinator considers it necessary or advisable that covered Work be observed by Construction Coordinator or inspected or tested by others, Contractor, at Construction Coordinator's request, shall uncover, expose, or otherwise make available for observation, inspection, or testing as Construction Coordinator may require, that portion of the Work in question, furnishing all necessary labor, material, and equipment.
- C. If it is found that the uncovered Work is defective, Contractor shall pay all claims, costs, losses, and damages (including but not limited to all fees and charges of Construction Coordinator, Engineers, Architects, Attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to such uncovering, exposure, observation, inspection, and testing, and of satisfactory replacement or reconstruction (including but not limited to all costs of repair or replacement of work of others); and Owner shall be entitled to an appropriate decrease in the Contract Price. If the parties are unable to agree as to the amount thereof, Owner may make a Claim therefor as provided in Paragraph 10.05.
- D. If, the uncovered Work is not found to be defective, Contractor shall be allowed an increase in the Contract Price or an extension of the Contract Times, or both, directly attributable to

such uncovering, exposure, observation, inspection, testing, replacement, and reconstruction. If the parties are unable to agree as to the amount or extent thereof, Contractor may make a Claim therefor as provided in Paragraph 10.05.

13.05 Owner May Stop the Work

- A. If the Work is defective, or Contractor fails to supply sufficient skilled workers or suitable materials or equipment, or fails to perform the Work in such a way that the completed Work will conform to the Contract Documents, Owner may order Contractor to stop the Work, or any portion thereof, until the cause for such order has been eliminated; however, this right of Owner to stop the Work shall not give rise to any duty on the part of Owner to exercise this right for the benefit of Contractor, any Subcontractor, any Supplier, any other individual or entity, or any surety for, or employee or agent of any of them.

13.06 Correction or Removal of Defective Work

- A. Promptly after receipt of notice, Contractor shall correct all defective Work, whether or not fabricated, installed, or completed, or, if the Work has been rejected by Construction Coordinator, remove it from the Project and replace it with Work that is not defective. Contractor shall pay all claims, costs, losses, and damages (including but not limited to all fees and charges of construction coordinator, engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to such correction or removal (including but not limited to all costs of repair or replacement of work of others).
- B. When correcting defective Work under the terms of this Paragraph 13.06 or Paragraph 13.07, Contractor shall take no action that would void or otherwise impair Owner's special warranty and guarantee, if any, on said Work.

13.07 Correction Period

- A. If within one year after the date of Substantial Completion (or such longer period of time as may be prescribed by the terms of any applicable special guarantee required by the Contract Documents) or by any specific provision of the Contract Documents, any Work is found to be defective, or if the repair of any damages to the land or areas made available for Contractor's use by Owner or permitted by Laws and Regulations as contemplated in Paragraph 6.11.A is found to be defective, Contractor shall promptly, without cost to Owner and in accordance with Owner's written instructions:
 - 1. repair such defective land or areas; or
 - 2. correct such defective Work; or
 - 3. if the defective Work has been rejected by Owner, remove it from the Project and replace it with Work that is not defective, and
 - 4. satisfactorily correct or repair or remove and replace any damage to other Work, to the work of others or other land or areas resulting therefrom.
- B. If Contractor does not promptly comply with the terms of Owner's written instructions, or in an emergency where delay would cause serious risk of loss or damage, Owner may have the defective Work corrected or repaired or may have the rejected Work removed and replaced. All claims, costs, losses, and damages (including but not limited to all fees and charges of construction coordinator, engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to such correction or repair or such removal and replacement (including but not limited to all costs of repair or replacement of work of others) will be paid by Contractor.

- C. In special circumstances where a particular item of equipment is placed in continuous service before Substantial Completion of all the Work, the correction period for that item may start to run from an earlier date if so provided in the Specifications.
- D. Where defective Work (and damage to other Work resulting therefrom) has been corrected or removed and replaced under this Paragraph 13.07, the correction period hereunder with respect to such Work will be extended for an additional period of one year after such correction or removal and replacement has been satisfactorily completed.
- E. Contractor's obligations under this Paragraph 13.07 are in addition to any other obligation or warranty. The provisions of this Paragraph 13.07 shall not be construed as a substitute for or a waiver of the provisions of any applicable statute of limitation or repose.

13.08 Acceptance of Defective Work

- A. If, instead of requiring correction or removal and replacement of defective Work, Owner (and, prior to Construction Coordinator's recommendation of final payment, Construction Coordinator) prefers to accept it, Owner may do so. Contractor shall pay all claims, costs, losses, and damages (including but not limited to all fees and charges of construction coordinator, engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) attributable to Owner's evaluation of and determination to accept such defective Work (such costs to be approved by Construction Coordinator as to reasonableness) and the diminished value of the Work to the extent not otherwise paid by Contractor pursuant to this sentence. If any such acceptance occurs prior to Construction Coordinator's recommendation of final payment, a Change Order will be issued incorporating the necessary revisions in the Contract Documents with respect to the Work, and Owner shall be entitled to an appropriate decrease in the Contract Price, reflecting the diminished value of Work so accepted. If the parties are unable to agree as to the amount thereof, Owner may make a Claim therefor as provided in Paragraph 10.05. If the acceptance occurs after such recommendation, an appropriate amount will be paid by Contractor to Owner.

13.09 Owner May Correct Defective Work

- A. If Contractor fails within a reasonable time after written notice from Construction Coordinator to correct defective Work or to remove and replace rejected Work as required by Construction Coordinator in accordance with Paragraph 13.06.A, or if Contractor fails to perform the Work in accordance with the Contract Documents, or if Contractor fails to comply with any other provision of the Contract Documents, Owner may, after seven (7) days written notice to Contractor, correct or remedy any such deficiency.
- B. In exercising the rights and remedies under this Paragraph 13.09, Owner shall proceed expeditiously. In connection with such corrective or remedial action, Owner may exclude Contractor from all or part of the Site, take possession of all or part of the Work and suspend Contractor's services related thereto, take possession of Contractor's tools, appliances, construction equipment and machinery at the Site, and incorporate in the Work all materials and equipment stored at the Site or for which Owner has paid Contractor but which are stored elsewhere. Contractor shall allow Owner, Owner's representatives, agents and employees, Owner's other contractors, and Construction Coordinator and Construction Coordinator's consultants access to the Site to enable Owner to exercise the rights and remedies under this Paragraph.
- C. All claims, costs, losses, and damages (including but not limited to all fees and charges of construction coordinator, engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) incurred or sustained by Owner in

exercising the rights and remedies under this Paragraph 13.09 will be charged against Contractor, and a Change Order will be issued incorporating the necessary revisions in the Contract Documents with respect to the Work; and Owner shall be entitled to an appropriate decrease in the Contract Price. If the parties are unable to agree as to the amount of the adjustment, Owner may make a Claim therefor as provided in Paragraph 10.05. Such claims, costs, losses and damages will include but not be limited to all costs of repair, or replacement of work of others destroyed or damaged by correction, removal, or replacement of Contractor's defective Work.

- D. Contractor shall not be allowed an extension of the Contract Times because of any delay in the performance of the Work attributable to the exercise by Owner of Owner's rights and remedies under this Paragraph 13.09.

PART 14 - PAYMENTS TO CONTRACTOR AND COMPLETION

14.01 Schedule of Values

- A. The Schedule of Values established as provided in Paragraph 2.07.A will serve as the basis for progress payments and will be incorporated into a form of Application for Payment acceptable to the Construction Coordinator. Progress payments on account of Unit Price Work will be based on the number of units completed.

14.02 Progress Payments

A. Applications for Payments

1. At least 20 days before the date established in the Agreement for each progress payment (but not more often than once a month), Contractor shall submit to the Construction Coordinator for review an Application for Payment filled out and signed by Contractor covering the Work completed as of the date of the Application and accompanied by such supporting documentation as is required by the Contract Documents. The date of the pay application must be the last day of the month. If payment is requested on the basis of materials and equipment not incorporated in the Work but delivered and suitably stored at the Site or at another location agreed to in writing, the Application for Payment shall also be accompanied by a bill of sale, invoice, or other documentation warranting that Owner has received the materials and equipment free and clear of all Liens and evidence that the materials and equipment are covered by appropriate property insurance or other arrangements to protect Owner's interest therein, all of which must be satisfactory to Owner.
2. Beginning with the second Application for Payment, each Application shall include an affidavit of Contractor stating that all previous progress payments received on account of the Work have been applied on account to discharge Contractor's legitimate obligations associated with prior Applications for Payment.
3. The amount of retainage with respect to progress payments will be as stipulated in the Agreement.

B. Review of Applications

1. Construction Coordinator will, within fifteen (15) days after receipt of each Application for Payment, either indicate in writing a recommendation of payment and present the Application to Owner or return the Application to Contractor indicating in writing Construction Coordinator's reasons for refusing to recommend payment. In the latter case, Contractor may make the necessary corrections and resubmit the Application.

2. Construction Coordinator's recommendation of any payment requested in an Application for Payment will constitute a representation by Construction Coordinator to Owner, based on Construction Coordinator's observations on the Site of the executed Work as an experienced and qualified design professional and on Construction Coordinator's review of the Application for Payment and the accompanying data and schedules, that to the best of Construction Coordinator's knowledge, information and belief:
 - a. the Work has progressed to the point indicated;
 - b. the quality of the Work is generally in accordance with the Contract Documents (subject to an evaluation of the Work as a functioning whole prior to or upon Substantial Completion, to the results of any subsequent tests called for in the Contract Documents, to a final determination of quantities and classifications for Unit Price Work under Paragraph 9.07, and to any other qualifications stated in the recommendation); and
 - c. the conditions precedent to Contractor's being entitled to such payment appear to have been fulfilled in so far as it is Construction Coordinator's responsibility to observe the Work.
3. By recommending any such payment Construction Coordinator will not thereby be deemed to have represented that:
 - a. inspections made to check the quality or the quantity of the Work as it has been performed have been exhaustive, extended to every aspect of the Work in progress, or involved detailed inspections of the Work beyond the responsibilities specifically assigned to Construction Coordinator in the Contract Documents; or
 - b. that there may not be other matters or issues between the parties that might entitle Contractor to be paid additionally by Owner or entitle Owner to withhold payment to Contractor.
4. Neither Construction Coordinator's review of Contractor's Work for the purposes of recommending payments nor Construction Coordinator's recommendation of any payment, including final payment, will impose responsibility on Construction Coordinator:
 - a. to supervise, direct, or control the Work, or
 - b. for the means, methods, techniques, sequences, or procedures of construction, or the safety precautions and programs incident thereto, or
 - c. for Contractor's failure to comply with Laws and Regulations applicable to Contractor's performance of the Work, or
 - d. to make any examination to ascertain how or for what purposes Contractor has used the moneys paid on account of the Contract Price, or
 - e. to determine that title to any of the Work, materials, or equipment has passed to Owner free and clear of any Liens.

5. Construction Coordinator may refuse to recommend the whole or any part of any payment if, in Construction Coordinator's opinion, it would be incorrect to make the representations to Owner stated in Paragraph 14.02.B 2. Construction Coordinator may also refuse to recommend any such payment or, because of subsequently discovered evidence or the results of subsequent inspections or tests, revise or revoke any such payment recommendation previously made, to such extent as may be necessary in Construction Coordinator's opinion to protect Owner from loss because:
 - a. the Work is defective, or completed Work has been damaged, requiring correction or replacement;
 - b. the Contract Price has been reduced by Change Orders;
 - c. Owner has been required to correct defective Work or complete Work in accordance with Paragraph 13.09; or
 - d. Construction Coordinator has actual knowledge of the occurrence of any of the events enumerated in Paragraph 15.02.A.

C. Payment Becomes Due

1. Fifteen (15) days after presentation of the Application for Payment to Owner with Construction Coordinator's recommendation, the amount recommended will (subject to the provisions of Paragraph 14.02.D) become due, and when due will be paid by Owner to Contractor.

D. Reduction in Payment

1. Owner may refuse to make payment of the full amount recommended by Construction Coordinator because:
 - a. claims have been made against Owner on account of Contractor's performance or furnishing of the Work;
 - b. Liens have been filed in connection with the Work, except where Contractor has delivered a specific bond satisfactory to Owner to secure the satisfaction and discharge of such Liens;
 - c. there are other items entitling Owner to a set-off against the amount recommended; or
 - d. Owner has actual knowledge of the occurrence of any of the events enumerated in Paragraphs 14.02.B.5.a through 14.02.B.5.c or Paragraph 15.02.A.
2. If Owner refuses to make payment of the full amount recommended by Construction Coordinator, Owner will give Contractor immediate written notice (with a copy to Construction Coordinator) stating the reasons for such action and promptly pay Contractor any amount remaining after deduction of the amount so withheld. Owner shall promptly pay Contractor the amount so withheld, or any adjustment thereto agreed to by Owner and Contractor, when Contractor corrects to Owner's satisfaction the reasons for such action.
3. If it is subsequently determined that Owner's refusal of payment was not justified, the amount wrongfully withheld shall be treated as an amount due as determined by Paragraph 14.02.C 1.

14.03 Contractor's Warranty of Title

- A. Contractor warrants and guarantees that title to all Work, materials, and equipment covered by any Application for Payment, whether incorporated in the Project or not, will pass to Owner no later than the time of payment free and clear of all Liens.

14.04 Substantial Completion

- A. When Contractor considers the entire Work ready for its intended use Contractor shall notify Owner and Construction Coordinator in writing that the entire Work is substantially complete (except for items specifically listed by Contractor as incomplete) and request that Construction Coordinator issue a certificate of Substantial Completion.
- B. Promptly after Contractor's notification, Owner, Contractor, and Construction Coordinator shall make an inspection of the Work to determine the status of completion. If Construction Coordinator does not consider the Work substantially complete, Construction Coordinator will notify Contractor in writing giving the reasons therefor.
- C. If Construction Coordinator considers the Work substantially complete, the Construction Coordinator will deliver to Owner a tentative certificate of Substantial Completion which shall fix the date of Substantial Completion. There shall be attached to the certificate a tentative list of items to be completed or corrected before final payment. Owner shall have seven (7) days after receipt of the tentative certificate during which to make written objection to Construction Coordinator as to any provisions of the certificate or attached list. If, after considering such objections, Construction Coordinator concludes that the Work is not substantially complete, Construction Coordinator will within 14 days after submission of the tentative certificate to Owner notify Contractor in writing, stating the reasons therefor. If, after consideration of Owner's objections, the Construction Coordinator considers the Work substantially complete, the Construction Coordinator will within be said 14 days execute and deliver to Owner and Contractor a definitive certificate of Substantial Completion (with a revised tentative list of items to be completed or corrected) reflecting such changes from the tentative certificate as Construction Coordinator believes justified after consideration of any objections from Owner.
- D. At the time of delivery of the tentative certificate of Substantial Completion, Construction Coordinator will deliver to Owner and Contractor a written recommendation as to division of responsibilities pending final payment between Owner and Contractor with respect to security, operation, safety, and protection of the Work, maintenance, heat, utilities, insurance, and warranties and guarantees. Unless Owner and Contractor agree otherwise in writing and so informs the Construction Coordinator in writing prior to Construction Coordinator's issuing the definitive certificate of Substantial Completion, Construction Coordinator's aforesaid recommendation will be binding on Owner and Contractor until final payment.
- E. Owner shall have the right to exclude Contractor from the Site after the date of Substantial Completion subject to allowing Contractor reasonable access to complete or correct items on the tentative list.

14.05 Partial Utilization

- A. Prior to Substantial Completion of all the Work, Owner may use or occupy any substantially completed part of the Work which has specifically been identified in the Contract Documents, or which Owner, Construction Coordinator, and Contractor agree constitutes a separately functioning and usable part of the Work that can be used by Owner for its intended purpose without significant interference with Contractor's performance of the remainder of the Work, subject to the following conditions.
 - 1. Owner at any time may request Contractor in writing to permit Owner to use or occupy any such part of the Work Which Owner believes to be ready for its intended use and

substantially complete. If and when Contractor agrees that such part of the Work is substantially complete, Contractor will certify to Owner and Construction Coordinator that such part of the Work is substantially complete and request Construction Coordinator to issue a certificate of Substantial Completion for that part of the Work.

2. Contractor at any time may notify Owner and Construction Coordinator in writing that Contractor considers any such part of the Work ready for its intended use and substantially complete and request Construction Coordinator to issue a certificate of Substantial Completion for that part of the Work. Said work should have, at a minimum, a temporary Certificate of Occupancy from the authority having jurisdiction.
3. Within a reasonable time after either such request, Owner, Contractor, and Construction Coordinator shall make an inspection of that part of the Work to determine its status of completion. If Construction Coordinator does not consider that part of the Work to be substantially complete, Construction Coordinator will notify Owner and Contractor in writing giving the reasons therefor. If Construction Coordinator considers that part of the Work to be substantially complete, the provisions of Paragraph 14.04 will apply with respect to certification of Substantial Completion of that part of the Work and the division of responsibility in respect thereof and access thereto.
4. No use or occupancy or separate operation of part of the Work may occur prior to compliance with the requirements of Paragraph 5.10 regarding property insurance.

14.06 Final Inspection

- A. Upon written notice from Contractor that the entire Work or an agreed portion thereof is complete, Construction Coordinator will promptly make a final inspection with Owner and Contractor and will notify Contractor in writing of all particulars in which this inspection reveals that the Work is incomplete or defective. Contractor shall immediately take such measures as are necessary to complete such Work or remedy such deficiencies.

14.07 Final Payment

- A. Application for Payment
 1. After Contractor has, in the opinion of Construction Coordinator, satisfactorily completed all corrections identified during the final inspection and has delivered, in accordance with the Contract Documents, all maintenance, training and operating instructions, schedules, guarantees, bonds, certificates or other evidence of insurance certificates of inspection, marked-up record documents to include digital as-buils of the project (as provided in Paragraph 6.12), and other documents, Contractor may make application for final payment following the procedure for progress payments.
 2. The final Application for Payment shall be accompanied (except as previously delivered) by:
 - a. all documentation called for in the Contract Documents, including but not limited to the evidence of insurance required by Paragraph 5.04.B.7;
 - b. consent of the surety, if any, to final payment;
 - c. a list of all Claims against Owner that Contractor believes are unsettled; and
 - d. complete and legally effective releases or waivers (satisfactory to Owner) of all Lien rights arising out of or Liens filed in connection with the Work.

3. In lieu of the releases or waivers of Liens specified in Paragraph 14.07.A.2 and as approved by Owner, Contractor may furnish receipts or releases in full and an affidavit of Contractor that: (i) the releases and receipts include all labor, services, material, and equipment for which a Lien could be filed; and (ii) all payrolls, material and equipment bills, and other indebtedness connected with the Work for which Owner or Owner's property might in any way be responsible have been paid or otherwise satisfied. If any Subcontractor or Supplier fails to furnish such a release or receipt in full, Contractor may furnish a bond or other collateral satisfactory to Owner to indemnify Owner against any Lien.

B. Construction Coordinator's Review of Application and Acceptance

1. If, on the basis of Construction Coordinator's observation of the Work during construction and final inspection, and Construction Coordinator's review of the final Application for Payment and accompanying documentation as required by the Contract Documents, Construction Coordinator is satisfied that the Work has been completed and Contractor's other obligations under the Contract Documents have been fulfilled, Construction Coordinator will, within ten (10) days after receipt of the final Application for Payment, indicate in writing Construction Coordinator's recommendation of payment and present the Application for Payment to Owner for payment. At the same time, Construction Coordinator will also give written notice to Owner and Contractor that the Work is acceptable subject to the provisions of Paragraph 14.09. Otherwise, Construction Coordinator will return the Application for Payment to Contractor, indicating in writing the reasons for refusing to recommend final payment, in which case Contractor shall make the necessary corrections and resubmit the Application for Payment.

C. Payment Becomes Due

1. Thirty (30) days after the presentation to Owner of the Application for Payment and accompanying documentation, the amount recommended by Construction Coordinator, less any sum Owner is entitled to set off against Construction Coordinator's recommendation, including but not limited to liquidated damages, will become due and, will be paid by Owner to Contractor.

14.08 Final Completion Delayed

- A. If, through no fault of Contractor, final completion of the Work is significantly delayed, and if Construction Coordinator so confirms, Owner shall, upon receipt of Contractor's final Application for Payment (for Work fully completed and accepted) and recommendation of Construction Coordinator, and without terminating the Contract, make payment of the balance due for that portion of the Work fully completed and accepted. If the remaining balance to be held by Owner for Work not fully completed or corrected is less than the retainage stipulated in the Agreement, and if bonds have been furnished as required in Paragraph 5.01, the written consent of the surety to the payment of the balance due for that portion of the Work fully completed and accepted shall be submitted by Contractor to the Construction Coordinator with the Application for such payment. Such payment shall be made under the terms and conditions governing final payment, except that it shall not constitute a waiver of Claims.

14.09 Waiver of Claims

- A. The making and acceptance of final payment will constitute:
 1. a waiver of all Claims by Owner against Contractor, except Claims arising from unsettled Liens, from defective Work appearing after final inspection pursuant to Paragraph 14.06, from failure to comply with the Contract Documents or the terms of any special

guarantees specified therein, or from Contractor's continuing obligations under the Contract Documents; and

2. a waiver of all Claims by Contractor against Owner other than those previously made in accordance with the requirements herein and expressly acknowledged by Owner in writing as still unsettled.

PART 15 - SUSPENSION OF WORK AND TERMINATION

15.01 Owner May Suspend Work

- A. At any time and without cause, Owner may suspend the Work or any portion thereof for a period of not more than 90 consecutive days by notice in writing to Contractor and Construction Coordinator which will fix the date on which Work will be resumed. Contractor shall resume the Work on the date so fixed. Contractor shall be granted an adjustment in the Contract Price or an extension of the Contract Times, or both, directly attributable to any such suspension if Contractor makes a Claim therefor as provided in Paragraph 10.05.

15.02 Owner May Terminate for Cause

- A. The occurrence of any one or more of the following events will justify termination for cause:
 1. Contractor's persistent failure to perform the Work in accordance with the Contract Documents (including, but not limited to, failure to supply sufficient skilled workers or suitable materials or equipment or failure to adhere to the Progress Schedule established under Paragraph 2.07 as adjusted from time to time pursuant to Paragraph 6.04);
 2. Contractor's disregard of Laws or Regulations of any public body having jurisdiction;
 3. Contractor's disregard of the authority of the Construction Coordinator; or
 4. Contractor's violation in any substantial way of any provisions of the Contract Documents.
- B. If one or more of the events identified in Paragraph 15.02.A occur, Owner may, after giving Contractor (and surety) seven (7) days written notice of its intent to terminate the services of Contractor:
 1. exclude Contractor from the Site, and take possession of the Work and of all Contractor's tools, appliances, construction equipment, and machinery at the Site, and use the same to the full extent they could be used by Contractor (without liability to Contractor for trespass or conversion),
 2. incorporate in the Work all materials and equipment stored at the Site or for which Owner has paid Contractor but which are stored elsewhere, and
 3. complete the Work as Owner may deem expedient.
- C. If Owner proceeds as provided in Paragraph 15.02.B, Contractor shall not be entitled to receive any further payment until the Work is completed. If the unpaid balance of the Contract Price exceeds all claims, costs, losses, and damages (including but not limited to all fees and charges of construction coordinator, engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) sustained by Owner arising out of or relating to completing the Work, such excess will be paid to Contractor. If such claims, costs, losses, and damages exceed such unpaid balance, Contractor shall pay the difference to Owner. Such claims, costs, losses, and damages incurred by Owner will be reviewed by the Construction Coordinator as to their reasonableness and, when so approved by the

Construction Coordinator, incorporated in a Change Order. When exercising any rights or remedies under this Paragraph Owner shall not be required to obtain the lowest price for the Work performed.

- D. Notwithstanding Paragraphs 15.02.B and 15.02.C, Contractor's services will not be terminated if Contractor begins within seven (7) days of receipt of notice of intent to terminate to correct its failure to perform and proceeds diligently to cure such failure within no more than 30 days of receipt of said notice.
- E. Where Contractor's services have been so terminated by Owner, the termination will not affect any rights or remedies of Owner against Contractor then existing or which may thereafter accrue. Any retention or payment of moneys due Contractor by Owner will not release Contractor from liability.
- F. If and to the extent that Contractor has provided a performance bond under the provisions of Paragraph 5.01.A, the termination procedures of that bond shall supersede the provisions of Paragraphs 15.02.B, and 15.02.C.

15.03 Owner May Terminate for Convenience

- A. Upon fifteen (15) days written notice to Contractor and Construction Coordinator, Owner may, without cause and without prejudice to any other right or remedy of Owner, terminate the Contract. In such case, Contractor shall be paid for (without duplication of any items):
 - 1. completed and acceptable Work executed in accordance with the Contract Documents prior to the effective date of termination, including fair and reasonable sums for overhead and profit on such Work;
 - 2. expenses sustained prior to the effective date of termination in performing services and furnishing labor, materials, or equipment as required by the Contract Documents in connection with uncompleted Work, plus fair and reasonable sums for overhead and profit on such expenses;
 - 3. all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) incurred in settlement of terminated contracts with Subcontractors, Suppliers, and others; and
 - 4. reasonable expenses directly attributable to termination.
- B. Contractor shall not be paid on account of loss of anticipated profits or revenue or other economic loss arising out of or resulting from such termination.

15.04 Contractor May Stop Work or Terminate

- A. If, through no act or fault of Contractor, (i) the Work is suspended for more than 90 consecutive days by Owner or under an order of court or other public authority, or (ii) Construction Coordinator fails to act on any Application for Payment within 30 days after it is submitted, or (iii) Owner fails for 30 days to pay Contractor any sum finally determined to be due, then Contractor may, upon seven (7) days written notice to Owner and Construction Coordinator, and provided Owner or Construction Coordinator do not remedy such suspension or failure within that time, terminate the Contract and recover from Owner payment on the same terms as provided in Paragraph 15.03.
- B. In lieu of terminating the Contract and without prejudice to any other right or remedy, if Construction Coordinator has failed to act on an Application for Payment within 30 days after it is submitted, or Owner has failed for 30 days to pay Contractor any sum finally determined

to be due, Contractor may, seven (7) days after written notice to Owner and Construction Coordinator, stop the Work until payment is made of all such amounts due Contractor, including interest thereon. The provisions of this Paragraph 15.04 are not intended to preclude Contractor from making a Claim under Paragraph 10.05 for an adjustment in Contract Price or Contract Times or otherwise for expenses or damage directly attributable to Contractor's stopping the Work as permitted by this Paragraph.

PART 16 - DISPUTE RESOLUTION

16.01 Methods and Procedures

- A. Either Owner or Contractor may request mediation of any Claim submitted to Construction Coordinator for a decision under Paragraph 10.05 before such decision becomes final and binding. The mediation will be governed by the Mediation Rules of the South Carolina Supreme Court in effect as of the Effective Date of the Agreement. The request for mediation shall stay the effect of paragraph 10.05.E.
- B. Owner and Contractor shall participate in the mediation process in good faith. The process shall be concluded within 60 days of the request.
- C. If the Claim is not resolved by mediation, Engineer's action under Paragraph 10.05.C or a denial pursuant to Paragraphs 10.05.C.3 or 10.05.D shall become final and binding 30 days after termination of the mediation unless, within that time period, Owner or Contractor:
 - 1. agrees with the other party to submit the Claim to another dispute resolution process, or
 - 2. gives written notice to the other party of their intent to submit the Claim to a court of competent jurisdiction.

PART 17 - MISCELLANEOUS

17.01 Giving Notice

- A. Whenever any provision of the Contract Documents requires the giving of written notice, it will be deemed to have been validly given if:
 - 1. delivered in person to the individual or to a member of the firm or to an officer of the corporation for whom it is intended, or
 - 2. delivered at or sent by registered or certified mail, postage prepaid, to the last business address known to the giver of the notice.

17.02 Computation of Times

- A. When any period of time is referred to in the Contract Documents by days, it will be computed to exclude the first and include the last day of such period. If the last day of any such period falls on a Saturday or Sunday or on a day made a legal holiday by the law of the applicable jurisdiction, such day will be omitted from the computation.

17.03 Cumulative Remedies

- A. The duties and obligations imposed by these General Conditions and the rights and remedies available hereunder to the parties hereto are in addition to, and are not to be construed in any way as a limitation of, any rights and remedies available to any or all of them which are otherwise imposed or available by Laws or Regulations, by special warranty or guarantee, or by other provisions of the Contract Documents. The provisions of this Paragraph will be as

effective as if repeated specifically in the Contract Documents in connection with each particular duty, obligation, right, and remedy to which they apply.

17.04 Survival of Obligations

- A. All representations, indemnifications, warranties, and guarantees made in, required by, or given in accordance with the Contract Documents, as well as all continuing obligations indicated in the Contract Documents, will survive final payment, completion, and acceptance of the Work or termination or completion of the Contract or termination of the services of Contractor.

17.05 Controlling Law

- A. This Contract is to be governed by the law of the State of South Carolina.

17.06 Headings

- A. Part and paragraph headings are inserted for convenience only and do not constitute parts of these General Conditions.

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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. Section includes administrative and procedural requirements governing allowances.
 - 1. Certain items are specified in the Contract Documents by allowances. Allowances have been established in lieu of additional requirements and to defer selection of actual materials and equipment to a later date when direction will be provided to Contractor. If necessary, additional requirements will be issued by Change Order.
- B. Types of allowances include the following:
 - 1. Lump-sum allowances.
 - 2. Unit-cost allowances.
- C. Temporary facilities for the Owners use during terminal renovation
- D. Temporary facilities
 - 1. Facilities for the Owner's use during the Work
 - a. Temporary public toilet
 - b. Temporary office for owner's staff
- B. Related Requirements:
 - 1. Divisions 02 through 33 Sections for items of Work covered by allowances.

1.2 SELECTION AND PURCHASE

- A. At the earliest practical date after award of the Contract, advise Architect of the date when final selection and purchase of each product or system described by an allowance must be completed to avoid delaying the Work.
- B. At Architect's request, obtain proposals for each allowance for use in making final selections. Include recommendations that are relevant to performing the Work.
- C. Purchase products and systems selected by Architect from the designated supplier.

1.3 ACTION SUBMITTALS

- A. Submit proposals for purchase of products or systems included in allowances, in the form specified for Change Orders.

1.4 INFORMATIONAL SUBMITTALS

- A. Submit invoices or delivery slips to show actual quantities of materials delivered to the site for use in fulfillment of each allowance.
- B. Submit time sheets and other documentation to show labor time and cost for installation of allowance items that include installation as part of the allowance.
- C. Coordinate and process submittals for allowance items in same manner as for other portions of the Work.
- D. Provide Manufacturer's product, pricing, and installation instructions including a monthly rate for each temporary facility

1.5 COORDINATION

- A. Coordinate allowance items with other portions of the Work. Furnish templates as required to coordinate installation.

1.6 LUMP-SUM ALLOWANCES

- A. Allowance shall include cost to Contractor of specific products and materials ordered by Owner or selected by Architect under allowance and shall include taxes, freight, and delivery to Project site.
- B. Unless otherwise indicated, Contractor's costs for receiving and handling at Project site, labor, installation, overhead and profit, and similar costs related to products and materials ordered by Owner or selected by Architect under allowance shall be included as part of the Contract Sum and not part of the allowance.
- C. Unused Materials: Return unused materials purchased under an allowance to manufacturer or supplier for credit to Owner, after installation has been completed and accepted.
 - 1. If requested by Architect, retain and prepare unused material for storage by Owner. Deliver unused material to Owner's storage space as directed.
- D. At Project closeout, credit unused amounts remaining in the contingency allowance to Owner by Change Order.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine products covered by an allowance promptly on delivery for damage or defects. Return damaged or defective products to manufacturer for replacement.

3.2 PREPARATION

- A. Coordinate materials and their installation for each allowance with related materials and installations to ensure that each allowance item is completely integrated and interfaced with related work.

3.3 SCHEDULE OF ALLOWANCES

- A. Allowance No. 1: Lump-Sum Allowance - Carpet: allow the sum of \$ 12,000.00 for the furnishing and installation of carpet including taxes. This allowance does not include the overhead and profit of the GC. The GC shall NOT issue a subcontract on this allowance without the prior approval of the Architect. This allowance does NOT include any attic stock, protection, or major floor prep. The GC is responsible for the protection of all new flooring until the Owner occupies the building.
- B. Allowance No. 2: Unit-Cost Allowance –Brick Pavers: Include the sum of \$350.00 per thousand for brick as specified in Division 32 Section "Unit Paving" and as shown on Drawings.
- C. Allowance No. 3: Unit-Cost Allowance - Tile: allow for tile raw material costs as follows: floor - 12x24 porcelain tile @ \$6.17/sf: typical wall - 12x24 porcelain tile @ \$4.65/sf: accent wall - 2x6 stone tile @ \$14.40/sf. This allowance does not include tax, installation, installer markup, GC overhead and profit of the GC. The GC shall NOT issue a subcontract on this allowance without the prior approval of the Architect. This allowance does NOT include any attic stock, protection, or major floor prep. The GC is responsible for the protection of all new flooring until the Owner occupies the building.
- D. Allowance No. 4: Lump-Sum Allowance - Generator: allow the sum of \$ 15,000.00 for the purchase of an electrical generator by the Owner. Allowance does not include any other piece of equipment nor does it include installation.
- E. Allowance No. 5: Lump-Sum Allowance – FF&E: Include a contingency allowance of \$100,000.00 for use according to Owner's written instructions.

3.4 TEMPORARY FACILITIES PRODUCTS

- 1. Temporary facilities for Owner to use during the terminal renovation. Assume rental time required is from Notice to Proceed with work on-site through date for Substantial Completion as established in the Contract Documents. Provide full tie-down of facilities matching what would

be required for an elementary or secondary school. Set-up and removal shall be turn key for all connections required including, but not limited to, ramps, power, domestic water, phone, data, radio and all other airport operations and control systems.

1. Temporary Public Toilet Facility – Basis of Design: Toilets- National Construction Rental, VIP Portable Restroom trailer (Standard Comfort Station on Skids), fully accessible with ramp and skirting.
2. Temporary Office Facility – Basis of Design; Double-Wide Deluxe Mobile Office (model 2464) by Acton Mobile - 24' x 60'. Includes ramp and skirting.
3. Substitutions for other providers of equal facilities may be submitted according to Div. 1.

END OF SECTION

SECTION 01 3300 - SUBMITTAL PROCEDURES

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. Section includes requirements for the submittal schedule and administrative and procedural requirements for submitting Shop Drawings, Product Data, Samples, and other submittals.

1.3 DEFINITIONS

- A. Action Submittals: Written and graphic information and physical samples that require Architect's responsive action. Action submittals are those submittals indicated in individual Specification Sections as "action submittals."
- B. Informational Submittals: Written and graphic information and physical samples that do not require Architect's responsive action. Submittals may be rejected for not complying with requirements. Informational submittals are those submittals indicated in individual Specification Sections as "informational submittals."
- C. File Transfer Protocol (FTP): Communications protocol that enables transfer of files to and from another computer over a network and that serves as the basis for standard Internet protocols. An FTP site is a portion of a network located outside of network firewalls within which internal and external users are able to access files.
- D. Portable Document Format (PDF): An open standard file format licensed by Adobe Systems used for representing documents in a device-independent and display resolution-independent fixed-layout document format.
- E. Submittal Schedule: Submit a schedule of submittals, arranged in chronological order by dates required by construction schedule. Include time required for review, ordering, manufacturing, fabrication, and delivery when establishing dates. Include additional time required for making corrections or revisions to submittals noted by Architect and additional time for handling and reviewing submittals required by those corrections.
 - 1. Coordinate submittal schedule with list of subcontracts, the schedule of values, and Contractor's construction schedule.
 - 2. Initial Submittal: Submit concurrently with startup construction schedule. Include submittals required during the first 60 days of construction. List those

- submittals required to maintain orderly progress of the Work and those required early because of long lead time for manufacture or fabrication.
3. Final Submittal: Submit concurrently with the first complete submittal of Contractor's construction schedule.
 - a. Submit revised submittal schedule to reflect changes in current status and timing for submittals.
 4. Format: Arrange the following information in a tabular format:
 - a. Scheduled date for first submittal.
 - b. Specification Section number and title.
 - c. Submittal category: Action; informational.
 - d. Name of subcontractor.
 - e. Description of the Work covered.
 - f. Scheduled date for Architect's final release or approval.
 - g. Scheduled date of fabrication.
 - h. Scheduled dates for purchasing.
 - i. Scheduled dates for installation.
 - j. Activity or event number.
- F. Architect's Digital Data Files: Electronic digital data files of the Contract Drawings will be provided by Architect for Contractor's use in preparing submittals.
1. Architect will furnish Contractor one set of digital data drawing files of the Contract Drawings for use in preparing Shop Drawings and Project record drawings.
 - a. Architect makes no representations as to the accuracy or completeness of digital data drawing files as they relate to the Contract Drawings.
 - b. Contractor shall execute a data licensing agreement in the form of Agreement form acceptable to Owner and Architect.
- G. Coordination: Coordinate preparation and processing of submittals with performance of construction activities.
1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.
 2. Submit all submittal items required for each Specification Section concurrently unless partial submittals for portions of the Work are indicated on approved submittal schedule.
 3. Submit action submittals and informational submittals required by the same Specification Section as separate packages under separate transmittals.
 4. Coordinate transmittal of different types of submittals for related parts of the Work so processing will not be delayed because of need to review submittals concurrently for coordination.
 - a. Architect reserves the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.

- H. Processing Time: Allow time for submittal review, including time for resubmittals, as follows. Time for review shall commence on Architect's receipt of submittal. No extension of the Contract Time will be authorized because of failure to transmit submittals enough in advance of the Work to permit processing, including resubmittals.
1. Initial Review: Allow 15 days for initial review of each submittal. Allow additional time if coordination with subsequent submittals is required. Architect will advise Contractor when a submittal being processed must be delayed for coordination.
 2. Intermediate Review: If intermediate submittal is necessary, process it in same manner as initial submittal.
 3. Resubmittal Review: Allow 15 days for review of each resubmittal.
 4. Concurrent Consultant Review: Where the Contract Documents indicate that submittals may be transmitted simultaneously to Architect and to Architect's consultants, allow 15 days for review of each submittal. Submittal will be returned to Architect before being returned to Contractor.
- I. Electronic Submittals: Identify and incorporate information in each electronic submittal file as follows:
1. Assemble complete submittal package into a single indexed file incorporating submittal requirements of a single Specification Section and transmittal form with links enabling navigation to each item.
 2. Name file with submittal number or other unique identifier, including revision identifier.
 - a. File name shall use project identifier and Specification Section number followed by a decimal point and then a sequential number (e.g., FMUHS-061000.01). Resubmittals shall include an alphabetic suffix after another decimal point (e.g., FMUHS-061000.01.A).
 3. Provide means for insertion to permanently record Contractor's review and approval markings and action taken by Architect.
 4. Transmittal Form for Electronic Submittals: Use software-generated form from electronic project management software acceptable to Owner, containing the following information:
 - a. Project name.
 - b. Date
 - c. Name and address of Architect.
 - d. Name of Contractor.
 - e. Name of firm or entity that prepared submittal.
 - f. Names of subcontractor, manufacturer, and supplier.
 - g. Category and type of submittal.
 - h. Submittal purpose and description.
 - i. Specification Section number and title.
 - j. Specification paragraph number or drawing designation and generic name for each of multiple items.

- k. Drawing number and detail references, as appropriate.
 - l. Location(s) where product is to be installed, as appropriate.
 - m. Related physical samples submitted directly.
 - n. Indication of full or partial submittal.
 - o. Transmittal number[, numbered consecutively].
 - p. Submittal and transmittal distribution record.
 - q. Other necessary identification.
 - r. Remarks.
- J. Options: Identify options requiring selection by Architect.
- K. Deviations and Additional Information: On an attached separate sheet, prepared on Contractor's letterhead, record relevant information, requests for data, revisions other than those requested by Architect on previous submittals, and deviations from requirements in the Contract Documents, including minor variations and limitations. Include same identification information as related submittal.
- L. Resubmittals: Make resubmittals in same form and number of copies as initial submittal.
- 1. Note date and content of previous submittal.
 - 2. Note date and content of revision in label or title block and clearly indicate extent of revision.
 - 3. Resubmit submittals until they are marked with approval notation from Architect's action stamp.
- M. Distribution: Furnish copies of final submittals to manufacturers, subcontractors, suppliers, fabricators, installers, authorities having jurisdiction, and others as necessary for performance of construction activities. Show distribution on transmittal forms.
- N. Use for Construction: Retain complete copies of submittals on Project site. Use only final action submittals that are marked with approval notation from Architect's action stamp.

PART 2 - PRODUCTS

2.1 SUBMITTAL PROCEDURES

- A. General Submittal Procedure Requirements: Prepare and submit submittals required by individual Specification Sections. Types of submittals are indicated in individual Specification Sections.
- 1. Post electronic submittals as PDF electronic files directly to Project Web site specifically established for Project.
 - a. Architect will return annotated file. Annotate and retain one copy of file as an electronic Project record document file.

- B. Product Data: Collect information into a single submittal for each element of construction and type of product or equipment.
1. If information must be specially prepared for submittal because standard published data are not suitable for use, submit as Shop Drawings, not as Product Data.
 2. Mark each copy of each submittal to show which products and options are applicable.
 3. Include the following information, as applicable:
 - a. Manufacturer's catalog cuts.
 - b. Manufacturer's product specifications.
 - c. Standard color charts.
 - d. Statement of compliance with specified referenced standards.
 - e. Testing by recognized testing agency.
 - f. Application of testing agency labels and seals.
 - g. Notation of coordination requirements.
 - h. Availability and delivery time information.
 4. For equipment, include the following in addition to the above, as applicable:
 - a. Wiring diagrams showing factory-installed wiring.
 - b. Printed performance curves.
 - c. Operational range diagrams.
 - d. Clearances required to other construction, if not indicated on accompanying Shop Drawings.
 5. Submit Product Data before or concurrent with Samples.
 6. Submit Product Data in the following format:
 - a. PDF electronic file.
- C. Shop Drawings: Prepare Project-specific information, drawn accurately to scale. Do not base Shop Drawings on reproductions of the Contract Documents or standard printed data.
1. Preparation: Fully illustrate requirements in the Contract Documents. Include the following information, as applicable:
 - a. Identification of products.
 - b. Schedules.
 - c. Compliance with specified standards.
 - d. Notation of coordination requirements.
 - e. Notation of dimensions established by field measurement.
 - f. Relationship and attachment to adjoining construction clearly indicated.
 - g. Seal and signature of professional engineer if specified.
 2. Sheet Size: Except for templates, patterns, and similar full-size drawings, submit Shop Drawings on sheets at least 8-1/2 by 11 inches, but no larger than 30 by 42 inches.

3. Submit Shop Drawings in the following format:
 - a. PDF electronic file.
- D. Samples: Submit Samples for review of kind, color, pattern, and texture for a check of these characteristics with other elements and for a comparison of these characteristics between submittal and actual component as delivered and installed.
 1. Transmit Samples that contain multiple, related components such as accessories together in one submittal package.
 2. Identification: Attach label on unexposed side of Samples that includes the following:
 - a. Generic description of Sample.
 - b. Product name and name of manufacturer.
 - c. Sample source.
 - d. Number and title of applicable Specification Section.
 - e. Specification paragraph number and generic name of each item.
 3. For projects where electronic submittals are required, provide corresponding electronic submittal of Sample transmittal, digital image file illustrating Sample characteristics, and identification information for record.
 4. Disposition: Maintain sets of approved Samples at Project site, available for quality-control comparisons throughout the course of construction activity. Sample sets may be used to determine final acceptance of construction associated with each set.
 - a. Samples that may be incorporated into the Work are indicated in individual Specification Sections. Such Samples must be in an undamaged condition at time of use.
 - b. Samples not incorporated into the Work, or otherwise designated as Owner's property, are the property of Contractor.
 5. Samples for Initial Selection: Submit manufacturer's color charts consisting of units or sections of units showing the full range of colors, textures, and patterns available.
 - a. Number of Samples: Submit one full set(s) of available choices where color, pattern, texture, or similar characteristics are required to be selected from manufacturer's product line. Architect will return submittal with options selected.
 6. Samples for Verification: Submit full-size units or Samples of size indicated, prepared from same material to be used for the Work, cured and finished in manner specified, and physically identical with material or product proposed for use, and that show full range of color and texture variations expected. Samples include, but are not limited to, the following: partial sections of manufactured or fabricated components; small cuts or containers of materials; complete units of repetitively used materials; swatches showing color, texture, and pattern; color range sets; and components used for independent testing and inspection.

- a. Number of Samples: Submit threesets of Samples. Architect will retain two Sample sets; remainder will be returned. Mark up and retain one returned Sample set as a project record sample.
 - 1) Submit a single Sample where assembly details, workmanship, fabrication techniques, connections, operation, and other similar characteristics are to be demonstrated.
 - 2) If variation in color, pattern, texture, or other characteristic is inherent in material or product represented by a Sample, submit at least three sets of paired units that show approximate limits of variations.

- E. Product Schedule: As required in individual Specification Sections, prepare a written summary indicating types of products required for the Work and their intended location. Include the following information in tabular form:
 - 1. Type of product. Include unique identifier for each product indicated in the Contract Documents or assigned by Contractor if none is indicated.
 - 2. Manufacturer and product name, and model number if applicable.
 - 3. Number and name of room or space.
 - 4. Location within room or space.
 - 5. Submit product schedule in the following format:
 - a. PDF electronic file.

- F. Coordination Drawing Submittals: Comply with requirements specified in Section 013100 "Project Management and Coordination."

- G. Test and Inspection Reports and Schedule of Tests and Inspections Submittals: Comply with requirements specified in Section 014000 "Quality Requirements."

- H. Closeout Submittals and Maintenance Material Submittals: Comply with requirements specified in Section 017700 "Closeout Procedures."

- I. Maintenance Data: Comply with requirements specified in Section 017823 "Operation and Maintenance Data."

- J. Qualification Data: Prepare written information that demonstrates capabilities and experience of firm or person. Include lists of completed projects with project names and addresses, contact information of architects and owners, and other information specified.

- K. Welding Certificates: Prepare written certification that welding procedures and personnel comply with requirements in the Contract Documents. Submit record of Welding Procedure Specification and Procedure Qualification Record on AWS forms. Include names of firms and personnel certified.

- L. Installer Certificates: Submit written statements on manufacturer's letterhead certifying that Installer complies with requirements in the Contract Documents and, where required, is authorized by manufacturer for this specific Project.

- M. **Manufacturer Certificates:** Submit written statements on manufacturer's letterhead certifying that manufacturer complies with requirements in the Contract Documents. Include evidence of manufacturing experience where required.
- N. **Product Certificates:** Submit written statements on manufacturer's letterhead certifying that product complies with requirements in the Contract Documents.
- O. **Material Certificates:** Submit written statements on manufacturer's letterhead certifying that material complies with requirements in the Contract Documents.
- P. **Material Test Reports:** Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting test results of material for compliance with requirements in the Contract Documents.
- Q. **Product Test Reports:** Submit written reports indicating that current product produced by manufacturer complies with requirements in the Contract Documents. Base reports on evaluation of tests performed by manufacturer and witnessed by a qualified testing agency, or on comprehensive tests performed by a qualified testing agency.
- R. **Research Reports:** Submit written evidence, from a model code organization acceptable to authorities having jurisdiction, that product complies with building code in effect for Project. Include the following information:
 - 1. Name of evaluation organization.
 - 2. Date of evaluation.
 - 3. Time period when report is in effect.
 - 4. Product and manufacturers' names.
 - 5. Description of product.
 - 6. Test procedures and results.
 - 7. Limitations of use.
- S. **Preconstruction Test Reports:** Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of tests performed before installation of product, for compliance with performance requirements in the Contract Documents.
- T. **Compatibility Test Reports:** Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of compatibility tests performed before installation of product. Include written recommendations for primers and substrate preparation needed for adhesion.
- U. **Field Test Reports:** Submit written reports indicating and interpreting results of field tests performed either during installation of product or after product is installed in its final location, for compliance with requirements in the Contract Documents.
- V. **Design Data:** Prepare and submit written and graphic information, including, but not limited to, performance and design criteria, list of applicable codes and regulations, and calculations. Include list of assumptions and other performance and design criteria and a summary of loads. Include load diagrams if applicable. Provide name and version of software, if any, used for calculations. Include page numbers.

2.2 DELEGATED-DESIGN SERVICES

- A. Performance and Design Criteria: Where professional design services or certifications by a design professional are specifically required of Contractor by the Contract Documents, provide products and systems complying with specific performance and design criteria indicated.
 - 1. If criteria indicated are not sufficient to perform services or certification required, submit a written request for additional information to Architect.
- B. Delegated-Design Services Certification: In addition to Shop Drawings, Product Data, and other required submittals, submit digitally signed PDF electronic file of certificate, signed and sealed by the responsible design professional, for each product and system specifically assigned to Contractor to be designed or certified by a design professional.
 - 1. Indicate that products and systems comply with performance and design criteria in the Contract Documents. Include list of codes, loads, and other factors used in performing these services.

PART 3 - EXECUTION

3.1 CONTRACTOR'S REVIEW

- A. Action and Informational Submittals: Review each submittal and check for coordination with other Work of the Contract and for compliance with the Contract Documents. Note corrections and field dimensions. Mark with approval stamp before submitting to Architect.
- B. Project Closeout and Maintenance Material Submittals: See requirements in Section 017700 "Closeout Procedures."
- C. Approval Stamp: Stamp each submittal with a uniform, approval stamp. Include Project name and location, submittal number, Specification Section title and number, name of reviewer, date of Contractor's approval, and statement certifying that submittal has been reviewed, checked, and approved for compliance with the Contract Documents.

3.2 ARCHITECT'S ACTION

- A. Action Submittals: Architect will review each submittal, make marks to indicate corrections or revisions required, and return it. Architect will stamp each submittal with an action stamp and will mark stamp appropriately to indicate action.
- B. Partial submittals prepared for a portion of the Work will be reviewed when use of partial submittals has received prior approval from Architect.

- C. Incomplete submittals are unacceptable, will be considered nonresponsive, and will be returned for resubmittal without review.
- D. Submittals not required by the Contract Documents may be returned by the Architect without action.

END OF SECTION 01 3300

SECTION 033000 - CAST-IN-PLACE CONCRETE

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. This Section specifies cast-in place concrete, including formwork, reinforcement, concrete materials, mix design, placement procedures, and finishes.
- B. Related Sections: The following Sections contain requirements that relate to this Section:
 - 1. Division 6 Section "Rough Carpentry" for wood construction.

1.3 DEFINITIONS

- A. Cementitious Materials: Portland cement alone or in combination with one or more of blended hydraulic cement, fly ash and other pozzolans, ground granulated blast-furnace slag, and silica fume.

1.4 SUBMITTALS

- A. Product Data: For each type of manufactured material and product, including reinforcement and forming accessories, admixtures, corrosion inhibitors, patching compounds, joint systems, curing compounds, and others as requested by the Architect.
- B. Design Mixes: For each concrete mix, including test reports. Include alternate mix designs when characteristics of materials, project conditions, weather, test results, or other circumstances warrant adjustments.
 - 1. Indicate amounts of mix water to be withheld for later addition at Project site.
- C. Steel Reinforcement Shop Drawings: Details of fabrication, bending, and placement, prepared according to ACI 315, "Details and Detailing of Concrete Reinforcement." Include material, grade, bar schedules, stirrup spacing, bent bar diagrams, arrangement, and supports of concrete reinforcement. Include special reinforcement required for openings through concrete structures.
- D. Material Certificates: Signed by manufacturers certifying that each of the following items complies with requirements:
 - 1. Cementitious materials and aggregates.
 - 2. Form – release agents.
 - 3. Steel reinforcement and reinforcement accessories.
 - 4. Admixtures.
 - 5. Curing materials.
 - 6. Bonding agents.

7. Adhesives.
8. Vapor retarders.
9. Joint-filler strips.
10. Repair materials.
11. Floor and slab treatments.
12. Water-stops.

- E. Floor surface flatness and levelness measurements to determine compliance with specified tolerances.
- F. Samples of materials as requested by the Architect, including names, sources and descriptions.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: An experienced installer who has completed concrete Work similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.
- B. Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products complying with ASTM C 94 requirements for production facilities and equipment.
 1. Manufacturer must be certified according to the National Ready Mixed Concrete Association's Certification of Ready Mixed Concrete Production Facilities.
- C. Testing Agency Qualifications: An independent testing agency, acceptable to authorities having jurisdiction, qualified according to ASTM C 1077 and ASTM E 329 to conduct the testing indicated, as documented according to ASTM E 548.
 1. Personnel conducting field tests shall be qualified as ACI Concrete Field Testing Technician, Grade 1 according to ACI CP-1 or an equivalent certification program.
- D. Source Limitations: Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant, each aggregate from one source, and each admixture from the same manufacturer.
- E. ACI Publications: Comply with the following, unless more stringent provisions are indicated:
 1. ACI 301, "Specification for Structural Concrete."
 2. ACI 117, "Specifications for Tolerances for Concrete Construction and Materials."
 3. ACI 318, "Building Code Requirements for Reinforced Concrete."

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, and handle steel reinforcement to prevent bending and damage.

PART 2 – PRODUCTS

2.1 FORM-FACING MATERIALS

- A. Forms for Exposed Finish Concrete: Form-facing panels that will provide continuous, true, and smooth concrete surfaces. Furnish in largest practicable sizes to minimize number of joints.

Form facing panels to be constructed of plywood, metal, metal-framed plywood faced, or other acceptable panel-type materials.

- B. Forms for Unexposed Finish Concrete: Plywood, lumber, metal, or another approved material. Provide lumber dressed on at least two edges and one side for tight fit.
- C. Form-Release Agent: Commercially formulated form-release agent that will not bond with, stain, or adversely affect concrete surfaces and will not impair subsequent treatments of concrete surfaces.
 - 1. Formulate form-release agent with rust inhibitor for steel form-facing materials.
- D. Form Ties: Factory-fabricated, adjustable-length, removable or snap-off metal or fiberglass form ties, designed to prevent form deflection and to prevent spalling concrete upon removed. Provide units that will leave end no closer than 1 inch to the exposed surface. Provide ties that when removed, will leave holes no larger than 1 inch in diameter at the concrete surface

2.2 STEEL REINFORCEMENT

- A. Reinforcing Bars: ASTM A 615, Grade 60, deformed.
- B. Plain-Steel Wire: ASTM A 82, as drawn.
- C. Plain-Steel Welded Wire Fabric: ASTM A 185, fabricated from as-drawn steel wire into flat sheets.

2.3 REINFORCEMENT ACCESSORIES

- A. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire fabric in place. Manufacture bar supports according to CRSI's "Manual of Standard Practice" from steel wire, plastic, or precast concrete or fiber-reinforced concrete of greater compressive strength than concrete, and as follows:
 - 1. For concrete surfaces where legs of supports are in contact with form, provide supports with legs that are protected by plastic (CRSI, Class 1) or stainless steel (CRSI, Class 2).

2.4 CONCRETE MATERIALS

- A. Portland Cement: ASTM C 150, Type I.
 - 1. Fly Ash: ASTM C 618, Class C or F.
- B. Normal-Weight Aggregate: ASTM C 33, uniformly graded, and as follows:
 - 1. For beams, elevated slabs, columns and walls nominal maximum aggregate size shall be 3/4 inch.
 - 2. For foundations, nominal maximum aggregate size shall be 1 inch.
 - 3. For ground floor slab, maximum aggregate size shall be 3/4 inch.
- C. Water: Potable and complying with ASTM C 94.

2.5 ADMIXTURES

- A. General: Admixtures certified by manufacturer to contain not more than 0.1 percent water-soluble chloride ions by mass of cementitious material and to be compatible with other admixtures and cementitious materials. Do not use admixtures containing calcium chloride.
- B. Air-Entraining Admixture: ASTM C 260.
- C. Water-Reducing Admixture: ASTM C 494, Type A.
- D. High-Range, Water-Reducing Admixture: ASTM C 494, Type F.
- E. Water-Reducing and Accelerating Admixture: ASTM C 494, Type E.
- F. Water-Reducing and Retarding Admixture: ASTM C 494, Type D.

2.6 VAPOR RETARDERS

- A. Vapor Retarder: ASTM E 1745, polyolefin sheet, not less than 15 mils thick.
- B. Fine-Graded Granular Material: Minimum 4 inch thick layer of either a clean mixture of crushed stone, crushed gravel, and manufactured or natural sand or 4 inch thick layer of either crushed stone or manufactured or natural coarse sand alone shall be used beneath all slabs on grade. See geotechnical report. Granular material shall meet the requirements of ASTM D 448, Size 10, with 100 percent passing a No. 4 (4.75-mm) sieve and 10 to 30 percent passing a No. 100 (0.15-mm) sieve; meeting deleterious substance limits of ASTM C 33 for fine aggregates.

2.7 CURING MATERIALS

- A. Evaporation Retarder: Waterborne, monomolecular film forming, manufactured for application to fresh concrete.
- B. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. dry.
- C. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.
- D. Water: Potable.
- E. Liquid Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class A.
- F. Clear, Waterborne, Membrane-Forming Curing and Sealing Compound: ASTM C 1315, Type 1, Class A. Use at all interior exposed concrete slabs. See architectural drawings for locations.

2.8 RELATED MATERIALS

- A. Joint-Filler Strips: ASTM D 1751, asphalt-saturated cellulosic fiber, or ASTM D 1752, cork or self-expanding cork.
- B. Epoxy-Bonding Adhesive: ASTM C 881, two-component epoxy resin, capable of humid curing and bonding to damp surfaces, of class and grade to suit requirements, and as follows:
 - 1. Type II, non-load bearing, for bonding freshly mixed concrete to hardened concrete.

2. Types I and II, non-load bearing, for bonding hardened or freshly mixed concrete to hardened concrete.
1. Types IV and V, load bearing, for bonding hardened or freshly mixed concrete to hardened concrete.

C. Sealers: Joint Sealers shall be as specified in Division 7.

2.9 CONCRETE MIXES

A. Prepare design mixes for each type and strength of concrete determined by either laboratory trial mix or field test data bases, as follows:

1. Proportion normal-weight concrete according to ACI 211.1 and ACI 301.

B. Use a qualified independent testing agency for preparing and reporting proposed mix designs for the laboratory trial mix basis.

C. Foundations, Piers, Beams and Columns: Proportion normal-weight concrete mix as follows:

1. Minimum Compressive Strength (28 Days): 4000 psi.
2. Maximum Slump: 4 inches (100 mm).
3. Maximum Slump for Concrete Containing High-Range Water-Reducing Admixture: 8 inches after admixture is added to concrete with 2 to 4 inch slump.

D. Ground Floor and Elevated Slabs: Proportion normal-weight concrete mix as follows:

1. Minimum Compressive Strength (28 Days): 4000 psi (27.6 MPa).
2. Maximum Slump: 4 inches (100 mm).
3. Maximum Slump for Concrete Containing High-Range Water-Reducing Admixture: 8 inches after admixture is added to concrete with 2 to 4 inch slump.

E. Cementitious Materials: Limit percentage, by weight, of cementitious materials other than Portland cement as follows:

1. Fly Ash: 25 percent

F. Air Content: Add air-entraining admixture at manufacturer's prescribed rate to result in concrete at point of placement having an air content of 2 to 4 percent, unless otherwise indicated. Do not air entrain concrete to trowel-finished interior floors and suspended slabs or toppings. Do not allow entrapped air content in interior concrete to exceed 1 ½ percent.

G. Limit water-soluble, chloride-ion content in hardened concrete to 0.15 percent by weight of cement.

H. Admixtures: Use admixtures according to manufacturer's written instructions.

1. Use water-reducing admixture or high-range water-reducing admixture (superplasticizer) in concrete, as required, for placement and workability.
2. Use water-reducing and retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.
3. Use water-reducing admixture in pumped concrete and concrete with a water-cementitious materials ratio below 0.50.

2.10 FABRICATING REINFORCEMENT

- A. Fabricate steel reinforcement according to CRSI's "Manual of Standard Practice."

2.11 CONCRETE MIXING

- A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C 94 and ASTM C 1116, and furnish batch ticket information.
 - 1. When air temperature is between 85 and 90 deg F (30 and 32 deg C), reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F (32 deg C), reduce mixing and delivery time to 60 minutes.

PART 3 - EXECUTION

3.1 FORMWORK

- A. Design, erect, shore, brace, and maintain formwork, according to ACI 301, to support vertical, lateral, static, and dynamic loads, and construction loads that might be applied, until concrete structure can support such loads.
- B. Construct formwork so concrete members and structures are of size, shape, alignment, elevation, and position indicated, within tolerance limits of ACI 117.
- C. Limit concrete surface irregularities, designated by ACI 347R as abrupt or gradual, as follows:
 - 1. Class A, 1/8 inch (3 mm) at exposed finish surfaces such as exposed concrete beams, columns and walls.
 - 2. Class B, 1/4 inch (13 mm) at all other locations.
- D. Construct forms tight enough to prevent loss of concrete mortar.
- E. Fabricate forms for easy removal without hammering or prying against concrete surfaces. Provide crush or wrecking plates where stripping may damage cast concrete surfaces. Provide top forms for inclined surfaces steeper than 1.5 horizontal to 1 vertical. Kerf wood inserts for forming keyways, reglets, recesses, and the like, for easy removal.
 - 1. Do not use rust-stained steel form-facing material.
- F. Set edge forms, bulkheads, and intermediate screed strips for slabs to achieve required elevations and slopes in finished concrete surfaces. Provide and secure units to support screed strips; use strike-off templates or compacting-type screeds.
- G. Form openings, chases, offsets, sinkages, keyways, reglets, blocking, screeds, and bulkheads required in the Work. Determine sizes and locations from trades providing such items.
- H. Clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, and other debris just before placing concrete.
- I. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.

- J. Coat contact surfaces of forms with form-release agent, according to manufacturer's written instructions, before placing reinforcement.

3.2 EMBEDDED ITEMS

- A. Place and secure anchorage devices and other embedded items required for adjoining work that is attached to or supported by cast-in-place concrete. Use Setting Drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.

3.3 REMOVING AND REUSING FORMS

- A. General: Formwork, for sides of beams, walls, columns, and similar parts of the Work, that does not support weight of concrete may be removed after cumulatively curing at not less than 50 deg F (10 deg C) for 24 hours after placing concrete provided concrete is hard enough to not be damaged by form-removal operations and provided curing and protection operations are maintained.
- B. Leave formwork, for beam soffits, joists, slabs, and other structural elements, that supports weight of concrete in place until concrete has achieved the following:
 - 1. 28-day design compressive strength.
 - 2. Determine compressive strength of in-place concrete by testing representative field-laboratory-cured test specimens according to ACI 301.
 - 3. Remove forms only if shores have been arranged to permit removal of forms without loosening or disturbing shores.
- C. Clean and repair surfaces of forms to be reused in the Work. Split, frayed, delaminated, or otherwise damaged form-facing material will not be acceptable for exposed surfaces. Apply new form-release agent.
- D. When forms are reused, clean surfaces, remove fins and laitance, and tighten to close joints. Align and secure joints to avoid offsets. Do not use patched forms for exposed concrete surfaces unless approved by Architect.

4 SHORES AND RESHORES

- A. Comply with ACI 318 (ACI 318M), ACI 301, and recommendations in ACI 347R for design, installation, and removal of shoring and reshoring.

3.5 VAPOR RETARDERS

- A. Vapor Retarder: Place, protect, and repair vapor-retarder sheets according to ASTM E 1643 and manufacturer's written instructions.

3.6 STEEL REINFORCEMENT

- A. General: Comply with CRSI's "Manual of Standard Practice" for placing reinforcement. Do not cut or puncture vapor retarder. Repair damage and reseal vapor retarder before placing concrete.
- B. Clean reinforcement of loose rust and mill scale, earth, ice, and other foreign materials.

- C. Accurately position, support, and secure reinforcement against displacement. Locate and support reinforcement with bar supports to maintain minimum concrete cover. Do not tack weld crossing reinforcing bars.
- D. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.
 - 2. Install welded wire fabric in longest practicable lengths for bar supports spaced to minimize sagging. Lap edges and ends of adjoining sheets at least one mesh spacing. Offset laps of adjoining sheet widths to prevent continuous laps in either direction. Lace overlaps with wire.

3.7 JOINTS

- A. General: Construct joints true to line with faces perpendicular to surface plane of concrete.
- B. Construction Joints: Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by Architect.
 - 1. Place joints perpendicular to main reinforcement. Continue reinforcement across construction joints, except where indicated otherwise.
 - 2. Form from bulkhead forms with keys, unless otherwise indicated. Embed keys at least 1 inch into concrete.
 - 3. Locate joints for beams and slabs in the middle third of spans.
 - 4. Use epoxy-bonding adhesive at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
- C. Contraction Joints in Slabs-on-Grade: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-fourth of concrete thickness, as follows (use construction joint keyways only where indicated on the drawings):
 - 1. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch-) wide joints into concrete when cutting action will not tear, abrade, or otherwise damage surface and before concrete develops random contraction cracks.

3.8 CONCRETE PLACEMENT

- A. Before placing concrete, verify that installation of formwork, reinforcement, and embedded items is complete and that required inspections have been performed.
- B. Before placing concrete, water may be added at Project site, subject to limitations of ACI 301 and subject to limits of maximum water/cement ratios listed.
 - 1. Do not add water to concrete after adding high-range water-reducing admixtures to mix.
- C. Deposit concrete continuously or in layers of such thickness that no new concrete will be placed on concrete that has hardened enough to cause seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as specified. Deposit concrete to avoid segregation.

- D. Deposit concrete in forms in horizontal layers no deeper than 24 inches (600 mm) and in a manner to avoid inclined construction joints. Place each layer while preceding layer is still plastic, to avoid cold joints.
1. Consolidate placed concrete with mechanical vibrating equipment. Use equipment and procedures for consolidating concrete recommended by ACI 309R.
 2. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations no farther than the visible effectiveness of the vibrator. Place vibrators to rapidly penetrate placed layer and at least 6 inches (150 mm) into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to lose plasticity. At each insertion, limit duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing mix constituents to segregate.
- E. Deposit and consolidate concrete for slabs in a continuous operation, within limits of construction joints, until placement of a panel or section is complete.
1. Consolidate concrete during placement operations so concrete is thoroughly worked around reinforcement and other embedded items and into corners.
 2. Maintain reinforcement in position on chairs during concrete placement.
 3. Scream slab surfaces with a straightedge and strike off to correct elevations.
 4. Slope surfaces uniformly to drains where required.
 5. Begin initial floating using bull floats or darbies to form a uniform and open-textured surface plane, free of humps or hollows, before excess moisture or bleedwater appears on the surface. Do not further disturb slab surfaces before starting finishing operations.
- F. Cold-Weather Placement: Comply with ACI 306.1 and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.
1. When air temperature has fallen to or is expected to fall below 40 deg F (4.4 deg C), uniformly heat water and aggregates before mixing to obtain a concrete mixture temperature of not less than 50 deg F (10 deg C) and not more than 80 deg F (27 deg C) at point of placement.
 2. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.
 3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators, unless otherwise specified and approved in mix designs.
- G. Hot-Weather Placement: Place concrete according to recommendations in ACI 305R and as follows, when hot-weather conditions exist:
1. Cool ingredients before mixing to maintain concrete temperature below 90 deg F at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
 2. Cover steel reinforcement with water-soaked burlap so steel temperature will not exceed ambient air temperature immediately before embedding in concrete.
 3. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade moisture uniform without standing water, soft spots, or dry areas.

3.9 FINISHING FORMED SURFACES

- A. Rough-Formed Finish: As-cast concrete texture imparted by form-facing material with tie holes and defective areas repaired and patched. Remove fins and other projections exceeding ACI 347R limits for class of surface specified.
 - 1. Apply to surfaces not exposed to public view.
- B. Smooth-Formed Finish: As-cast concrete texture imparted by form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams. Repair and patch tie holes and defective areas. Remove fins and other projections exceeding 1/8 inch (3 mm) in height.
 - 1. Apply to concrete surfaces exposed to public view.
- C. Related Unformed Surfaces: At tops of walls, horizontal offsets, and similar unformed surfaces adjacent to formed surfaces, strike off smooth and finish with a texture matching adjacent surfaces. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces, unless otherwise indicated.

3.10 FINISHING FLOORS AND SLABS

- A. General: Comply with recommendations in ACI 302.1R for screeding, restraightening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.
- B. Float Finish: Consolidate surface with power-driven floats or by hand floating if area is small or inaccessible to power driven floats. Restraighten, cut down high spots, and fill low spots. Repeat float passes and restraightening until surface is left with a uniform, smooth, granular texture.
 - 1. Apply float finish to surfaces indicated and to surfaces to receive trowel or light trowel finish.
- C. Trowel Finish: After applying float finish, apply first trowel finish and consolidate concrete by hand or power-driven trowel. Continue troweling passes and restraighten until surface is free of trowel marks and uniform in texture and appearance. Grind smooth any surface defects that would telegraph through applied coatings or floor coverings.
 - 1. Apply a trowel finish to all slab surfaces, unless noted otherwise.
 - 2. Finish surfaces to the following tolerances, measured within 24 hours according to ASTM E 1155/E 1155M for a randomly trafficked floor surface:
 - a. Specified overall values of flatness, F(F) 35; and levelness, F(L) 25; with minimum local values of flatness, F(F) 24; and levelness, F(L) 17; for slabs on grade.
 - b. Specified overall values of flatness, F(F) 30; and levelness, F(L) 20; with minimum local values of flatness, F(F) 24; levelness F(L) 15; for elevated slabs.
- D. Light Trowel Finish: After applying float finish, apply first trowel finish and consolidate concrete by hand or power-driven trowel. Continue troweling passes and restraighten until surface is free of trowel marks and uniform in texture and appearance.
 - 1. Finish surfaces to the following tolerances, measured within 24 hours according to ASTM E 1155/E 1155M for a randomly trafficked floor surface:
 - a. Specified overall values of flatness, F(F) 25; and levelness, F(L) 20; with minimum local values of flatness, F(F) 20; and levelness, F(L) 17.

- E. Trowel and Fine-Broom Finish: Apply a partial trowel finish, stopping after first troweling. While concrete is still plastic, slightly scarify the surface with a fine broom.
 - 1. Apply trowel and fine broom finish to slabs to receive a bonded concrete topping or where quarry or ceramic tile is to be installed by either the thickset or thin-set method.
- F. Broom Finish: Apply a broom finish to exterior concrete platforms, steps, ramps, and elsewhere as indicated
 - 1. Immediately after float finishing, slightly roughen trafficked surface by brooming with fiber-bristle broom perpendicular to main traffic route. Coordinate required final finish with Architect before application.

3.11 MISCELLANEOUS CONCRETE ITEMS

- A. Filling In: Fill in holes and openings left in concrete structures, unless otherwise indicated, after work of other trades is in place. Mix, place, and cure concrete, as specified, to blend with in-place construction. Provide other miscellaneous concrete filling indicated or required to complete Work.

3.12 CONCRETE PROTECTION AND CURING

- A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306.1 for cold-weather protection and with recommendations in ACI 305R for hot-weather protection during curing.
- B. Formed Surfaces: Cure formed concrete surfaces, including underside of beams, supported slabs, and other similar surfaces. If forms remain during curing period, moist cure after loosening forms. If removing forms before end of curing period, continue curing by one or a combination of the following methods:
- C. Unformed Surfaces: Begin curing immediately after finishing concrete. Cure unformed surfaces, including floors and slabs, concrete floor toppings, and other surfaces, by one or a combination of the following methods:
 - 1. Moisture Curing: Keep surfaces continuously moist for not less than seven days with the following materials:
 - a. Water.
 - b. Continuous water-fog spray.
 - c. Absorptive cover, water saturated, and kept continuously wet. Cover concrete surfaces and edges with 12-inch (300-mm) lap over adjacent absorptive covers.
 - 2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches (300 mm), and sealed by waterproof tape or adhesive. Cure for not less than seven days. Immediately repair any holes or tears during curing period using cover material and waterproof tape.
 - a. Cure concrete surfaces to receive bonded concrete toppings or ceramic or quarry tile installed with either the thickset or thin-set method with a moisture-retaining cover. Do not use curing compound to cure concrete slabs at these locations.

3. Curing or Curing and Sealing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating and repair damage during curing period. Use Curing and Sealing compounds for all interior exposed concrete slabs. See architectural drawings for locations.

3.13 JOINT FILLING

- A. Prepare, clean, and install joint filler according to manufacturer's written instructions.
 1. Defer joint filling until concrete has aged at least six months. Do not fill joints until construction traffic has permanently ceased.
- B. Remove dirt, debris, saw cuttings, curing compounds, and sealers from joints; leave contact faces of joint clean and dry.

3.14 CONCRETE SURFACE REPAIRS

- A. Defective Concrete: Repair and patch defective areas when approved by Architect. Remove and replace concrete that cannot be repaired and patched to Architect's approval.
- C. Perform structural repairs of concrete, subject to Architect's approval, using epoxy adhesive and patching mortar.

3.15 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will provide a qualified independent testing and inspection agency to sample materials, perform tests, and submit test reports during concrete placement. Sampling and testing for quality control may include those specified in this article.
- B. Testing Services: Testing of composite samples of fresh concrete obtained according to ASTM C 172 shall be performed according to the following requirements:
 1. Testing Frequency: Obtain one composite sample for each day's pour of each concrete mix exceeding 5 cu. yd. (4 cu. m), but less than 25 cu. yd. (19 cu. m), plus one set for each additional 50 cu. yd. (38 cu. m) or fraction thereof.
 - a. When frequency of testing will provide fewer than five compressive-strength tests for each concrete mix, testing shall be conducted from at least five randomly selected batches or from each batch if fewer than five are used.
 2. Slump: ASTM C 143; one test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mix. Perform additional tests when concrete consistency appears to change.
 3. Air Content: ASTM C 231, pressure method, for normal-weight concrete; one test for each composite sample, but not less than one test for each day's pour of each concrete mix.
 4. Concrete Temperature: ASTM C 1064; one test hourly when air temperature is 40 deg F (4.4 deg C) and below and when 80 deg F (27 deg C) and above, and one test for each composite sample.
 5. Compression Test Specimens: ASTM C 31/C 31M; cast and laboratory cure one set of four standard cylinder specimens for each composite sample.
 - a. Cast and field cure one set of four standard cylinder specimens for each composite sample.
 6. Compressive-Strength Tests: ASTM C 39.

- a. Test one field-cured specimens at 7 days and two at 28 days, and keep one for a spare.
 - b. A compressive-strength test shall be the average compressive strength from two specimens obtained from same composite sample and tested at age indicated.
- C. Test results shall be reported in writing to Architect, concrete manufacturer, and Contractor within 48 hours of testing. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work, design compressive strength at 28 days, concrete mix proportions and materials, compressive breaking strength, and type of break for both 7-and 28-day tests.
- D. When strength of field cured cylinders is less than 85 percent of companion laboratory cured cylinders, Contractor shall evaluate operations and provide corrective procedures for protecting and curing in-place concrete.
- E. Strength of each concrete mix will be satisfactory if every average of any three consecutive compressive strength tests equals or exceeds the specified compressive strength by more than 500 psi.
- F. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Architect but will not be used as sole basis for approval or rejection of concrete.
- G. Additional Tests: Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Architect. Testing and inspecting agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42 or by other methods as directed by Architect.

3.16 SPECIAL INSPECTIONS

- A. Special Inspections as related to IBC 2015 Chapter 17 requirements are required for this project. Owner will engage a testing and inspection agency with experience, qualifications, certifications, and licenses required to perform the special inspections and testing indicated below. Reference IBC 2015 Table 1705.3 and Specification Section 01400 "Quality Requirements".
1. Continuous sampling and subsequent testing of fresh concrete as called for in Section 3.15, above.
 2. Periodic inspections of reinforcing steel and placement to comply with the requirements of Section 3.6, above, and as shown on the drawings. Inspections shall be made of all reinforcing prior to each concrete pour.
 3. Continuous inspection of concrete placement and techniques to comply with the requirements of Section 3.8, above.
 4. Continuous inspection of anchor bolts installed in concrete prior to and during placement of concrete.
 5. Periodic inspection for maintenance of specified curing temperatures and techniques to comply with Section 3.12, above.
 6. Periodic inspection of floor finishes to meet tolerances as specified in Section 3.10, above.

END OF SECTION

SECTION 061000 - ROUGH CARPENTRY

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:
 - 1. Plywood sheathing.
 - 2. Wood framing.
 - 3. Steel bolts, washers, and plates for connectors.
 - 4. Wood fasteners.

- B. Related Sections: The following Sections contain requirements that relate to this Section:
 - 1. Division 3 Section "Cast-in-Place Concrete."
 - 2. Division 6 Section "Metal plate Connected Wood Trusses" for wood roof and floor trusses.

1.2 DEFINITIONS

- A. Rough Carpentry: Carpentry work not specified in other Sections and not exposed, unless otherwise specified.

- B. Exposed Framing: Dimension lumber not concealed by other construction and indicated to receive a stained or natural finish.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Wood-Preservative-Treated Materials:
 - a. Baxter: J.H. Baxter Co.
 - b. Chemical Specialties, Inc.
 - c. Continental Wood Preservers, Inc.
 - d. Cox
 - e. Hickson Corp.
 - f. Hoover Treated Wood Products, Inc.
 - g. Koppers
 - h. Osmose Wood Preserving, Inc

 - 2. Metal Framing Anchors:
 - a. Cleveland Steel Specialty Co.
 - b. Simpson Strong-Tie Company, Inc.
 - c. Southeastern Metals Manufacturing Co., Inc.

2.2 LUMBER, GENERAL

- A. Lumber Standards: Comply with DOC PS 20, "American Softwood Lumber Standard," and with applicable grading rules of inspection agencies certified by ALSC's Board of Review.
- B. Inspection Agencies: Inspection agencies, and the abbreviations used to reference them, include the following:
 - 1. SPIB – South Pine Inspection Bureau.
- C. Grade Stamps: Provide lumber with each piece factory marked with grade stamp of inspection agency evidencing compliance with grading rule requirements and identifying grading agency, grade, species, moisture content at time of surfacing, and mill.
- D. Where nominal sizes are indicated, provide actual sizes required by DOC PS 20 for moisture content specified. Where actual sizes are indicated, they are minimum dressed sizes for dry lumber.
 - 1. Provide dressed lumber, S4S, unless otherwise indicated.
 - 2. Provide dry lumber with 19 percent maximum moisture content at time of dressing for 2-inch nominal (38-mm actual) thickness or less, unless otherwise indicated.

2.3 WOOD-PRESERVATIVE-TREATED MATERIALS

- A. General: Where lumber or plywood is indicated as preservative treated or is specified to be treated, comply with applicable requirements of AWWA C2 (lumber) and AWWA C9 (plywood). Mark each treated item with the Quality Mark Requirements of an inspection agency approved by ALSC's Board of Review.
- B. Pressure treat above ground items with waterborne preservatives to a minimum retention of 0.25 lb/cu. ft. (4.0 kg/cu. m.) After treatment, kiln-dry lumber and plywood to a maximum moisture content of 19 and 15 percent, respectively. Treat indicated items and the following:
 - 1. Wood sills, sleepers, blocking, stripping, and similar concealed members in contact with masonry or concrete.
 - 2. Wood floor plates installed over concrete slabs directly in contact with earth.
 - 3. All wood members and framing exposed to the weather including all members at exterior decks and stairs and all members below the 1st floor framing.
- C. Pressure treat wood members in contact with ground or freshwater with waterborne preservatives to a minimum retention of 0.40 lb/cu. ft. (6.4 kg/cu.m.).
- D. Complete fabrication of treated items before treatment, where possible. If cut after treatment, apply field treatment complying with AWWA M4 to cut surfaces. Inspect each piece of lumber or plywood after drying and discard damaged or defective pieces.

2.4 DIMENSION LUMBER

- A. General: Provide dimension lumber of grades indicted according to the ALSC National Grading Rule (NGR) provisions of the inspection agency indicated.
- B. Roof and floor framing, bearing plates, stud wall framing, etc.
 - 1. Grade: No. 2.
 - 2. Species: Southern pine; SPIB.
- C. Other Framing Not Listed Above, including nailers, blocking, and supports for other construction: Provide the following grades and species:
 - 1. Grade: No. 2
 - 2. Species: Southern Pine, SPIB.

2.5 ENGINEERED WOOD PRODUCTS

- A. General: Provide engineered wood products acceptable to authorities having jurisdiction and for which current model code research or evaluation reports exist that evidence compliance with building code in effect for Project.
- B. Laminated Veneer Lumber (LVL): Lumber manufactured from thin sheets of veneer structurally bonded together using an exterior-type adhesive complying with ASTM D 2559, cured under pressure and complying with the following requirements.
 - 1. Allowable Design Stresses: Provide laminated veneer lumber with allowable design stresses, as published by manufacturer, that meet or exceed those indicated. Manufacturer's published values shall be determined from empirical data or by rational engineering analysis, and demonstrated by comprehensive testing performed by a qualified independent testing agency.
 - 2. Extreme Fiber Stress in Bending: 2900 psi
 - 3. Modulus of Elasticity: 2,000,000 psi.
 - 4. Compression Parallel to Grain: 2600 psi.
 - 5. Compression Perpendicular to Grain: 845 psi.
 - 6. Horizontal Shear: 285 psi.

2.6 MISCELLANEOUS LUMBER

- A. General: Provide lumber for support or attachment of other non-structural construction, including nailers, blocking, furring, grounds, striping, and similar members.
- B. Fabricate miscellaneous lumber from dimension lumber of sizes indicated and into shapes shown.
- C. Moisture Content: 19 percent maximum for lumber items not specified to received wood preservative treatment.
- D. Grade: For dimension lumber sizes, provide No. 3 or Standard grade lumber per ALSC's NGRs of any species. For board-size lumber. Provide No. 2 Common grade per NELMA, NLGA, or WWPA; No. 3 grade per SPIB; or Standard grade per NLGA, WCLIB or WWPA of any species.

2.7 WOOD-BASED STRUCTURAL-USE PANELS, GENERAL

- A. Structural-Use Panel Standard: Provide plywood panels complying with DOC PS 1, "U.S. product Standard for Construction and Industrial Plywood."
- B. Trademark: Factory mark structural-use panels with APA trademark evidencing compliance with grade requirements.

2.8 CONCEALED, PERFORMANCE-RATED STRUCTURAL-USE PANELS

- A. General: Where structural-use panels are indicated for the following concealed types of applications, provide APA-performance-rated panels complying with requirements designated under each applications for grade, span rating, exposure durability classification, and edge detail (where applicable).
 - 1. Thickness: Provide panel meeting requirements specified but not less than the thickness indicated.
 - 2. Span Ratings: Provide panels with span ratings required to meet "Code Plus" provisions of APA Form No. E30, "APA Design/Construction Guide: Residential & Commercial."
- B. Wall Sheathing and Roof Sheathing: APA Rated Sheathing. Use plywood sheathing for the roof and wall sheathing as shown on the structural drawings.
 - 1. Exposure Durability Classification: Exposure 1.
 - 2. Span Rating: As required to meet APA "Code Plus" provisions.

2.9 STRUCTURAL-USE PANELS FOR BACKING

- A. Plywood Backing Panels: For mounting electrical or telephone equipment, provide fire-retardant-treated plywood panels with grade, C-D Plugged Exposure 1, in thickness indicated or, if not otherwise indicated, not less than 15/32 inch (11.9 mm) thick.

2.10 FASTENERS

- A. General: Provide fasteners of size and type indicated that comply with requirements specified in this Article for material and manufacture.
 - 1. Where rough carpentry is exposed to weather, in ground contact, or in area of high relative humidity, provide fasteners with a hot-dip zinc coating per ASTM A 153 or of Type 304 stainless steel.
- B. Nails, Wire, Brads, and Staples: FS FF-N-105. Nails for attachment of roof plywood to 2 x 6 T & G decking at high roof (10d) shall be 1 ½ inches long and shall not extend through the 2 x 6 T&G wood decking.
- C. Power-Driven Fasteners: CABO NER-272.

- D. Lag Bolts: ASME B18.2.1. (ASME B18.2.3.8M)
- E. Bolts: Steel bolts complying with ASTM A 307, Grade A (ASTM F 568, Property Class 4.6); with ASTM A 563 (ASTM A 563M) hex nuts and, where indicated, flat washers.

2.11 METAL FRAMING ANCHORS

- A. General: Provide galvanized steel framing anchors of structural capacity, type, and size indicated and as follows:
 - 1. Research or Evaluation Reports: Provide products for which model code research or evaluation reports exist that are acceptable to authorities having jurisdiction and that evidence compliance of metal framing anchors for application indicated with building code in effect for Project.
 - 2. Allowable Design Loads: Provide products with allowable design loads, as published by manufacturer, that meet or exceed those of the products indicated. Manufacturer's published values shall be determined from empirical data or by rational engineering analysis, and demonstrated by comprehensive testing performed by a qualified independent testing agency.
- B. Galvanized Steel Sheet for Typical Anchors: Hot-dip, zinc-coated steel sheet complying as a minimum with ASTM A 653, having a G185 zinc coating as specified by Simpson Strong-Tie as Zmax Triple Coating: structural, commercial, or lock-forming quality, as standard with manufacturer for type of anchor indicated.
- C. Joist Ties: Flat straps with holes for fasteners, for tying joists together over supports.
- D. Rafter Tie-Downs (Hurricane Anchors): Bent strap tie for fastening rafters of roof trusses to wall studs below, as indicated.

2.12 MISCELLANEOUS MATERIALS

- A. Water-Repellent Preservative: NWWDA-tested and-accepted formulation containing 3-iodo-2-propynyl butyl carbonate (IPBC) as its active ingredient.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Discard units of material with defects that impair quality of rough carpentry and that are too small to use with minimum number of joint or optimum joint arrangement.
- B. Set rough carpentry to required levels and lines, with members plumb, true to line, cut, and fitted.
- C. Fit rough carpentry to other construction; scribe and cope as required for accurate fit. Correlate location of furring, nailers, blocking, grounds, and similar supports to allow attachment of other construction.

- D. Apply field treatment complying with AWPAs M4 to cut surfaces of preservative-treated lumber and plywood.
- E. Securely attach rough carpentry work to substrate by anchoring and fastening as indicated, complying with the following as a minimum, unless noted otherwise.
 - 1. CABO NER-272 for power-driven staples, P-nails, and allied fasteners.
 - 2. Published requirements of metal framing anchor manufacturer.
 - 3. "Table 2304.9.1—Fastening Schedule, " of the IBC 2003 Code.
- F. Use common wire nails, unless otherwise indicated. Use finishing nails for finish work. Select fasteners of size that will not fully penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections between members. Install fasteners without splitting wood; predrill as required.
- G. Use stainless-steel nails where rough carpentry is exposed to weather, or in ground contact.
- H. Countersink nail heads on exposed carpentry work and fill holes with wood filler.

3.2 INSTALLATION OF STRUCTURAL-USE PANELS

- A. General: Comply with applicable recommendations contained in APA Form No. E30, "APA Design/Construction Guide: Residential & Commercial," for types of structural-use panels and applications indicated.
 - 1. Comply with "Code Plus" provisions of above-referenced guide.
- B. Fastening Methods: Fasten panels as indicated below. Spacing of fasteners to be as indicated on the drawings.
 - 1. Wall Sheathing: Screw to supporting metal stud walls.
 - 2. Roof Sheathing: Nail to wood trusses and framing.
 - 3. Plywood Backing Panels: Screw to supports.

3.3 SPECIAL INSPECTIONS

- A. Special Inspections as related to IBC 2015 Chapter 17 requirements are required for this project. Owner will engage a testing and inspection agency with experience, qualifications, certifications, and licenses required to perform the special inspections and testing indicated below.
 - 1. Periodic inspection of High Load Shear Walls relative to the requirements of the metal stud shop drawings and the structural contract drawings and Sections 2.6, 2.7, and 3.2, above (reference Section 1705.5.1 of the IBC 2015).

2. Periodic inspection of High Load Diaphragms relative to the requirements of the structural contract drawings and Sections 2.6, 2.7, and 3.2, above (reference Section 1705.5.1 of the IBC 2015).
3. Periodic inspection of screwing, bolting, and anchoring within the seismic force resisting system including shear walls relative to the requirements of the metal stud shop drawings and the structural contract drawings and Section 3.2, above (reference IBC 2015).
4. Periodic inspection of wood frame construction to meet the requirements of the structural documents.

END OF SECTION

SECTION 061600 - SHEATHING

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. Wall sheathing.
 - 2. Roof sheathing.
- B. Related Sections
 - 1. Section 061000 "Rough Carpentry" for plywood backing panels.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.
 - 1. Include data for wood-preservative treatment from chemical treatment manufacturer and certification by treating plant that treated plywood complies with requirements. Indicate type of preservative used and net amount of preservative retained.
 - 2. For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.
 - 3. Include copies of warranties from chemical treatment manufacturers for each type of treatment.

1.4 INFORMATIONAL SUBMITTALS

- A. Evaluation Reports: For following products, from ICC-ES:
 - 1. Preservative-treated plywood.

1.5 QUALITY ASSURANCE

- A. Testing Agency Qualifications: For testing agency providing classification marking for fire-retardant-treated material, an inspection agency acceptable to authorities having jurisdiction that periodically performs inspections to verify that the material bearing the classification marking is representative of the material tested.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Stack panels flat with spacers beneath and between each bundle to provide air circulation. Protect sheathing from weather by covering with waterproof sheeting, securely anchored. Provide for air circulation around stacks and under coverings.

PART 2 - PRODUCTS

2.1 WOOD PANEL PRODUCTS

- A. Plywood: DOC PS 1.
- B. Thickness: As needed to comply with requirements specified, but not less than thickness indicated.
- C. Factory mark panels to indicate compliance with applicable standard.

2.2 PRESERVATIVE-TREATED PLYWOOD

- A. Preservative Treatment by Pressure Process: AWPA U1; Use Category UC2.
 - 1. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium.
- B. Mark plywood with appropriate classification marking of an inspection agency acceptable to authorities having jurisdiction.
- C. Application: Treat items indicated on Drawings and plywood in contact with masonry or concrete or used with roofing, flashing, vapor barriers, and waterproofing.
- D. Kiln-dry material after treatment to a maximum moisture content of 15 percent. Do not use material that is warped or does not comply with requirements for untreated material.
- E. Application: Treat all plywood unless otherwise indicated.

2.3 WALL SHEATHING

- A. Plywood Wall Sheathing: Exterior
 - 1. Nominal Thickness: Not less than ½ inch

2.4 ROOF SHEATHING

- A. Plywood Roof Sheathing: Exterior sheathing.
 - 1. Span Rating: Not less than 48/24.
 - 2. Nominal Thickness: Not less than ¾ inch.

2.5 FASTENERS

- A. General: Provide fasteners of size and type indicated that comply with requirements specified in this article for material and manufacture.
 - 1. For roof and wall sheathing, provide fasteners with hot-dip zinc coating complying with ASTM A 153/A 153M.
- B. Nails, Brads, and Staples: ASTM F 1667.
- C. Power-Driven Fasteners: NES NER-272.
- D. Wood Screws: ASME B18.6.1.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Do not use materials with defects that impair quality of sheathing or pieces that are too small to use with minimum number of joints or optimum joint arrangement. Arrange joints so that pieces do not span between fewer than three support members.
- B. Cut panels at penetrations, edges, and other obstructions of work; fit tightly against abutting construction unless otherwise indicated.
- C. Securely attach to substrate by fastening as indicated, complying with the following:
 - 1. NES NER-272 for power-driven fasteners.
 - 2. Table R602.3(1), "Fastener Schedule for Structural Members," and Table R602.3(2), "Alternate Attachments," in ICC's "International Residential Code for One- and Two-Family Dwellings."
- D. Use common wire nails unless otherwise indicated. Select fasteners of size that will not fully penetrate members where opposite side will be exposed to view or will

receive finish materials. Make tight connections. Install fasteners without splitting wood.

- E. Coordinate wall and roof sheathing installation with flashing and joint-sealant installation so these materials are installed in sequence and manner that prevent exterior moisture from passing through completed assembly.
- F. Do not bridge building expansion joints; cut and space edges of panels to match spacing of structural support elements.
- G. Coordinate sheathing installation with installation of materials installed over sheathing so sheathing is not exposed to precipitation or left exposed at end of the workday when rain is forecast.

3.2 WOOD STRUCTURAL PANEL INSTALLATION

- A. General: Comply with applicable recommendations in APA Form No. E30, "Engineered Wood Construction Guide," for types of structural-use panels and applications indicated.
- B. Fastening Methods: Fasten panels as indicated below:
 - 1. Roof Sheathing:
 - a. Space panels 1/8 inch apart at edges and ends.

END OF SECTION 06 1600

SECTION 061900 - METAL-PLATE-CONNECTED WOOD TRUSSES

PART 1 GENERAL

1.1 SUMMARY

A. This Section includes the following and applies only to the Retail Building:

1. Triangular-pitched roof trusses with flat bottom chords.
2. Triangular-pitched scissors type roof trusses.
3. Girder trusses and truss headers.
4. Roof trusses with flat bottom chords and single pitch low slope top chords.
5. Truss accessories.

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

1. Division 6 Section "Rough Carpentry" for roof and wall sheathing of structural-use panels, dimension lumber for supplementary and roof framing, permanent bracing, columns, vertical strand laminated lumber for load bearing support, and for hardware for anchoring trusses to timber construction.

1.2 DEFINITIONS

A. Metal-plate-connected wood trusses include planar structural units consisting of metal-plate-connected members fabricated from dimension lumber and cut and assembled before delivery to Project site.

1.3 PERFORMANCE REQUIREMENTS

A. Structural Performance for Roof Trusses: Engineer, fabricate, and erect metal-plate-connected wood trusses to withstand design loads within limits and under conditions required.

1. Design Loads:

a. Design Loads: Dead and Live Top Chord

Dead Load = 15 psf

Live Load = 20 psf

Bottom Chord

Dead Load = 10 psf

Live Load = 10 psf + actual weights of mechanical units located within the roof framing. Coordinate with mechanical drawings for unit weights and locations.

b. Design Loads – Lateral

Wind Load...In accordance with the requirements of ASCE 7-10 and the following:

Basic Wind Speed = 134 mph

Exposure Category = C

Seismic Load...In accordance with IBC 2015 and ASCE 7-10.

Sds = 0.603

Sd1 = 0.492

Occupancy Importance Factor (Ie)=1.00

Seismic Use Group II
Site Class D
Seismic Design Category D
Analysis Procedure = Equivalent Lateral Force Procedure

- B. Engineering Responsibility: Engage a fabricator who uses a qualified professional engineer to prepare calculations, shop drawings, and other structural data for metal-plate-connected wood trusses.
- C. Provide designs and details for all truss to truss connections and for bracing of truss system as a whole. Truss manufacturer shall design and provide any bottom chord or web bracing necessary for construction or final in-place loadings.
- D. Design roof trusses to withstand design loads without deflections greater than the following:
 - 1. Vertical deflection of 1/240 of span due to total load.
 - 2. Vertical deflection of 1/360 of span due to live load.
 - 3. Horizontal deflection at reactions due to total load of ¼ inch.

1.4 SUBMITTALS

- A. Product Data for lumber, metal-plate connectors, metal framing connectors, bolts, and fasteners.
- B. Shop Drawings detailing location, pitch, span, camber, configuration, and spacing for each type of truss required; species, sizes, and stress grades of lumber to be used; splice details; type, size, material, finish, design values, and orientation and location of metal connector plates; and bearing details. Include supplementary framing, permanent bracing and temporary (erection) bracing required.
 - 1. Include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
 - 2. Include truss Shop Drawings signed and sealed by the qualified professional engineer responsible for their preparation.
- C. Product certificates signed by officer of truss fabricating firm certifying that metal-plate-connected wood trusses supplied for Project comply with specified requirements and Shop Drawings.
- D. Qualification data for firms and persons specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: Engage an experienced Installer who has completed wood truss installation similar in material, design, and extent to that indicated for this Project and with a record of successful in-service performance.
- B. Fabricator's Qualifications: Engage a firm that complies with the following requirements for quality control and is experienced in fabricating metal-plate-connected wood trusses similar to those indicated for this Project and with a record of successful in-service performance:

1. Fabricator participates in a recognized quality-assurance program that involves inspection by SPIB; Timber Products Inspection, Inc.; Truss Plate Institute (TPI); or other independent inspecting and testing agency acceptable to Architect and authorities having jurisdiction.
- C. Comply with applicable requirements and recommendations of the following publications:
1. ANSI/TP1 1, "National Design Standard for Metal-Plate-Connected Wood Truss Construction."
 2. TPI HIB "Commentary and Recommendations for Handling Installing & Bracing Metal Plate Connected Wood Trusses."
 3. TPI DSB "Recommended Design Specification for Temporary Bracing of Metal Plate Connected Wood Trusses."
- D. Metal-Plate Connector Manufacturer's Qualifications: A manufacturer that is a member of TPI and that complies with TPI quality-control procedures for manufacture of connector plates published in ANSI/TPI 1.
- E. Single-Source Responsibility for Connector Plates: Provide metal connector plates from one source and by a single manufacturer.
- F. Wood Structural Design Standard: Comply with applicable requirements of AFPA's "National Design Specification for Wood Construction" and its "Supplement."
- G. Single-Source Engineering Responsibility: Provide trusses engineered by manufacturer to support superimposed dead and live loads indicated, with design approved and certified by a qualified professional engineer.
- H. Professional Engineer Qualifications: A professional engineer who is legally authorized to practice in the jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated that have resulted in installing metal-plate-connected wood trusses similar to those indicated for this Project and with a record of successful in-service performance.
- 1.6 DELIVERY, STORAGE, AND HANDLING
- A. Handle and store trusses with care and comply with manufacturer's written instructions and TPI recommendations to avoid damage and lateral bending.
 - B. Inspect trusses showing discoloration, corrosion, or other evidence of deterioration. Discard and replace trusses that are damaged or defective.
- 1.7 SEQUENCING AND SCHEDULING
- A. Time delivery and erection of trusses to avoid extended on-site storage and to avoid delaying progress of other trades whose work must follow erection of trusses.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
1. Metal Connector Plates:
 - a. Alpine Engineered Products, Inc.
 - b. Computrus, Inc.
 - c. Mitek Industries, Inc.
 - d. Robbins Manufacturing Company.
 - e. Tee-Lok Corporation.
 - f. Truswal Systems Corporation.
 2. Metal Framing Anchors:
 - a. Simpson Strong-Tie Company, Inc.
 - b. Southeastern Metals Manufacturing Co., Inc.
 - c. United Steel Products Co.

2.2 DIMENSION LUMBER

- A. Lumber Standards: Comply with DOC PS 20, "American Softwood Lumber Standard," and with applicable grading rules of inspection agencies certified by ALSC's Board of Review.
- B. Inspection Agencies: Inspection agencies, and the abbreviations used to reference them, include the following:
1. NELMA - Northeastern Lumber Manufacturers Association.
 2. SPIB - Southern Pine Inspection Bureau.
- C. Grade Stamps: Provide lumber with each piece factory marked with grade stamp of inspection agency evidencing compliance with grading rule requirements and identifying grading agency, grade, species, moisture content at time of surfacing, and mill.
- D. Provide dressed lumber, S4S, manufactured to actual sizes required by DOC PS 20 for moisture content specified, to comply with requirements indicated below:
1. Provide lumber with 15 percent maximum moisture content at time of dressing.
- E. Grade and Species: Provide dimension lumber of the following grades and species for truss chord and web members, graded visually or mechanically, and capable of supporting required loads without exceeding allowable design values according to AFPA's "National Design Specification for Wood Construction" and its "Supplement."
1. Grade and Species for Chord Members: No. 2 or better, Southern Pine, SPIB.
 2. Grade and Species for Web Members: No. 2 or better, Southern Pine, SPIB.

2.3 METAL CONNECTOR PLATES

- A. General: Fabricate connector plates from metal complying with requirements indicated below.

- B. Hot-Dip Galvanized Steel Sheet: Structural-quality steel sheet, zinc coated by hot-dip process complying with ASTM A 653, G60 (ASTM A 653M, Z180) coating designation; Grade 33 and not less than 0.0359 inch (0.91 mm) thick.

2.4 FASTENERS

- A. General: Provide fasteners of size and type indicated that comply with requirements specified below for material and manufacture.
 - 1. Where truss members are exposed to weather or to high relative humidities, provide fasteners with a hot-dip zinc coating per ASTM A 153 or of stainless steel, Type 304 or 316.
- B. Nails, Wire, Brads, and Staples: FS FF-N-105.
- C. Power-Driven Fasteners: CABO NER-272.
- D. Wood Screws: ASME B18.6.1.
- E. Lag Bolts and Screws: ASME B18.2.1 (ASME B18.2.3.8M).
- F. Bolts: Steel bolts complying with ASTM A 307, Grade A (ASTM F 568, Property Class 4.6); with ASTM A 563 (ASTM A 563M) hex nuts and, where indicated, flat washers.

2.5 METAL FRAMING ANCHORS

- A. General: Provide metal framing anchors of structural capacity, type, size, metal, and finish indicated that comply with requirements specified, including the following:
 - 1. Research or Evaluation Reports: Provide products for which model code research or evaluation reports exist that are acceptable to authorities having jurisdiction and that evidence compliance of metal framing anchors for application indicated with building code in effect for this Project.
 - 2. Allowable Design Loads: Provide products with allowable design loads, as published by manufacturer, that meet or exceed those of the products indicated on the drawings. Manufacturer's published values shall be determined from empirical data or by rational engineering analysis, and demonstrated by comprehensive testing performed by a qualified independent testing agency.
- B. Galvanized Steel Sheet: Hot-dip, zinc-coated steel sheet complying with ASTM A 653, G60 (ASTM A 653M, Z180) coating designation; structural, commercial, or lock-forming quality, as standard with manufacturer for type of anchor indicated. Framing anchors in contact with treated wood or exposed to the weather shall be Triple Z-Max Coated.

2.6 MISCELLANEOUS MATERIALS

- A. Galvanizing Repair Paint: SSPC-Paint 20 or DOD-P-21035, with dry film containing a minimum of 94 percent zinc dust by weight.

2.7 FABRICATION

- A. Cut truss members to accurate lengths, angles, and sizes to produce close-fitting joints.
- B. Fabricate metal connector plates to size, configuration, thickness, and anchorage details required to withstand design loadings for types of joint designs indicated.
- C. Assemble truss members in design configuration indicated using jigs or other means to ensure uniformity and accuracy of assembly with joints closely fitted to comply with tolerances of ANSI/TPI 1. Position members to produce design camber indicated.
 - 1. Fabricate wood trusses within manufacturing tolerances of ANSI/TPI 1.
- D. Connect truss members by metal connector plates located and securely embedded simultaneously into both sides of wood members by air or hydraulic press.

PART 3 EXECUTION

3.1 INSTALLATION

- A. Do not install wood trusses until supporting construction is in place and is braced and secured.
- B. Before installing, splice trusses delivered to Project site in more than one piece.
- C. Hoist trusses in place by lifting equipment suited to sizes and types of trusses required, exercising care not to damage truss members or joints by out-of-plane bending or other causes.
- D. Install and brace trusses according to recommendations of TPI and as indicated.
- E. Install trusses plumb, square, and true to line and securely fasten to supporting construction.
- F. Space, adjust, and align trusses in location before permanently fastening and as follows:
 - 1. Truss Spacing: 24 inches o.c. typically, See Framing Plans.
- G. Anchor trusses securely at all bearing points using metal framing anchors or as indicated. Install fasteners through each fastener hole in metal framing anchor according to manufacturer's fastening schedules and written instructions.
- H. Securely connect each truss ply required for forming built-up girder trusses.
 - 1. Anchor trusses to girder trusses as designed and detailed by truss manufacturer.
- I. Install and fasten permanent bracing during truss erection and before construction loads are applied. Anchor ends of permanent bracing where terminating at walls or beams.
- J. Install wood trusses within installation tolerances of ANSI/TPI 1.
- K. Do not cut or remove truss members.
- L. Return wood trusses that are damaged or do not meet requirements to fabricator and replace

with trusses that do meet requirements.

1. Do not alter trusses in the field.

3.2 REPAIRS AND PROTECTION

- A. Repair damaged galvanized coatings on exposed surfaces with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.

3.3 SPECIAL INSPECTIONS

- A. Special Inspections as related to IBC 2015 Chapter 17 requirements are required for this project. Owner will engage a testing and inspection agency with experience, qualifications, certifications, and licenses required to perform the special inspections and testing indicated below.

1. Periodic inspection of metal plate connected wood trusses (reference Section 1704.2.5 of the IBC 2015). Verify that the fabricator maintains detailed fabrication and quality control procedures and review the procedures for completeness and adequacy relative to the code requirements for the fabricators scope of work and the requirements of Section 2.7, above. Per requirements of Section 1704.2.5 of the IBC 2015, Special Inspections shall not be required where the fabricator is approved in accordance with Section 1704.2.5.1 of the IBC 2015.
2. Periodic inspection of installation of metal plated wood trusses to meet the requirements of the structural contract drawings and the wood truss shop drawings.

END OF SECTION

SECTION 06 4116 - PLASTIC-LAMINATE-FACED ARCHITECTURAL CABINETS

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. Plastic-laminate-faced architectural cabinets.
2. Plastic laminate faced countertops
3. Brushed Stainless Steel countertops
4. Granite countertops
5. Wood furring, blocking, shims, and hanging strips for installing plastic-laminate-faced architectural cabinets unless concealed within other construction before cabinet installation.

B. Related Requirements:

1. Section 061000 "Rough Carpentry" for wood furring, blocking, shims, and hanging strips required for installing cabinets and concealed within other construction before cabinet installation.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product, including panel products high-pressure decorative laminate adhesive for bonding plastic laminate and cabinet hardware and accessories.
- B. Shop Drawings: Show location of each item, dimensioned plans and elevations, large-scale details, attachment devices, and other components.
 1. Show locations and sizes of furring, blocking, and hanging strips, including concealed blocking and reinforcement specified in other Sections.

2. Show locations and sizes of cutouts and holes for installed in architectural plastic-laminate cabinets.

C. Samples for Initial Selection:

1. Plastic laminates.
2. Brushed Stainless
3. Granite

D. Samples for Verification:

1. Plastic laminates, 8 by 10 inches, for each type, color, pattern, and surface finish.
2. Exposed cabinet hardware and accessories, one unit for each type and finish.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer and fabricator.

B. Product Certificates: For the following:

1. Composite wood and agrifiber products.
2. High-pressure decorative laminate.
3. Adhesives.

1.5 QUALITY ASSURANCE

- A. Fabricator Qualifications: Shop that employs skilled workers who custom fabricate products similar to those required for this Project and whose products have a record of successful in-service performance.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Do not deliver cabinets until painting and similar operations that could damage woodwork have been completed in installation areas. If cabinets must be stored in other than installation areas, store only in areas where environmental conditions comply with requirements specified in "Field Conditions" Article.

1.7 FIELD CONDITIONS

- A. Environmental Limitations: Do not deliver or install cabinets until building is enclosed, wet work is complete, and HVAC system is operating and maintaining temperature between 60 and 90 deg F and relative humidity between 43 and 70 percent during the remainder of the construction period.

- B. Field Measurements: Where cabinets are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication, and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
 - 1. Locate concealed framing, blocking, and reinforcements that support cabinets by field measurements before being enclosed, and indicate measurements on Shop Drawings.
- C. Established Dimensions: Where cabinets are indicated to fit to other construction, establish dimensions for areas where cabinets are to fit. Provide allowance for trimming at site, and coordinate construction to ensure that actual dimensions correspond to established dimensions.

1.8 COORDINATION

- A. Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of Work specified in other Sections to ensure that cabinets can be supported and installed as indicated.

PART 2 - PRODUCTS

2.1 PLASTIC LAMINATE COUNTERTOPS

- 1. High-Pressure Decorative Laminate Grade: HGS.
- 2. Colors, Patterns, and Finishes: As selected from manufacturer's full range.
- 3. Edge Treatment: Same as laminate cladding on horizontal surfaces. Lumber edge for transparent finish matching wood species and cut on cabinet surfaces as indicated.
- 4. Core Material at Sinks: Medium-density, exterior-grade plywood.

2.2 PLASTIC-LAMINATE-FACED ARCHITECTURAL CABINETS

- A. Quality Standard: Unless otherwise indicated, comply with the "Architectural Woodwork Standards" for grades of architectural plastic-laminate cabinets indicated for construction, finishes, installation, and other requirements.
 - 1. The Contract Documents contain selections chosen from options in the quality standard and additional requirements beyond those of the quality standard. Comply with those selections and requirements in addition to the quality standard.
- B. Grade: Premium.
- C. Regional Materials: Plastic-laminate cabinets shall be manufactured within 500 miles of Project site.

- D. Type of Construction: Frameless.
- E. Cabinet, Door, and Drawer Front Interface Style: Flush overlay .
- F. Reveal Dimension: 1/2 inch.
- G. High-Pressure Decorative Laminate: NEMA LD 3, grades as indicated or if not indicated, as required by woodwork quality standard.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Abet Laminati, Inc.
 - b. Formica Corporation.
 - c. Wilsonart International; Div. of Premark International, Inc.
- H. Laminate Cladding for Exposed Surfaces:
 - 1. Horizontal Surfaces: [Grade HGS] [Grade HGL].
 - 2. Vertical Surfaces: [Grade HGS] [Grade VGS].
 - 3. Edges: Grade HGS.
- I. Colors, Patterns, and Finishes: Provide materials and products that result in colors and textures of exposed laminate surfaces complying with the following requirements:
 - 1. As indicated by laminate manufacturer's designations.
 - 2. Match Architect's sample.
 - 3. As selected by Architect from laminate manufacturer's full range in the following categories:
 - a. Solid colors, matte finish.
 - b. Patterns, matte finish.

2.3 WOOD MATERIALS

- A. Wood Products: Provide materials that comply with requirements of referenced quality standard for each type of woodwork and quality grade specified unless otherwise indicated.
 - 1. Wood Moisture Content: 8 to 13 percent.
- B. Composite Wood and Agrifiber Products: Provide materials that comply with requirements of referenced quality standard for each type of woodwork and quality grade specified unless otherwise indicated.

2.4 CABINET HARDWARE AND ACCESSORIES

- A. Frameless Concealed Hinges (European Type): BHMA A156.9, B01602, 170

degrees of opening, self-closing.

- B. Back-Mounted Pulls: BHMA A156.9, B02011.
- C. Shelf Rests: BHMA A156.9, B04013; metal.
- D. Drawer Slides: BHMA A156.9.
 - 1. Grade 1HD-100 and Grade 1HD-200: Side mounted; full-extension type; zinc-plated-steel ball-bearing slides.
 - 2. For drawers more than 3 inches high but not more than 6 inches high and not more than 24 inches wide, provide Grade 1HD-100.
 - 3. For drawers more than 6 inches high or more than 24 inches wide, provide Grade 1HD-200.
- E. Door and Drawer Silencers: BHMA A156.16, L03011.
- F. Exposed Hardware Finishes: For exposed hardware, provide finish that complies with BHMA A156.18 for BHMA finish number indicated.
 - 1. Satin Stainless Steel: BHMA 630.
- G. For concealed hardware, provide manufacturer's standard finish that complies with product class requirements in BHMA A156.9.

2.5 MISCELLANEOUS MATERIALS

- A. Furring, Blocking, Shims, and Hanging Strips: Softwood or hardwood lumber, kiln dried to less than 15 percent moisture content.
- B. Anchors: Select material, type, size, and finish required for each substrate for secure anchorage. Provide metal expansion sleeves or expansion bolts for post-installed anchors. Use nonferrous-metal or hot-dip galvanized anchors and inserts at inside face of exterior walls and at floors.
- C. Adhesives: Do not use adhesives that contain urea formaldehyde.

2.6 FABRICATION

- A. Fabricate cabinets to dimensions, profiles, and details indicated.
- B. Complete fabrication, including assembly and hardware application, to maximum extent possible before shipment to Project site. Disassemble components only as necessary for shipment and installation. Where necessary for fitting at site, provide ample allowance for scribing, trimming, and fitting.
- C. Shop-cut openings to maximum extent possible to receive hardware, appliances, electrical work, and similar items. Locate openings accurately and use templates or

roughing-in diagrams to produce accurately sized and shaped openings. Sand edges of cutouts to remove splinters and burrs.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Before installation, condition cabinets to average prevailing humidity conditions in installation areas.
- B. Before installing cabinets, examine shop-fabricated work for completion and complete work as required.

3.2 INSTALLATION

- A. Grade: Install cabinets to comply with same grade as item to be installed.
- B. Assemble cabinets and complete fabrication at Project site to the extent that it was not completed in the shop.
- C. Install cabinets level, plumb, true, and straight. Shim as required with concealed shims. Install level and plumb to a tolerance of 1/8 inch in 96 inches.
- D. Scribe and cut cabinets to fit adjoining work, refinish cut surfaces, and repair damaged finish at cuts.
- E. Anchor cabinets to anchors or blocking built in or directly attached to substrates. Secure with countersunk, concealed fasteners and blind nailing. Use fine finishing nails for exposed fastening, countersunk and filled flush with woodwork.
 - 1. Use filler matching finish of items being installed.
- F. Cabinets: Install without distortion so doors and drawers fit openings properly and are accurately aligned. Adjust hardware to center doors and drawers in openings and to provide unencumbered operation. Complete installation of hardware and accessory items as indicated.
 - 1. Install cabinets with no more than 1/8 inch in 96-inch sag, bow, or other variation from a straight line.
 - 2. Fasten wall cabinets through back, near top and bottom, and at ends not more than 16 inches o.c. with No. 10 wafer-head sheet metal screws through metal backing or metal framing behind wall finish.

3.3 ADJUSTING AND CLEANING

- A. Repair damaged and defective cabinets, where possible, to eliminate functional and visual defects; where not possible to repair, replace woodwork. Adjust joinery for uniform appearance.
- B. Clean, lubricate, and adjust hardware.
- C. Clean cabinets on exposed and semi-exposed surfaces.

END OF SECTION 06 4116

SECTION 06 4550 - PVC COLUMN WRAP

PART 1 GENERAL

1.1 SECTION INCLUDES

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- A. Simulated Wood Column Wrap.

1.2 RELATED SECTIONS

- A. Section 061100 – Rough Carpentry.
- B. Section 099113 – Exterior Painting.

1.3 REFERENCES

- A. ASTM D 792 – Density and Specific Gravity of Plastics by Displacement.
- B. ASTM D 570 – Water Absorption of Plastics.
- C. ASTM D 638 – Tensile Property of Plastics.
- D. ASTM D 790 – Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials.
- E. ASTM D 792 - Standard Test Methods for Density and Specific Gravity (Relative Density) of Plastics by Displacement.
- F. ASTM D 1761- Mechanical Fasteners in Wood.
- G. ASTM D 5420 – Standard Test Method for Impact Resistance of Flat, Rigid Plastic Specimen by means of a Striker Impacted by Falling Weight.
- H. ASTM D 256 – Determining the Pendulum Impact Resistance of Plastics.
- I. ASTM D 696 – Coefficient of Linear Thermal Expansion of Plastics Between -30 deg C and 30 deg C with a Vitreous Silica Dilatometer.
- J. ASTM D 635 - Rate of Burning and/or Extent and Time of Burning of Plastics in a Horizontal Position.
- K. ASTM E 84 – Surface Burning Characteristics of Building Materials
- L. ASTM D 648 – Deflection Temperature of Plastics Under Flexural Load in Edgewise Position.
- M. ASTM 3679 – Standard Specification for Rigid Poly Vinyl Chloride (PVC) Siding.

1.4 SUBMITTALS

- A. Submit under provisions of Section 01300.
- B. Product Data: Manufacturer's data sheets on each product to be used, including:
 - 1. Preparation instructions and recommendations.
 - 2. Storage and handling requirements and recommendations.
 - 3. Installation methods, including nailing patterns.
- C. Verification Samples: For each finish profile specified, two samples, minimum size 6 inches (150 mm) long, representing actual product and patterns finish.
- D. Manufacturer's Certificates: Certify products meet or exceed specified requirements.

1.5 QUALITY ASSURANCE

- A. Manufacturer Qualifications: A minimum of 10 years in the manufacture of PVC products.
- B. Installer Qualifications: A minimum of 3 years in the installation of PVC products.
 - 1. Finish areas designated by Architect.
 - 2. Include mock-up for each profile combination indicated on the Drawings
 - 3. Do not proceed with remaining work until workmanship, color, and sheen are approved by Architect.
 - 4. Refinish mock-up area as required to produce acceptable work.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Store products in manufacturer's unopened packaging until ready for installation.
- B. Protect materials from exposure to moisture. Do not deliver until after wet work is complete and dry.

1.7 PROJECT CONDITIONS

- A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.

1.8 WARRANTY

- A. Warranted to the original Owner under normal and proper use to be free of manufacturing defects for a period of 25 years.

1.9 COORDINATION

- A. Coordinate Work with other operations and installation of trim to avoid damage to installed materials.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Acceptable Manufacturer: CertainTeed Corp., CertainTeed Restoration Millwork, which is located at: 750 E. Swedesford Rd. ; Valley Forge, PA 19482; Toll Free Tel: 800-233-8990 ; Fax: 610-341-7940 ; Email: request info; Web: <http://www.certainteed.com/products/trim>.
- B. Requests for substitutions will be considered in accordance with Division 1 provisions.

2.2 MATERIAL

- A. General: CertainTeed Restoration Millwork is a Freefoam Cellular PVC that is homogenous and free of voids, holes, cracks, and foreign inclusions and other defects. Edges must be square and top and bottom surfaces shall be flat with no convex or concave deviation.
- B. Physical Properties: Free foam cellular PVC material with a small-cell microstructure of 0.60 grams/cm³ in accordance with ASTM D 792 with the following physical and performance properties:
 - 1. Mechanical:
 - a. Tensile Strength: 1261 psi when tested in accordance with ASTM D 638.
 - b. Tensile Modulus: 79,463 psi when tested in accordance with ASTM D 638.
 - c. Flexural Strength: 4082 psi when tested in accordance with ASTM D 790.
 - d. Nail Hold: 66 (finish nail) lbf/in of penetration when tested in accordance with ASTM D 1761.
 - e. Screw Hold: 593 lbf/in of penetration when tested in accordance with ASTM D 1761.
 - f. Gardner Impact: 16 in-lbs when tested in accordance with ASTM D 4226.
 - g. Charpy Impact (23 deg C): 0.1526 ft-lbs/in when tested in accordance with ASTM D 256.
 - 2. Thermal:
 - a. Coefficient of Linear Expansion: 3.2 x10⁻⁵ in/in/deg F when tested in accordance with ASTM D 696.
 - b. Burning Rate: No burn when flame removed when tested in accordance with ASTM D 635.
 - c. Flame Spread Index: 20 when tested in accordance with ASTM E 84.
 - 3. Manufacturing Tolerances:
 - a. Variation in component length: minus 0.00 plus 1.00 inch.
 - b. Variation in component width: plus or minus 1/16 inch.
 - c. Variation in component edge cut: plus or minus 2 degrees.
 - d. Variation in Density: minus 0 percent to plus 10 percent.
- C. Workmanship, Finish, and Appearance:
 - 1. Products are provided with a natural white color and a smooth finish on both sides.
 - 2. Products do not require paint for protection but may be painted to achieve a custom color.

2.3 SIMULATED WOOD TRIM

- A. General:

1. Provide simulated wood trim to the following profiles and to the configurations indicated on the Drawings.
- B. Estate Column Wrap 10" x 10" x 108":
 1. Nominal Thickness: 1/2 inch.
 2. Nominal Width: 10 inches.
 3. Nominal Length: 108 inches. Note: Two taller column wraps required for project may be fabricated out of 10"x 1/2" longer trim boards

2.4 ACCESSORIES

- A. Fasteners:
 1. Use fasteners designed for wood trim and siding (thinner shank, blunt point, full round head).
 2. Use a highly durable fastener such as stainless steel or hot dipped galvanized steel.
 3. Staples, small brads and wire nails must not be used as fastening members.
 4. Fasteners should be long enough to penetrate a solid wood substrate a minimum of 1-1/2 inch (38 mm).
 5. The use of standard nail guns is acceptable.
 6. Use two fasteners per every framing member for trimboard applications. Use additional fasteners for trimboards 12 inches (305 mm) or wider, as well as sheets.
 7. Install fasteners no more than 2 inches (51 mm) from the end of the board.
 8. Fasten trim into a flat, solid substrate. Fastening trim into hollow or uneven areas must be avoided.
 9. Pre-drilling is typically not required unless a large fastener is used or product is being installed in low temperatures.
- B. Adhesives:
 1. Glue all trim joints (scarf or miter) with a cellular PVC cement/adhesive such as TrimTight or Bond & Fill.
 2. Glue joints should be secured with a fastener and/or fastened on each side of the joint to allow adequate bonding time.
 3. Surfaces to be glued should be smooth, clean and in complete contact with each other.
 4. Various adhesives may be used. Consult adhesive manufacturer to determine suitability.
- C. Sealants:
 1. Use urethane, polyurethane or acrylic based sealants without silicone as specified in Section 07910.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Do not begin installation until substrates have been properly prepared.
- B. Prior to installation, verify governing dimensions of and condition of substrate.
- C. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.2 PREPARATION

- A. Clean surfaces thoroughly prior to installation.
- B. Examine, clean, and repair as necessary any substrate conditions that would be detrimental to proper installation.
- C. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.3 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
 - 1. Comply with all terms necessary to maintain warranty coverage.
 - 2. Use trim details indicated on Drawings.
 - 3. Touch up all field cut edges before installing.
- B. Cutting:
 - 1. Use carbide tipped blades designed to cut wood. Do not use fine-tooth metal-cutting blades or plywood blades.
 - 2. Avoid rough edges from cutting caused by: excessive friction, poor board support, worn saw blades or badly aligned tools.
- C. Drilling:
 - 1. Drill with standard woodworking drill bits.
 - 2. Do not use bits made for rigid PVC.
 - 3. Avoid frictional heat build-up and remove shavings from the drill hole frequently.
- D. Milling:
 - 1. Mill using standard milling machines used to mill lumber.
 - 2. Relief angle 20 to 30 degrees.
 - 3. Cutting speed to be optimized with the number of knives and feed rate.
- E. Routing:
 - 1. Use sharp carbide tipped router bits.
- F. Edge Finishing:
 - 1. Use machine edging, sanding, grinding, or filling to finish edges.
- G. Nail Location:
 - 1. Refer to fastening schedule and diagrams in the most current version of the manufacturer's installation manual for recommended fastener spacing.
 - 2. Install fasteners no more than 3/4 inches (19 mm) from the end of each board.
- H. Thermal Expansion and Contraction:
 - 1. Expansion and contraction will occur with changes in temperature.
 - 2. When properly fastened, allow 1/4 inch (6 mm) per 18 foot (5.49 m) for expansion and contraction.
 - 3. Joints between pieces should be glued to eliminate joint separation. When gaps are glued on a long run, allow for expansion and contraction at the end of the runs.

- I. Finishing.
 - 1. Correct dents and gouges before applying final coating.
 - 2. Prepare surfaces and paint materials as recommended by the molding manufacturer. Paint as specified in Section 09900.
 - 3. If moldings get dirty during installation, clean with a soft bristle brush and a bucket of soapy water. For stubborn stains, mold or mildew, use a cleaner suitable for PVC products.

3.4 PROTECTION

- A. Protect installed products until completion of project.
- B. Touch-up, repair or replace damaged products before Substantial Completion.

END OF SECTION

SECTION 064600 - WOOD TRIM

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. Interior standing and running trim.
- 2. Wood furring, blocking, shims, and hanging strips for installing woodwork items unless concealed within other construction before woodwork installation.
- 3. Shop priming of wood trim.

- B. Related Requirements:

- 1. Section 061000 "Rough Carpentry" for wood furring, blocking, and shims required for installing wood trim and concealed within other construction before wood trim installation.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product, including finishing materials and processes.

- B. Shop Drawings: Show location of each item, dimensioned plans and elevations, large-scale details, attachment devices, and other components.

- 1. Show details full size.
- 2. Show locations and sizes of furring, blocking, and hanging strips, including concealed blocking and reinforcement specified in other Sections.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer and fabricator.

1.5 QUALITY ASSURANCE

- A. Fabricator Qualifications: Shop that employs skilled workers who custom fabricate products similar to those required for this Project and whose products have a record of successful in-service performance.

- B. Installer Qualifications: Fabricator of products.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Do not deliver wood trim until operations that could damage wood trim have been completed in installation areas. If wood trim must be stored in other than installation areas, store only in areas where environmental conditions comply with requirements specified in "Field Conditions" Article.

1.7 FIELD CONDITIONS

- A. Environmental Limitations for Interior Work: Do not deliver or install interior wood trim until building is enclosed, wet work is complete, and HVAC system is operating and maintaining temperature between 60 and 90 deg F and relative humidity between 43 and 70 percent during the remainder of the construction period.

1.8 COORDINATION

- A. Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of Work specified in other Sections to ensure that wood trim can be supported and installed as indicated.

PART 2 - PRODUCTS

2.1 WOOD TRIM, GENERAL

- A. Quality Standard: Unless otherwise indicated, comply with the "Architectural Woodwork Standards" for grades of wood trim indicated for construction, finishes, installation, and other requirements.
 - 1. The Contract Documents contain selections chosen from options in the quality standard and additional requirements beyond those of the quality standard. Comply with those selections and requirements in addition to the quality standard.

2.2 INTERIOR STANDING AND RUNNING TRIM FOR TRANSPARENT FINISH

- A. Grade: Premium.
- B. Wood Species and Cut: Match profiles and details indicated for opaque-finished architectural woodwork e indicated.
 - 1. Species: Cherry for transparent finish
 - 2. Cut: Plain sliced/plain sawn at transparent finish

2.3 INTERIOR STANDING AND RUNNING TRIM FOR OPAQUE FINISH

- A. Grade: Premium.
- B. Wood Species: Any closed-grain hardwood.

2.4 WOOD MATERIALS

- A. Wood Products: Provide materials that comply with requirements of referenced quality standard for each type of wood trim and quality grade specified unless otherwise indicated.

- 1. Wood Moisture Content for Interior Materials: 8 to 13 percent.

2.5 MISCELLANEOUS MATERIALS

- A. Interior Furring, Blocking, Shims, and Hanging Strips: Softwood or hardwood lumber, kiln dried to less than 15 percent moisture content.
- B. Provide self-drilling screws for metal-framing supports, as recommended by metal-framing manufacturer.
- C. Anchors: Select material, type, size, and finish required for each substrate for secure anchorage. Provide metal expansion sleeves or expansion bolts for post-installed anchors. Use nonferrous-metal or hot-dip galvanized anchors and inserts at inside face of exterior walls and at floors.
- D. Adhesives: Do not use adhesives that contain urea formaldehyde.
- E. VOC Limits for Installation Adhesives and Sealants: Use products that comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):
 - 1. Wood Glues: 30 g/L.
 - 2. Multipurpose Construction Adhesives: 70 g/L.
 - 3. Structural Wood Member Adhesive: 140 g/L.
 - 4. Architectural Sealants: 250 g/L.

2.6 FABRICATION

- A. Sand fire-retardant-treated wood lightly to remove raised grain on exposed surfaces before fabrication.
- B. Fabricate wood trim to dimensions, profiles, and details indicated. Ease edges to radius indicated for the following:
 - 1. Edges of Solid-Wood (Lumber) Members: 1/16 inch unless otherwise indicated.
 - 2. Edges of Rails and Similar Members More Than 3/4 Inch Thick: 1/8 inch.

- C. Backout or groove backs of flat trim members and kerf backs of other wide, flat members except for members with ends exposed in finished work.
- D. Assemble casings in shop except where shipping limitations require field assembly.
- E. Assemble moldings in shop to maximum extent possible. Miter corners in shop and prepare for field assembly with bolted fittings designed to pull connections together.

2.7 SHOP PRIMING

- A. Preparations for Finishing: Comply with referenced quality standard for sanding, filling countersunk fasteners, sealing concealed surfaces, and similar preparations for finishing wood trim, as applicable to each unit of work.
 - 1. Backpriming: Apply one coat of sealer or primer, compatible with finish coats, to concealed surfaces of wood trim. Apply two coats to surfaces installed in contact with concrete or masonry and to end-grain surfaces.

2.8 PREPARATION

- A. Before installation, condition wood trim to average prevailing humidity conditions in installation areas.
- B. Before installing architectural wood trim, examine shop-fabricated work for completion and complete work as required, including removal of packing and backpriming.

2.9 INSTALLATION

- A. Grade: Install wood trim to comply with same grade as item to be installed.
- B. Assemble wood trim and complete fabrication at Project site to the extent that it was not completed in the shop.
- C. Install wood trim level, plumb, true, and straight. Shim as required with concealed shims. Install level and plumb to a tolerance of 1/8 inch in 96 inches.
- D. Scribe and cut wood trim to fit adjoining work, refinish cut surfaces, and repair damaged finish at cuts.
- E. Anchor wood trim to anchors or blocking built in or directly attached to substrates. Secure with countersunk, concealed fasteners and blind nailing. Use fine finishing nails for exposed fastening, countersunk and filled flush with woodwork.
 - 1. For shop-finished items, use filler matching finish of items being installed.
- F. Standing and Running Trim: Install with minimum number of joints possible, using full-length pieces (from maximum length of lumber available) to greatest extent possible. Do not use pieces less than 96 inches long except where shorter

single-length pieces are necessary. Scarf running joints and stagger in adjacent and related members.

1. Fill gaps, if any, between top of base and wall with plastic wood filler; sand smooth; and finish same as wood base if finished.
 2. Install standing and running trim with no more variation from a straight line than 1/8 inch in 96 inches.
 3. Install wall railings on indicated metal brackets securely fastened to wall framing.
- G. Touch up finishing work specified in this Section after installation of wood trim. Fill nail holes with matching filler where exposed.

2.10 ADJUSTING AND CLEANING

- A. Repair damaged and defective wood trim, where possible, to eliminate functional and visual defects; where not possible to repair, replace wood trim. Adjust joinery for uniform appearance.
- B. Clean wood trim on exposed and semi-exposed surfaces. Touch up shop-applied finishes to restore damaged or soiled areas.

END OF SECTION 06 4600

SECTION 07 2100 - THERMAL INSULATION

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. Glass-fiber blanket insulation.
- B. Related Sections:

1.3 ACTION SUBMITTALS

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

1.4 INFORMATIONAL SUBMITTALS

- A. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for each product.

1.5 QUALITY ASSURANCE

- A. Surface-Burning Characteristics: As determined by testing identical products according to ASTM E 84 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Protect insulation materials from physical damage and from deterioration due to moisture, soiling, and other sources. Store inside and in a dry location. Comply with manufacturer's written instructions for handling, storing, and protecting during installation.

1.7 GLASS-FIBER BLANKET INSULATION

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. CertainTeed Corporation.
 - 2. Guardian Building Products, Inc.
 - 3. Johns Manville.
 - 4. Owens Corning.

- B. Unfaced, Glass-Fiber Blanket Insulation: ASTM C 665, Type I; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively, per ASTM E 84; passing ASTM E 136 for combustion characteristics.
 - 1. Provide R19 -4" thick unfaced batts friction fit between exterior wood studs at entire perimeter
 - 2. Provide R30 -9" thick unfaced batts over entire ceiling in attic

- C. Sustainability Requirements: Provide glass-fiber blanket insulation complying with one of the following:
 - 1. Free of Formaldehyde: Insulation manufactured with 100 percent acrylic binders and no formaldehyde.
 - 2. Low Emitting: Insulation tested according to ASTM D 5116 and shown to emit less than 0.05-ppm formaldehyde.

1.8 ACCESSORIES

- A. Penetration Filler: Provide insulated sheathing manufacturer's recommended polyurethane foam foR sealing penetrations of insulated sheathing.
 - 1. Acceptable Products:
 - a. The Dow Chemical Company "GREAT STUFF PRO™ Gaps & Cracks" single-Component polyurethane insulating foam sealant and/or "GREAT STUFF PRO™ Window & Door" single-component polyurethane low-pressure foam sealant
 - b. Or approved equals

- B. Gap Air Infiltration Filler: Two Component, Quick Cure Polyurethane Foam:
 - 1. Acceptable Products:
 - a. The Dow Chemical Company FROTH-PAK™ Foam Insulation two component, quick-cure polyurethane foam
 - b. Approved Equal
 - 2. Characteristics:

- a. NFPA 286 Approval for Exposed use to the interior of the building without the need for a 15-min thermal barrier.
- C. Flexible polyethylene foam gasketing strip to reduce air infiltration between a concrete foundation and sill plate. Provide continuous under all sill plates in width equal to width of the sill.
 - 1. Acceptable Products:
 - a. The Dow Chemical Company "STYROFOAM™ Sill Seal Foam Gasket
 - b. Approved Equal

PART 2 - EXECUTION

2.1 PREPARATION

- A. Clean substrates of substances that are harmful to insulation or that interfere with insulation attachment.

2.2 INSTALLATION, GENERAL

- A. Comply with insulation manufacturer's written instructions applicable to products and applications indicated.
- B. Install insulation that is undamaged, dry, and unsoiled and that has not been left exposed to ice, rain, or snow at any time.
- C. Extend insulation to envelop entire area to be insulated. Cut and fit tightly around obstructions and fill voids with insulation. Remove projections that interfere with placement.
- D. Provide sizes to fit applications indicated and selected from manufacturer's standard thicknesses, widths, and lengths. Apply single layer of insulation units to produce thickness indicated unless multiple layers are otherwise shown or required to make up total thickness.

2.3 PROTECTION

- A. Protect installed insulation from damage due to harmful weather exposures, physical abuse, and other causes. Provide temporary coverings or enclosures where insulation is subject to abuse and cannot be concealed and protected by permanent construction immediately after installation.

END OF SECTION

SECTION 07 2726 - FLUID-APPLIED MEMBRANE AIR BARRIERS

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 fluid-applied, membrane air barriers.

1.3 DEFINITIONS

- A. Air-Barrier Material: A primary element that provides a continuous barrier to the movement of air.
- B. Air-Barrier Accessory: A transitional component of the air barrier that provides continuity.
- C. Air-Barrier Assembly: The collection of air-barrier materials and accessory materials applied to an opaque wall, including joints and junctions to abutting construction, to control air movement through the wall.

1.4 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.
 - 1. Review air-barrier requirements and installation, special details, mockups, air-leakage and bond testing, air-barrier protection, and work scheduling that covers air barriers.

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include manufacturer's written instructions for evaluating, preparing, and treating substrate; technical data; and tested physical and performance properties of products.
 - 2. products, documentation including printed statement of VOC content.
- B. Shop Drawings: For air-barrier assemblies.
 - 1. Show locations and extent of air barrier. Include details for substrate joints and

- cracks, counterflashing strips, penetrations, inside and outside corners, terminations, and tie-ins with adjoining construction.
2. Include details of interfaces with other materials that form part of air barrier.

1.6 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer. Include list of ABAA-certified installers and supervisors employed by the Installer, who work on Project.
- B. Product Certificates: From air-barrier manufacturer, certifying compatibility of air barriers and accessory materials with Project materials that connect to or that come in contact with the barrier.
- C. Product Test Reports: For each air-barrier assembly, for tests performed by a qualified testing agency.

1.7 QUALITY ASSURANCE

- A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.
 1. Installer shall be licensed by ABAA according to ABAA's Quality Assurance Program and shall employ ABAA-certified installers and supervisors on Project.
- B. Mockups: Build mockups to set quality standards for materials and execution and for preconstruction testing.
 1. Build integrated mockups of exterior wall assembly , 150 sq. ft., incorporating backup wall construction, external cladding, window, storefront, door frame and sill, insulation, ties and other penetrations, and flashing to demonstrate surface preparation, crack and joint treatment, application of air barriers, and sealing of gaps, terminations, and penetrations of air-barrier assembly.
 - a. If Architect determines mockups do not comply with requirements, reconstruct mockups and apply air barrier until mockups are approved.
 2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
 3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Remove and replace liquid materials that cannot be applied within their stated shelf life.
- B. Protect stored materials from direct sunlight.

1.9 FIELD CONDITIONS

- A. Environmental Limitations: Apply air barrier within the range of ambient and substrate temperatures recommended by air-barrier manufacturer.
 - 1. Protect substrates from environmental conditions that affect air-barrier performance.
 - 2. Do not apply air barrier to a damp or wet substrate or during snow, rain, fog, or mist.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

- A. Source Limitations: Obtain primary air-barrier materials and air-barrier accessories from single source from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

- A. General: Air barrier shall be capable of performing as a continuous vapor- permeable air barrier and as a liquid-water drainage plane flashed to discharge to the exterior incidental condensation or water penetration. Air-barrier assemblies shall be capable of accommodating substrate movement and of sealing substrate expansion and control joints, construction material changes, penetrations, tie-ins to installed waterproofing, and transitions at perimeter conditions without deterioration and air leakage exceeding specified limits.
- B. Air-Barrier Assembly Air Leakage: Maximum 0.02 cfm/sq. ft. of surface area at 1.57 lbf/sq. ft., when tested according to ASTM E 2357.

2.3 VAPOR-PERMEABLE MEMBRANE AIR-BARRIER

- A. Fluid-Applied, Vapor-Permeable Membrane Air Barrier: synthetic polymer membrane.
 - 1. , provide one of the following:
 - a. Synthetic Polymer Membrane:
 - 1) Grace, W. R., & Co. - Conn.; Perm-A-Barrier VP.
 - 2) Henry Company; Air-Bloc 33.
 - 3) Tremco Incorporated, an RPM company; ExoAir 230.
- B. Physical and Performance Properties:
 - b. Air Permeance: Maximum 0.004 cfm/sq. ft. of surface area at 1.57-lbf/sq. ft. pressure difference; ASTM E
 - c. Vapor Permeance: Minimum 5.5 perms; ASTM E 96/E 96M.

- d. Ultimate Elongation: Minimum 200 percent; ASTM D 412, Die C.

2.4 ACCESSORY MATERIALS

- A. General: Accessory materials recommended by air-barrier manufacturer to produce a complete air-barrier assembly and compatible with primary air-barrier material.
- B. Primer: Liquid solvent-borne primer recommended for substrate by air-barrier material manufacturer.
- C. Counterflashing Strip: Modified bituminous, 40-mil- thick, self-adhering sheet consisting of 32 mils of rubberized asphalt laminated to an 8-mil- thick, cross-laminated polyethylene film with release liner backing.
- D. Modified Bituminous Strip: Vapor retarding, 40 mils thick, smooth surfaced, self-adhering; consisting of 36 mils of rubberized asphalt laminated to a 4-mil- thick polyethylene film with release liner backing.
- E. Joint Reinforcing Strip: Air-barrier manufacturer's glass-fiber-mesh tape.
- F. Substrate-Patching Membrane: Manufacturer's standard trowel-grade substrate filler.
- G. Adhesive and Tape: Air-barrier manufacturer's standard adhesive and pressure-sensitive adhesive tape.
- H. Sprayed Polyurethane Foam Sealant: One- or two-component, foamed-in-place, polyurethane foam sealant, 1.5- to 2.0-lb/cu. ft density; flame-spread index of 25 or less according to ASTM E 162; with primer and noncorrosive substrate cleaner recommended by foam sealant manufacturer.
- I. Modified Bituminous Transition Strip: Vapor retarding, 40 mils thick, smooth surfaced, self-adhering; consisting of 36 mils of rubberized asphalt laminated to a 4-mil- thick polyethylene film with release liner backing.
- J. Elastomeric Flashing Sheet: ASTM D 2000, minimum 50- to 65-mil- thick, cured sheet neoprene with manufacturer-recommended contact adhesives and lap sealant with aluminum termination bars and stainless-steel fasteners.
- K. Preformed Silicone-Sealant Extrusion: Manufacturer's standard system consisting of cured low-modulus silicone extrusion, sized to fit opening widths, with a single-component, neutral-curing, Class 100/50 (low-modulus) silicone sealant for bonding extrusions to substrates.
1. Products: Subject to compliance with requirements, provide one of the following:
- a. Dow Corning Corporation; 123 Silicone Seal.
 - b. Pecora Corporation; Sil-Span.
 - c. Tremco Incorporated, an RPM company; Spectrem Simple Seal.
- L. Joint Sealant: ASTM C 920, single-component, neutral-curing silicone; Class 100/50 (low modulus), Grade NS, Use NT related to exposure, and, as applicable to joint

substrates indicated, Use O. Comply with Section 079200 "Joint Sealants."

- M. Termination Mastic: Air-barrier manufacturer's standard cold fluid-applied elastomeric liquid; trowel grade.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements and other conditions affecting performance of the Work.
 - 1. Verify that substrates are sound and free of oil, grease, dirt, excess mortar, or other contaminants.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 SURFACE PREPARATION

- A. Clean, prepare, treat, and seal substrate according to manufacturer's written instructions. Provide clean, dust-free, and dry substrate for air-barrier application.
- B. Mask off adjoining surfaces not covered by air barrier to prevent spillage and overspray affecting other construction.
- C. Remove grease, oil, bitumen, form-release agents, paints, curing compounds, and other penetrating contaminants or film-forming coatings from concrete.
- D. Remove fins, ridges, mortar, and other projections and fill honeycomb, aggregate pockets, holes, and other voids in concrete with substrate-patching membrane.
- E. Remove excess mortar from masonry ties, shelf angles, and other obstructions.
- F. At changes in substrate plane, apply sealant or termination mastic beads at sharp corners and edges to form a smooth transition from one plane to another.
- G. Cover gaps in substrate plane and form a smooth transition from one substrate plane to another with stainless-steel sheet mechanically fastened to structural framing to provide continuous support for air barrier.

3.3 JOINT TREATMENT

- A. Concrete and Masonry: Prepare, treat, rout, and fill joints and cracks in substrate according to ASTM C 1193 and air-barrier manufacturer's written instructions. Remove dust and dirt from joints and cracks complying with ASTM D 4258 before coating surfaces.
 - 1. Prime substrate and apply a single thickness of air-barrier manufacturer's recommended preparation coat extending a minimum of 3 inches along each

side of joints and cracks. Apply a double thickness of fluid air-barrier material and embed a joint reinforcing strip in preparation coat.

3.4 TRANSITION STRIP INSTALLATION

- A. General: Install strips, transition strips, and accessory materials according to air-barrier manufacturer's written instructions to form a seal with adjacent construction and maintain a continuous air barrier.
 - 1. Coordinate the installation of air barrier with installation of roofing membrane and base flashing to ensure continuity of air barrier with roofing membrane.
 - 2. Install strip on roofing membrane or base flashing so that a minimum of 3 inches of coverage is achieved over each substrate.
- B. Apply primer to substrates at required rate and allow it to dry. Limit priming to areas that will be covered by fluid air-barrier material on same day. Reprime areas exposed for more than 24 hours.
- C. At end of each working day, seal top edge of strips and transition strips to substrate with termination mastic.
- D. Apply joint sealants forming part of air-barrier assembly within manufacturer's recommended application temperature ranges. Consult manufacturer when sealant cannot be applied within these temperature ranges.
- E. Wall Openings: Prime concealed, perimeter frame surfaces of windows, curtain walls, storefronts, and doors. Apply preformed silicone-sealant extrusion so that a minimum of 3 inches of coverage is achieved over each substrate. Maintain 3 inches of full contact over firm bearing to perimeter frames with not less than 1 inch of full contact.
 - 1. Preformed Silicone-Sealant Extrusion: Set in full bed of silicone sealant applied to walls, frame, and air-barrier material.
- F. Fill gaps in perimeter frame surfaces of windows, , and doors, and miscellaneous penetrations of air-barrier material with foam sealant.
- G. Seal strips and transition strips around masonry reinforcing or ties and penetrations with termination mastic.
- H. Seal top of through-wall flashings to air barrier with an additional 6-inch- wide, strip.
- I. Seal exposed edges of strips at seams, cuts, penetrations, and terminations not concealed by metal counterflashings or ending in reglets with termination mastic.
- J. Repair punctures, voids, and deficient lapped seams in strips and transition strips. Slit and flatten fishmouths and blisters. Patch with transition strips extending 6 inches beyond repaired areas in strip direction.

3.5 FLUID AIR-BARRIER MEMBRANE INSTALLATION

- A. General: Apply fluid air-barrier material to form a seal with strips and transition strips and to achieve a continuous air barrier according to air-barrier manufacturer's written instructions. Apply fluid air-barrier material within manufacturer's recommended application temperature ranges.
1. Apply primer to substrates at required rate and allow it to dry.
 2. Limit priming to areas that will be covered by fluid air-barrier material on same day. Reprime areas exposed for more than 24 hours.

(1.0-mm)Apply strip and transition strip over cured air-barrier material overlapping 3 inches onto each surface according to air-barrier manufacturer's written instructions.

- C. Do not cover air barrier until it has been tested and inspected by Owner's testing agency.
- D. Correct deficiencies in or remove air barrier that does not comply with requirements; repair substrates and reapply air-barrier components.

3.6 FIELD QUALITY CONTROL

- A. Inspections: Air-barrier materials, accessories, and installation are subject to inspection for compliance with requirements. Inspections may include the following:
1. Continuity of air-barrier system has been achieved throughout the building envelope with no gaps or holes.
 2. Continuous structural support of air-barrier system has been provided.
 3. Masonry and concrete surfaces are smooth, clean, and free of cavities, protrusions, and mortar droppings.
 4. Site conditions for application temperature and dryness of substrates have been maintained.
 5. Maximum exposure time of materials to UV deterioration has not been exceeded.
 6. Surfaces have been primed, if applicable.
 7. Laps in strips and transition strips have complied with minimum requirements and have been shingled in the correct direction (or mastic has been applied on exposed edges), with no fishmouths.
 8. Termination mastic has been applied on cut edges.
 9. Strips and transition strips have been firmly adhered to substrate.
 10. Compatible materials have been used.
 11. Transitions at changes in direction and structural support at gaps have been provided.
 12. Connections between assemblies (air-barrier and sealants) have complied with requirements for cleanliness, surface preparation and priming, structural support, integrity, and continuity of seal.
 13. All penetrations have been sealed.

3.7 CLEANING AND PROTECTION

- A. Protect air-barrier system from damage during application and remainder of construction period, according to manufacturer's written instructions.

1. Protect air barrier from exposure to UV light and harmful weather exposure as required by manufacturer. If exposed to these conditions for more than 30 days, remove and replace air barrier or install additional, full-thickness, air-barrier application after repairing and preparing the overexposed membrane according to air-barrier manufacturer's written instructions.
 2. Protect air barrier from contact with incompatible materials and sealants not approved by air-barrier manufacturer.
- B. Clean spills, stains, and soiling from construction that would be exposed in the completed work using cleaning agents and procedures recommended by manufacturer of affected construction.
- C. Remove masking materials after installation.

END OF SECTION

SECTION 07 3113 - ASPHALT SHINGLES

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. Asphalt shingles on low slope roof
- 2. Underlayment – two layers.
- 3. Ridge Vents

- B. Related Sections:

- 1. Section 061000 "Rough Carpentry" for wood framing and sheathing
- 2. Section 076200 "Sheet Metal Flashing and Trim" for metal roof penetration flashings counterflashings and flashings.

1.3 DEFINITION

- A. Roofing Terminology: See ASTM D 1079 and glossary of NRCA's "The NRCA Roofing and Waterproofing Manual" for definitions of terms related to roofing work in this Section.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Samples for Initial Selection: For each type of asphalt shingle indicated.
 - 1. Include similar Samples of trim and accessories involving color selection.
- C. Samples for Verification: For the following products, of sizes indicated, to verify color selected:
 - 1. Asphalt Shingle: Full size.
 - 2. Ridge and Hip Cap Shingles: Full size.
 - 3. Ridge Vent: 12-inch- long Sample.
 - 4. Exposed Valley Lining: 12 inches square.
 - 5. Self-Adhering Underlayment: 12 inches square.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified Installer.
- B. Product Test Reports: Based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified testing agency, for asphalt shingles.
- C. Research/Evaluation Reports: For each type of asphalt shingle required, from the ICC.
- D. Warranties: Sample of special warranties.

1.6 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For each type of asphalt shingle to include in maintenance manuals.

1.7 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Asphalt Shingles: 100 sq. ft of each type, in unbroken bundles.

1.8 QUALITY ASSURANCE

- A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of units required for this Project.
- B. Source Limitations: Obtain ridge and hip cap shingles and ridge vents from single source from single manufacturer.
- C. Fire-Resistance Characteristics: Where indicated, provide asphalt shingles and related roofing materials identical to those of assemblies tested for fire resistance per test method below by UL or another testing and inspecting agency acceptable to authorities having jurisdiction. Identify products with appropriate markings of applicable testing agency.
 - 1. Exterior Fire-Test Exposure: Class A; ASTM E 108 or UL 790, for application and roof slopes indicated.
- D. Preinstallation Conference: Conduct conference at Project site.

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Store roofing materials in a dry, well-ventilated, weathertight location according to asphalt shingle manufacturer's written instructions. Store underlayment rolls on end on pallets or other raised surfaces. Do not double stack rolls.

1. Handle, store, and place roofing materials in a manner to avoid significant or permanent damage to roof deck or structural supporting members.
- B. Protect unused underlayment from weather, sunlight, and moisture when left overnight or when roofing work is not in progress.

1.10 PROJECT CONDITIONS

- A. Environmental Limitations: Do not deliver or install asphalt shingles until spaces are enclosed and weathertight, wet work in spaces is complete and dry, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.
 1. Install self-adhering sheet underlayment within the range of ambient and substrate temperatures recommended by manufacturer.

1.11 WARRANTY

- A. Special Warranty: Standard form in which manufacturer agrees to repair or replace asphalt shingles that fail in materials or workmanship within specified warranty period.
 1. Failures include, but are not limited to, the following:
 - a. Manufacturing defects.
 - b. Structural failures including failure of asphalt shingles to self-seal after a reasonable time.
 2. Material Warranty Period: 20 years from date of Substantial Completion, prorated, with first five years nonprorated.
 3. Wind-Speed Warranty Period: Asphalt shingles will resist blow-off or damage caused by wind speeds up to 80 mph for 10 years from date of Substantial Completion.
 4. Algae-Discoloration Warranty Period: Asphalt shingles will not discolor 10 years from date of Substantial Completion.
 5. Workmanship Warranty Period: 10 years from date of Substantial Completion.
- B. Special Project Warranty: Roofing Installer's Warranty, or warranty form at end of this Section, signed by roofing Installer, covering the Work of this Section, in which roofing Installer agrees to repair or replace components of asphalt shingle roofing that fail in materials or workmanship within specified warranty period.
 1. Warranty Period: Two years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 GLASS-FIBER-REINFORCED ASPHALT SHINGLES

- A. Laminated-Strip Asphalt Shingles: ASTM D 3462, laminated, multi-ply overlay construction, glass-fiber reinforced, mineral-granule surfaced, and self-sealing.
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide GAF Timberline Natural Shadow or comparable product by one of the following:
 - a. CertainTeed Corporation.
 - b. Elk Premium Building Products, Inc.; an ElkCorp company.
 - 2. Tab Arrangement: 5 tabs; randomly spaced.
 - 3. Butt Edge: Straight Cut.
 - 4. Strip Size: Manufacturer's standard.
 - 5. Algae Resistance: Granules treated to resist algae discoloration. Impact Resistance: UL 2218, Class 4.
 - 6. Color and Blends: As selected by Architect from manufacturer's full range.
- B. Hip and Ridge Shingles: Manufacturer's standard units to match asphalt shingles.

2.2 UNDERLAYMENT MATERIALS

- A. Two Layers of Self-Adhering Sheet Underlayment, High Temperature: Minimum of 30- to 40-mil- thick, slip-resisting, polyethylene-film-reinforced top surface laminated to layer of butyl or SBS-modified asphalt adhesive, with release paper backing; cold applied
 - 1. Thermal Stability: Stable after testing at 240 deg F; ASTM D 1970.
 - 2. Low-Temperature Flexibility: Passes after testing at minus 20 deg F; ASTM D 1970.
 - 3. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 4. Basis-of-Design Product: Subject to compliance with requirements, provide [product indicated on Drawings] <Insert manufacturer's name; product name or designation> or comparable product by one of the following:
 - a. Grace, W. R. & Co. - Conn.
 - b. Henry Company, RF 200.

2.3 RIDGE VENTS

- A. Rigid Ridge Vent: Manufacturer's standard, rigid section high-density polypropylene or other UV-stabilized plastic ridge vent with nonwoven geotextile filter strips ; for use under ridge shingles.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
2. Basis-of-Design Product: Subject to compliance with requirements, provide [product indicated on Drawings] <Insert manufacturer's name; product name or designation> or comparable product by one of the following:
 - a. Cor-A-Vent, Inc.
 - b. GAF Materials Corporation.
3. Width: As indicated on drawings.
4. Thickness: As indicated on drawings.

2.4 ACCESSORIES

- A. Asphalt Roofing Cement: ASTM D 4586, Type II, asbestos free.
- B. Roofing Nails: ASTM F 1667; stainless-steel shingle nails, minimum 0.120-inch-diameter, smooth shank, sharp-pointed, with a minimum 3/8-inch-diameter flat head and of sufficient length to penetrate 3/4 inch into solid wood decking or extend at least 1/8 inch through OSB or plywood sheathing. Where underside of sheathing is visible coordinate nail length to ensure point is not visible from below.
 1. Where nails are in contact with metal flashing, use nails made from same metal as flashing.

2.5 METAL FLASHING AND TRIM

- A. General: Comply with requirements in Section 076200 "Sheet Metal Flashing and Trim."
- B. Fabricate sheet metal flashing and trim to comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, metal, and other characteristics of the item.
 1. Apron Flashings: Fabricate with lower flange a minimum of 5 inches over and 4 inches beyond each side of downslope asphalt shingles and 6 inches up the vertical surface.
 2. Step Flashings: Fabricate with a headlap of 2 inches and a minimum extension of 5 inches over the underlying asphalt shingle and up the vertical surface.
 3. Cricket or Backer Flashings: Fabricate with concealed flange extending a minimum of 18 inches beneath upslope asphalt shingles and 6 inches beyond each side of chimney skylight and 6 inches above the roof plane.
 4. Open-Valley Flashings: Fabricate in lengths not exceeding 10 feet with 1-inch-high, inverted-V profile at center of valley and equal flange widths of 10 inches.
 5. Drip Edges: Fabricate in lengths not exceeding 10 feet with 2-inch roof-deck flange and 1-1/2-inch fascia flange with 3/8-inch drip at lower edge.

- C. Vent Pipe Flashings: ASTM B 749, Type L51121, at least 1/16 inch thick. Provide lead sleeve sized to slip over and turn down into pipe, soldered to skirt at slope of roof, and extending at least 4 inches from pipe onto roof.

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 the Work.
 - 1. Examine roof sheathing to verify that sheathing joints are supported by framing and blocking or metal clips and that installation is within flatness tolerances.
 - 2. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and completely anchored; and that provision has been made for flashings and penetrations through asphalt shingles.
- B. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 UNDERLAYMENT INSTALLATION

- A. General: Comply with underlayment manufacturer's written installation instructions applicable to products and applications indicated unless more stringent requirements apply.
- B. Self-Adhering Sheet Underlayment: Install, wrinkle free, on roof deck. Comply with low-temperature installation restrictions of underlayment manufacturer if applicable. Install two layers over entire roof, lapped in direction to shed water. Lap sides not less than 3-1/2 inches. Lap ends not less than 6 inches staggered 24 inches between courses. Roll laps with roller. Cover underlayment within seven days.
- C. Metal-Flashed, Open-Valley Underlayment: Install two layers of 36-inch- wide felt underlayment centered in valley. Stagger end laps between layers at least 72 inches. Lap ends of each layer at least 12 inches in direction to shed water, and seal with asphalt roofing cement. Fasten each layer to roof deck with nails.
 - 1. Lap roof-deck felt underlayment over first layer of valley felt underlayment at least 6 inches.

3.3 METAL FLASHING INSTALLATION

- A. General: Install metal flashings and other sheet metal to comply with requirements in Section 076200 "Sheet Metal Flashing and Trim."

1. Install metal flashings according to recommendations in ARMA's "Residential Asphalt Roofing Manual" and asphalt shingle recommendations in NRCA's "The NRCA Roofing and Waterproofing Manual."
- B. Apron Flashings: Extend lower flange over and beyond each side of downslope asphalt shingles and up the vertical surface.
- C. Step Flashings: Install with a headlap of 2 inches and extend over the underlying asphalt shingle and up the vertical surface. Fasten to roof deck only.
- D. Cricket or Backer Flashings: Install against the roof-penetrating element extending concealed flange beneath upslope asphalt shingles and beyond each side.
- E. Open-Valley Flashings: Install centered in valleys, lapping ends at least 8 inches in direction to shed water. Fasten upper end of each length to roof deck beneath overlap.
 1. Adhere 9-inch- wide strip of self-adhering sheet to metal flanges and to self-adhering sheet underlayment.
- F. Rake Drip Edges: Install rake drip edge flashings over underlayment and fasten to roof deck.
- G. Eave Drip Edges: Install eave drip edge flashings below underlayment and fasten to roof sheathing.
- H. Pipe Flashings: Form flashing around pipe penetrations and asphalt shingles. Fasten and seal to asphalt shingles as recommended by manufacturer.

3.4 ASPHALT SHINGLE INSTALLATION

- A. General: Install asphalt shingles according to manufacturer's written instructions, recommendations in ARMA's "Residential Asphalt Roofing Manual," and asphalt shingle recommendations in NRCA's "The NRCA Roofing and Waterproofing Manual."
- B. Install starter strip along lowest roof edge, consisting of an asphalt shingle strip with tabs removed at least 7 inches wide with self-sealing strip face up at roof edge.
 1. Extend asphalt shingles 1/2 inch over fasciae at eaves and rakes.
 2. Install starter strip along rake edge.
- C. Install first and remaining courses of asphalt shingles stair-stepping diagonally across roof deck with manufacturer's recommended offset pattern at succeeding courses, maintaining uniform exposure.
- D. Fasten asphalt shingle strips with a minimum of four roofing nails located according to manufacturer's written instructions.
 1. When ambient temperature during installation is below 50 deg F, seal asphalt

shingles with asphalt roofing cement spots.

- E. Open Valleys: Cut and fit asphalt shingles at open valleys, trimming upper concealed corners of shingle strips. Maintain uniform width of exposed open valley from highest to lowest point.
 - 1. Set valley edge of asphalt shingles in a 3-inch- wide bed of asphalt roofing cement.
 - 2. Do not nail asphalt shingles to metal open-valley flashings.
- F. Ridge Vents: Install continuous ridge vents over asphalt shingles according to manufacturer's written instructions. Fasten with roofing nails of sufficient length to penetrate sheathing.
- G. Ridge and Hip Cap Shingles: Maintain same exposure of cap shingles as roofing shingle exposure. Lap cap shingles at ridges to shed water away from direction of prevailing winds. Fasten with roofing nails of sufficient length to penetrate sheathing.
 - 1. Fasten ridge cap asphalt shingles to cover ridge vent without obstructing airflow.

3.5 ROOFING INSTALLER'S WARRANTY

- A. WHEREAS <Insert name> of <Insert address>, herein called the "Roofing Installer," has performed roofing and associated work ("work") on the following project:
 - 1. Owner: <Insert name of Owner>.
 - 2. Address: <Insert address>.
 - 3. Building Name/Type: <Insert information>.
 - 4. Address: <Insert address>.
 - 5. Area of Work: <Insert information>.
 - 6. Acceptance Date: <Insert date>.
 - 7. Warranty Period: <Insert time>.
 - 8. Expiration Date: <Insert date>.
- B. AND WHEREAS Roofing Installer has contracted (either directly with Owner or indirectly as a subcontractor) to warrant said work against leaks and faulty or defective materials and workmanship for designated Warranty Period,
- C. NOW THEREFORE Roofing Installer hereby warrants, subject to terms and conditions herein set forth, that during Warranty Period he will, at his own cost and expense, make or cause to be made such repairs to or replacements of said work as are necessary to correct faulty and defective work and as are necessary to maintain said work in a watertight condition.
- D. This Warranty is made subject to the following terms and conditions:
 - 1. Specifically excluded from this Warranty are damages to work and other parts of the building, and to building contents, caused by:

- a. Lightning;
 - b. Peak gust wind speed exceeding <Insert wind speed> mph;
 - c. Fire;
 - d. Failure of roofing system substrate, including cracking, settlement, excessive deflection, deterioration, and decomposition;
 - e. Faulty construction of parapet walls, copings, chimneys, skylights, vents, equipment supports, and other edge conditions and penetrations of the work;
 - f. Vapor condensation on bottom of roofing; and
 - g. Activity on roofing by others, including construction contractors, maintenance personnel, other persons, and animals, whether authorized or unauthorized by Owner.
2. When work has been damaged by any of foregoing causes, Warranty shall be null and void until such damage has been repaired by Roofing Installer and until cost and expense thereof have been paid by Owner or by another responsible party so designated.
 3. Roofing Installer is responsible for damage to work covered by this Warranty but is not liable for consequential damages to building or building contents resulting from leaks or faults or defects of work.
 4. During Warranty Period, if Owner allows alteration of work by anyone other than Roofing Installer, including cutting, patching, and maintenance in connection with penetrations, attachment of other work, and positioning of anything on roof, this Warranty shall become null and void on date of said alterations, but only to the extent said alterations affect work covered by this Warranty. If Owner engages Roofing Installer to perform said alterations, Warranty shall not become null and void unless Roofing Installer, before starting said work, shall have notified Owner in writing, showing reasonable cause for claim, that said alterations would likely damage or deteriorate work, thereby reasonably justifying a limitation or termination of this Warranty.
 5. During Warranty Period, if original use of roof is changed and it becomes used for, but was not originally specified for, a promenade, work deck, spray-cooled surface, flooded basin, or other use or service more severe than originally specified, this Warranty shall become null and void on date of said change, but only to the extent said change affects work covered by this Warranty.
 6. Owner shall promptly notify Roofing Installer of observed, known, or suspected leaks, defects, or deterioration and shall afford reasonable opportunity for Roofing Installer to inspect work and to examine evidence of such leaks, defects, or deterioration.
 7. This Warranty is recognized to be the only warranty of Roofing Installer on said work and shall not operate to restrict or cut off Owner from other remedies and resources lawfully available to Owner in cases of roofing failure. Specifically, this Warranty shall not operate to relieve Roofing Installer of responsibility for performance of original work according to requirements of the Contract Documents, regardless of whether Contract was a contract directly with Owner or a subcontract with Owner's General Contractor.
- E. IN WITNESS THEREOF, this instrument has been duly executed this <Insert day> day of <Insert month>, <Insert year>.

1. Authorized Signature: <Insert signature>.
2. Name: <Insert name>.
3. Title: <Insert title>.

END OF SECTION 073113

SECTION 07 4100 - PREFORMED METAL STANDING SEAM ROOFING

PART 1 GENERAL

1.1 DESCRIPTION OF WORK

- A. This Section covers the, pre-finished, pre-fabricated Architectural standing seam roof system. All metal trim, accessories, fasteners, insulation, and sealants indicated on the drawings as part of this section. See description of alternates.

1.2 RELATED SECTIONS

- A. SECTION 7, Sheet Metal Flashings and Trim
- B. SECTION 7, Joint Sealants

1.3 QUALITY ASSURANCE

- A. Manufacturer and installer shall demonstrate experience, of a minimum of five (5) years in this type of project.

1.4 ROOF SYSTEM PERFORMANCE TESTING

- A. Water Penetration: When tested per ASTM E-283/1680 and ASTM E-331/1646 there shall be no uncontrolled water penetration or air infiltration through the panel joints.
- B. Roof System shall be designed to meet wind load requirements shown on the structural drawings.
- C. Provide professional engineer calculations, see Submittals.

1.5 WARRANTIES

- A. The Contractor shall warrant for twenty years (20) from the date of substantial completion of the Work related to this section, that the work is not defective in workmanship or material, and that the roof will be adequate to prevent leaks. This warranty may be provided in the short term by the Contractor/Roof Installer, however must have the backing and assurance of the roof system manufacturer.
- B. Finish Warranty on Aluminum:
Written 20 Year Finish Warranty shall be required for the Aluminum Standing Seam Roof System including Flashings, and related rain-carrying equipment as supplied by the manufacturer and roofing contractor. This warranty will be for 20 Years and cover: Chalking, Fading and Integrity of the Kynar 500™ paint finish on the Aluminum

1.6 SUBMITTALS

- A. Furnish detailed drawings showing profile and gauge of exterior sheets, location and type of fasteners, location, gauges, shape and method of attachment of all trim locations and

type of sealants, and any other details as may be required for a weather-tight installation.

- B. Provide finish samples of all colors specified.
- C. Shop Drawings: Show layouts of metal roof panels, including plans, elevations, sections, details, and attachments to other work.
 - 1. Include details of edge conditions, joints, panel profiles, corners, anchorages, trim, flashings, closures, and accessories.
 - 2. Include structural analysis data signed and sealed by the qualified South Carolina licensed professional engineer responsible for their preparation.

PART 2 PRODUCTS

2.1 PANEL DESIGN: Roof panels shall be standing seam in 16" widths with 1 ¾" high seam, in .032" Standard Aluminum Association gage, sheet metal factory roll-formed standing seam roofing panels.

2.2 ACCEPTABLE MANUFACTURERS

- A. Use the following Basis of Design or prior approved equal: Petersen Aluminum Corporation, Kennesaw, GA "SNAP-CLAD" PANEL,
- B. Approved Equals:
 - 1. AEP-Span.
 - 2. Fabral, Inc.
 - 3. McElroy Metal, Inc.
 - 4. Merchant & Evans, Inc.
 - 5. Englert, Inc.

2.3 MATERIAL AND FINISHES

- A. Face Sheet Material: Aluminum Standing Seam sheet shall be produced from ASTM B-209 quality Aluminum, 3105 H-14 Alloy and Temper material. Aluminum shall be tension leveled (temper passed and stretcher leveled) with camber a maximum of 1/4 inch in 20 feet, manufactured in the USA, and be 032" Thick Aluminum U.S. standard gauge. Product to meet UL-90 Design Standards and shall meet applicable SC Building Code Wind load requirements for this project location.
- C. Finish:
 - a. Finish shall be Kynar 500 or Hylar 5000 Fluorocarbon coating with a top side film thickness of 0.70 to 0.90 mil over 0.25 to 0.31 mil prime coat to provide a total dry film thickness of 0.95 to 1.25 mil. Bottom side shall be coated with a primer with a dry film thickness of 0.25 mil. Finish shall conform to all tests for adhesion, flexibility and longevity as specified by Kynar 500 or Hylar 5000 finish supplier.
 - b. If Strippable coating shall be applied on the pre-finished panels to the top side to protect the finish during fabrication, shipping and field handling. This strippable coating shall be removed before installation.
 - c. Field protection must be provided by the Contractor at the job site so material is

- not exposed to weather and moisture.
- d. Exposed Face Color: Architect to select from manufacturer's standard finishes including metallic finishes.
- D. Exposed Flashing and Trim:
 - a. Unless otherwise specified, all exposed adjacent flashing and trim shall be of the same material and finish as panel system.
- E. Forming: Use continuous end rolling method. No end laps on panels. No portable rollforming machines by the installer shall be permitted. Panels shall be "factory manufactured" and "tension-leveled" by the designated manufacturer listed above.
- F. Trim: Trim shall be fabricated of the same material and finish to match the profiled sheeting and press broken in lengths of 10 to 12 feet. Trim shall be formed only by the manufacturer or their approved dealer. Trim to be erected in overlapped condition. Use lap strips only as indicated on drawings. Miter conditions shall be factory welded material to match the sheeting.
- G. Closures: Use composition or metal profiled closures at top of each elevation to close ends of the panels. Metal closures to be made in the same material and finish as face sheet.
Panel Clips: Shall be Stainless Steel as required by the panel manufacturer in appropriate Gage and spacing of Clips to meet the job-specific Wind Load requirements by the SC Building Code. Necessary engineering documentation of this clip spacing and attachment to be provided in the submittal stage to the Architect.
- H. Fasteners: Fasteners shall be 400 series stainless steel, dished washers stainless steel with bonded neoprene.
- I. Zees: Where required by design of primary structural framing system shall be used to span between beams and/or joists. Thermally responsive base and top clips shall be fastened to the zees on 12" centers.

2.4 ROOFING UNDERLAYMENT

- A. Provide (1) layer 40 Mil "Peel & Stick Membrane" Membrane to be smooth, non-granular over the full surface of the roof, one of the following manufacturers:
 - a) DeWitts "Lite-N-Smooth"
 - b) W.R. Grace "Ice & Water Shield".
 - c) Carlisle: CCW WIP 300HT.
 - d) Interwrap: Titanium PSU.
 - e) MFM Corp: "Wind & Water Shield".
 - f) Polyguard: Deck Guard HT or Polyglas HT.
 - g) TAMKO: TW Tile & Metal Underlayment.

2.5 SEALANTS

- A. Provide under Division 7; section "Joint Sealants" Provide sealants also approved by roof manufacturer.

2.6 FABRICATION

- A. Comply with dimensions, profile limitations, gauges and fabrication details shown and if not shown and, if not shown, provide manufacturer's standard product fabrication.
- B. Fabricate components of the system in factory, ready for field assembly.
- C. Fabricate components and assemble units to comply with fire and performance requirements specified.

- D. Apply specified finishes in conformance with manufacturer's standards, and according to manufacturer's instructions.

PART 3 - EXECUTION

3.1 INSPECTION

- A. Examine alignment of building structure and related supports prior to installation and do not proceed until the defects are corrected by the responsible contractor.

3.2 FASTENERS

- A. Secure units to supports.
- B. Place fasteners as indicated in manufacturer's standards.
- C. Coordinate lengths of fasteners to not penetrate non-structural plywood where underside of roof sheathing is visible beyond the face of the building. Show in shop drawings. No fasteners exposed to the exterior will be accepted.

3.3 INSTALLATION

- A. Panels shall be installed plumb and true in proper alignment and relation to the structural framing. The erector must have at least five years successful experience with similar applications.
- B. Install metal panels, fasteners, trim and related sealants in accordance with approved shop drawings and as may be required for a weather-tight installation.
- D. Remove all strippable coating and provide a dry wipe-down cleaning of the panels as they are erected.

3.4 DAMAGED MATERIAL

- E. Upon determination of responsibility, repair or replace damaged metal panels and trim to the satisfaction of the Architect and Owner.

END OF SECTION 07410

SECTION 07 4646 - FIBER CEMENT SIDING, PANELS & TRIM

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Fiber cement lap siding, panels, trim, fascia, molding and accessories; James Hardie HZ10 Engineered for Climate Siding at base bid and James Hardie Artisan at alternate.
- B. Cementitious express/reveal jointed panel installed in ceilings.

1.2 RELATED SECTIONS

- A. Section 06 1000 - Rough Carpentry
- B. Section 06 1600 - Sheathing
- C. Section 09 9113 - Exterior Painting

1.3 REFERENCES

- A. ASTM D3359 - Standard Test Method for Measuring Adhesion by Tape Test, Tool and Tape.
- B. ASTM E136 - Standard Test Method for Behavior of Materials in a Vertical Tube Furnace at 750 degrees C.

1.4 SUBMITTALS

- A. Submit under provisions of Section 01 3000.
- B. Product Data: Manufacturer's data sheets on each product to be used, including:
 - 1. Preparation instructions and recommendations.
 - 2. Storage and handling requirements and recommendations.
 - 3. Installation methods.
- C. Shop Drawings: Provide detailed drawings of atypical non-standard applications of cementitious siding materials which are outside the scope of the standard details and specifications provided by the manufacturer.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: Minimum of 2 years experience with installation of similar products.
- B. Mock-Up: Provide a mock-up for evaluation of surface preparation techniques and application workmanship.
 - 1. Finish areas designated by Architect.
 - 2. Do not proceed with remaining work until workmanship, color, and sheen are approved by Architect.
 - 3. Refinish mock-up area as required to produce acceptable work.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Store products in manufacturer's unopened packaging until ready for installation.
- B. Store siding on edge or lay flat on a smooth level surface. Protect edges and corners from chipping. Store sheets under cover and keep dry prior to installing.
- C. Store and dispose of solvent-based materials, and materials used with solvent-based materials, in accordance with requirements of local authorities having jurisdiction.

1.7 PROJECT CONDITIONS

- A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.

1.8 WARRANTY

- A. Product Warranty: Limited, non-pro-rated product warranty.
 - 1. lap siding for 30 years.
- B. Finish Warranty: Limited product warranty against manufacturing finish defects.
 - 1. When used for its intended purpose, properly installed and maintained according to Hardie's published installation instructions, James Hardie's ColorPlus finish with ColorPlus Technology, for a period of 15 years from the date of purchase: will not peel; will not crack; and will not chip. Finish warranty includes the coverage for labor and material.
- C. Workmanship Warranty: Application limited warranty for 2 years.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Acceptable Manufacturer: James Hardie Building Products, Inc., which is located at: 26300 La Alameda Suite 400 ; Mission Viejo, CA 92691; Toll Free Tel: 866-274-3464; Tel: 949-367-4980; Fax: 949-367-4981; Email: [request info \(info@jameshardie.com\)](mailto:request_info@jameshardie.com); Web: www.jameshardiecommercial.com
- B. Requests for approval of equal substitutions will be considered.

2.2 CEILING PANELS

- A. Cement Cladding Panels: Hardie Reveal Panel as manufactured by James Hardie Building Products, Inc. 7/16 inches thick, 3 feet 11.5 inches (1206 mm) wide by 7 feet 11.5 inches (2426 mm) long. Product shall be engineered for climate conditions.
 - 1. Manufacturer's Climate Zone Product: HZ10 for hot humid and wet climates with a yellow tint primer.

2.3 SIDING

- A. Lap siding requirement for Materials:
 - 1. Fiber-cement Siding - complies with ASTM C 1186 Grade II, Type A.
 - 2. Fiber-cement Siding - classified as noncombustible when tested in

3. Fiber-cement Siding- have a flame-spread index of 0 and a smoke-developed index of 5 when tested in accordance with ASTM E 84.
 4. Warnock Hersey Product Listing.
 5. CAL-FIRE, Fire Engineering Division Building Materials Listing - Wildland Urban Interface (WUI) Listed Product.
 6. Florida State Product Approval FL10477.
 7. Miami Dade County, Florida Notice of Acceptance 12-0517.05.
 8. Texas Department of Insurance Product Evaluation EC-55.
 9. Manufacturer's Technical Data Sheet.
- B. Lock Joint System requirement for Materials:
1. Fiber-cement Siding - complies with ASTM C 1186 Grade II, Type A
 2. Fiber-cement Siding - classified as noncombustible when tested in accordance with ASTM E 136.
 3. Fiber-cement Siding - have a flame-spread index of 0 and a smoke-developed index of 5 when tested in accordance with ASTM E 84.
 4. Warnock Hersey Product Listing..
 5. Manufacturer's Technical Data Sheet.
- C. Lap Siding: HardiePlank 5/16" Lap Siding (**BASE BID**)as manufactured by James Hardie Building Products, Inc.
1. Type: Smooth Texture 7-1/4 inches (184 mm) with 7 inches (152 mm) exposure.
- D. Lap Siding: Artisan 5/8" Lap Siding (**ALTERNATE**)as manufactured by James Hardie Building Products, Inc.
1. Type: Smooth Texture 7-1/4 inches (184 mm) with 7 inches (152 mm) exposure.
- E. Vented Soffit Panels; HardieSoffit as manufactured by James Hardie Building Products, Inc.
1. Type; Vented Smooth
- F. Trim:
1. Accent trim HardieTrim (**BASE BID**)as manufactured by James Hardie Building Products, Inc. compatible with lap siding.
 2. Accent trim Artisan Trim (**ALTERNATE**) as manufacture by Jame Hardie Building Products, Inc, compatible with lap siding

2.4 FASTENERS

- A. Wood Framing Fasteners:
1. Stainless steel fasteners of depth required to fully engage the backup wall system.
- B. Masonry Walls (Brick):
1. Stainless steel fasteners of depth required to fully engage the masonry. Provide additional 2x4 blocking between the siding and the CMU if required to meet wind speed exposure and forces.

2.5 FINISHES

- A. Factory Finish: Refer to Exterior Finish Schedule.

- Product: ColorPlus Technology by James Hardie.
1. Definition: Factory applied finish; defined as a finish applied in the same facility and company that manufactures the siding substrate.
 2. Process:
 - a. Factory applied finish by fiber cement manufacturer in a controlled environment within the fiber cement manufacturer's own facility utilizing a multi-coat, heat cured finish within one manufacturing process.
 - b. Each finish color must have documented color match to delta E of 0.5 or better between product lines, manufacturing lots or production runs as measured by photo spectrometer and verified by third party.
 3. Protection: Factory applied finish protection such as plastic laminate that is removed once siding is installed
 4. Accessories: Complete finishing system includes pre-packaged touch-up kit provided by fiber cement manufacturer. Provide quantities as recommended by manufacturer.
- B. Factory Primer finish for Cladding (at ceiling panels):
1. Factory applied sealer/primer by James Hardie. Apply flat sheen finishes to panels.
- C. Factory Finish Color for Trim and Siding Colors:
1. As selected from the manufacturer's full line of colors

PART 3 EXECUTION

3.1 EXAMINATION

- A. Do not begin installation until substrates have been properly prepared.
- B. If framing preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.
- C. Nominal 2 inch by 4 inch (51 mm by 102 mm) wood framing selected for minimal shrinkage and complying with local building codes, including the use of water-resistive barriers or vapor barriers where required. Minimum 1-1/2 inches (38 mm) face and straight, true, of uniform dimensions and properly aligned.
 1. Install water-resistive barriers and claddings to dry surfaces.
 2. Repair any punctures or tears in the water-resistive barrier prior to the installation of the siding.
 3. Protect siding from other trades.
- D. Minimum 20 gauge 3-5/8 inch (92 mm) C-Stud 16 inches maximum on center or 16 gauge 3-5/8 inches (92 mm) C-Stud 24 inches (610 mm) maximum on center metal framing complying with local building codes, including the use of water-resistive barriers and/or vapor barriers where required. Minimum 1-1/2 inches (38 mm) face and straight, true, of uniform dimensions and properly aligned.
 1. Install water-resistive barriers and claddings to dry surfaces.
 2. Repair any punctures or tears in the water-resistive barrier prior to the installation of the siding.
 3. Protect siding from other trades.

3.2 PREPARATION

- A. Clean surfaces thoroughly prior to installation.
- B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.
- C. Install a water-resistive barrier is required in accordance with local building code requirements.
- D. The water-resistive barrier must be appropriately installed with penetration and junction flashing in accordance with local building code requirements.
- E. Install Engineered for Climate™ HardieWrap™ weather barrier in accordance with local building code requirements.

3.3 INSTALLATION - LAP SIDING

- A. Install materials in strict accordance with manufacturer's installation instructions.
- B. Starting: Install a minimum 1/4 inch (6 mm) thick lath starter strip at the bottom course of the wall. Apply planks horizontally with minimum 1-1/4 inches (32 mm) wide laps at the top. The bottom edge of the first plank overlaps the starter strip.
- C. Allow minimum vertical clearance between the edge of siding and any other material in strict accordance with the manufacturer's installation instructions.
- D. Maintain clearance between siding and adjacent finished grade.
- E. Locate splices at least one stud cavity away from window and door openings.
- F. Use off-stud metal joiner in strict accordance with manufacturer's installation instructions.
- G. Wind Resistance: Where a specified level of wind resistance is required Artisan lap siding is installed to framing members and secured with fasteners described in ICC-ES Evaluation Report No. ESR-2290
- H. Face nail to sheathing.
- I. Locate splices at least 12 inches (305 mm) away from window and door openings.

3.4 INSTALLATION - TRIM BOARDS

- A. Install materials in strict accordance with manufacturer's installation instructions. Install flashing around all wall openings.
- B. Fasten through trim into structural framing or code complying sheathing. Fasteners must penetrate minimum 3/4 inch (19 mm) or full thickness of sheathing. Additional fasteners may be required to ensure adequate security.
- C. Place fasteners no closer than 3/4 inch (19 mm) and no further than 2 inches (51 mm) from side edge of trim board and no closer than 1 inch (25 mm) from end. Fasten maximum 16 inches (406 mm) on center.
- D. Maintain clearance between trim and adjacent finished grade.

- E. Trim inside corner with a single board trim both side of corner.
- F. Outside Corner Board Attach Trim on both sides of corner with 16 gage corrosion resistant finish nail 1/2 inch (13 mm) from edge spaced 16 inches (406 mm) apart, weather cut each end spaced minimum 12 inches (305 mm) apart.
- G. Allow 1/8 inch gap between trim and siding.
- H. Seal gap with high quality, paint-able caulk.
- I. Shim frieze board as required to align with corner trim..
- J. Fasten through overlapping boards. Do not nail between lap joints.
- K. Overlay siding with single board of outside corner board then align second corner board to outside edge of first corner board. Do not fasten Trim boards to Siding boards.
- L. Shim frieze board as required to align with corner trim.
- M. Install HardieTrim Fascia boards to rafter tails or to sub fascia.

3.5 PROTECTION

- A. Protect installed products until completion of project.
- B. Touch-up, repair or replace damaged products before Substantial Completion.

END OF SECTION

SECTION 07 6200 - SHEET METAL FLASHING AND TRIM

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. Formed low-slope roof sheet metal fabrications.
2. Formed wall sheet metal fabrications.
3. Formed equipment support flashing.
4. Formed overhead-piping safety pans.

- B. Related Requirements:

1. Section 073113 "Asphalt Shingles" for sloped roof flashing and trim.
2. Section 077100 "Roofing Specialties" for roof drainage sheet metal fabrication,

1.3 COORDINATION

- A. Coordinate sheet metal flashing and trim layout and seams with sizes and locations of penetrations to be flashed, and joints and seams in adjacent materials.
- B. Coordinate sheet metal flashing and trim installation with adjoining roofing and wall materials, joints, and seams to provide leakproof, secure, and noncorrosive installation.
- C. Shop Drawings: For sheet metal flashing and trim.
 1. Include plans, elevations, sections, and attachment details.
 2. Detail fabrication and installation layouts, expansion-joint locations, and keyed details. Distinguish between shop- and field-assembled work.
 3. Include identification of material, thickness, weight, and finish for each item and location in Project.
 4. Include details for forming, including profiles, shapes, seams, and dimensions.
 5. Include details for joining, supporting, and securing, including layout and spacing of fasteners, cleats, clips, and other attachments. Include pattern of seams.
 6. Include details of termination points and assemblies.
 7. Include details of special conditions.
 8. Include details of connections to adjoining work.
 9. Detail formed flashing and trim at scale of not less than 1-1/2 inches per 12 inches.

1.4 QUALITY ASSURANCE

- A. Fabricator Qualifications: Employs skilled workers who custom fabricate sheet metal flashing and trim similar to that required for this Project and whose products have a record of successful in-service performance.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Do not store sheet metal flashing and trim materials in contact with other materials that might cause staining, denting, or other surface damage. Store sheet metal flashing and trim materials away from uncured concrete and masonry.
- B. Protect strippable protective covering on sheet metal flashing and trim from exposure to sunlight and high humidity, except to extent necessary for period of sheet metal flashing and trim installation.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. General: Sheet metal flashing and trim assemblies shall withstand wind loads, structural movement, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Completed sheet metal flashing and trim shall not rattle, leak, or loosen, and shall remain watertight.
- B. Sheet Metal Standard for Flashing and Trim: Comply with NRCA's "The NRCA Roofing Manual" and SMACNA's "Architectural Sheet Metal Manual" requirements for dimensions and profiles shown unless more stringent requirements are indicated.
- C. SPRI Wind Design Standard: Manufacture and install roof edge flashings tested according to SPRI ES-1 and capable of resisting the following design pressure:
 - 1. Design Pressure: As indicated on Drawings.
- D. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes to prevent buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
 - 1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces

2.2 SHEET METALS

- A. General: Protect mechanical and other finishes on exposed surfaces from damage by applying strippable, temporary protective film before shipping.

- B. Aluminum Sheet: ASTM B 209, alloy as standard with manufacturer for finish required, with temper as required to suit forming operations and performance required; with smooth, flat surface.
 - 1. As-Milled Finish: Mill .
- C. Stainless-Steel Sheet: ASTM A 240/A 240M, Type 304, dead soft, fully annealed; with embossed surface.
 - 1. Finish: 2B (bright, cold rolled).
- D. Self-Adhering, High-Temperature Sheet: Minimum 30 mils thick, consisting of a slip-resistant polyethylene- or polypropylene-film top surface laminated to a layer of butyl- or SBS-modified asphalt adhesive, with release-paper backing; specifically designed to withstand high metal temperatures beneath metal roofing. Provide primer according to written recommendations of underlayment manufacturer.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Carlisle Residential, a division of Carlisle Construction Materials; WIP 300HT.
 - b. Grace Construction Products, a unit of W. R. Grace & Co.-Conn.; Grace Ice and Water Shield HT.
 - c. Henry Company; Blueskin PE200 HT.
 - 2. Thermal Stability: ASTM D 1970; stable after testing at 240 deg F or higher.
 - 3. Low-Temperature Flexibility: ASTM D 1970; passes after testing at minus 20 deg F or lower.

2.3 MISCELLANEOUS MATERIALS

- A. General: Provide materials and types of fasteners[, solder], protective coatings, sealants, and other miscellaneous items as required for complete sheet metal flashing and trim installation and as recommended by manufacturer of primary sheet metal unless otherwise indicated.
- B. Fasteners: Wood screws, annular threaded nails, self-tapping screws, self-locking rivets and bolts, and other suitable fasteners designed to withstand design loads and recommended by manufacturer of primary sheet metal[or manufactured item].
 - 1. General: Blind fasteners or self-drilling screws, gasketed, with hex-washer head.
 - a. Exposed Fasteners: Heads matching color of sheet metal using plastic caps or factory-applied coating. Provide metal-backed EPDM or PVC sealing washers under heads of exposed fasteners bearing on weather side of metal.

- b. Blind Fasteners: High-strength aluminum or stainless-steel rivets suitable for metal being fastened.
- c. Spikes and Ferrules: Same material as gutter; with spike with ferrule matching internal gutter width.
2. Fasteners for Aluminum Sheet: Aluminum or Series 300 stainless steel.
3. Fasteners for Stainless-Steel Sheet: Series 300 stainless steel.

Sealant Tape: Pressure-sensitive, 100 percent solids, polyisobutylene compound sealant tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape 1/2 inch wide and 1/8 inch thick.

- C. Elastomeric Sealant: ASTM C 920, elastomeric [polyurethane] [polysulfide] [silicone] polymer sealant; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and trim and remain watertight.
- D. Epoxy Seam Sealer: Two-part, noncorrosive, aluminum seam-cementing compound, recommended by aluminum manufacturer for exterior nonmoving joints, including riveted joints.
- E. Bituminous Coating: Cold-applied asphalt emulsion according to ASTM D 1187.
- F. Asphalt Roofing Cement: ASTM D 4586, asbestos free, of consistency required for application.

2.4 FABRICATION, GENERAL

- A. General: Custom fabricate sheet metal flashing and trim to comply with details shown and recommendations in cited sheet metal standard that apply to design, dimensions, geometry, metal thickness, and other characteristics of item required. Fabricate sheet metal flashing and trim in shop to greatest extent possible.
 1. Fabricate sheet metal flashing and trim in thickness or weight needed to comply with performance requirements, but not less than that specified for each application and metal.
 2. Obtain field measurements for accurate fit before shop fabrication.
 3. Form sheet metal flashing and trim to fit substrates without excessive oil canning, buckling, and tool marks; true to line, levels, and slopes; and with exposed edges folded back to form hems.
 4. Conceal fasteners and expansion provisions where possible. Do not use exposed fasteners on faces exposed to view.
- B. Fabrication Tolerances: Fabricate sheet metal flashing and trim that is capable of installation to a tolerance of 1/4 inch in 20 feet on slope and location lines indicated on Drawings and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.
- C. Fabrication Tolerances: Fabricate sheet metal flashing and trim that is capable of installation to tolerances specified in MCA's "Guide Specification for Residential Metal Roofing."

- D. Expansion Provisions: Form metal for thermal expansion of exposed flashing and trim.
 - 1. Form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with butyl sealant concealed within joints.
 - 2. Use lapped expansion joints only where indicated on Drawings.
- E. Sealant Joints: Where movable, non-expansion-type joints are required, form metal to provide for proper installation of elastomeric sealant according to cited sheet metal standard.
- F. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal.
- G. Fabricate cleats and attachment devices of sizes as recommended by cited sheet metal standard for application, but not less than thickness of metal being secured.
- H. Seams: Fabricate nonmoving seams with flat-lock seams. Tin edges to be seamed, form seams, and solder.
- I. Seams: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with elastomeric sealant unless otherwise recommended by sealant manufacturer for intended use. Rivet joints where necessary for strength.
- J. Seams for Aluminum: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with epoxy seam sealer. Rivet joints where necessary for strength.
- K. Do not use graphite pencils to mark metal surfaces.
- L. Opening Flashings in Frame Construction: Fabricate head, sill, jamb, and similar flashings to extend 4 inches beyond wall openings. Form head and sill flashing with 2-inch-high, end dams. Fabricate from the following materials:
 - 1. Aluminum: 0.032 inch thick.

2.5 MISCELLANEOUS SHEET METAL FABRICATIONS

- A. Equipment Support Flashing: Fabricate from the following materials:
 - 1. Aluminum-Zinc Alloy-Coated Steel: [0.028 inch] <Insert dimension> thick.
- B. Overhead-Piping Safety Pans: Fabricate from the following materials:
 - 1. Stainless Steel: 0.025 inch thick.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, substrate, and other conditions affecting performance of the Work.
 - 1. Verify compliance with requirements for installation tolerances of substrates.
 - 2. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored.
 - 3. Verify that air- or water-resistant barriers have been installed over sheathing or backing substrate to prevent air infiltration or water penetration.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 UNDERLAYMENT INSTALLATION

- A. Self-Adhering Sheet Underlayment: Install self-adhering sheet underlayment, wrinkle free. Prime substrate if recommended by underlayment manufacturer. Comply with temperature restrictions of underlayment manufacturer for installation; use primer for installing underlayment at low temperatures. Apply in shingle fashion to shed water, with end laps of not less than 6 inches staggered 24 inches between courses. Overlap side edges not less than 3-1/2 inches. Roll laps and edges with roller. Cover underlayment within 14 days.

3.3 INSTALLATION, GENERAL

- A. General: Anchor sheet metal flashing and trim and other components of the Work securely in place, with provisions for thermal and structural movement. Use fasteners, protective coatings, separators, sealants, and other miscellaneous items as required to complete sheet metal flashing and trim system.
 - 1. Install sheet metal flashing and trim true to line, levels, and slopes. Provide uniform, neat seams with minimum exposure of solder, welds, and sealant.
 - 2. Install sheet metal flashing and trim to fit substrates and to result in watertight performance. Verify shapes and dimensions of surfaces to be covered before fabricating sheet metal.
 - 3. Space cleats not more than 12 inches apart. Attach each cleat with at least two fasteners. Bend tabs over fasteners.
 - 4. Install exposed sheet metal flashing and trim with limited oil canning, and free of buckling and tool marks.
 - 5. Torch cutting of sheet metal flashing and trim is not permitted.
 - 6. Do not use graphite pencils to mark metal surfaces.
- B. Metal Protection: Where dissimilar metals contact each other, or where metal contacts pressure-treated wood or other corrosive substrates, protect against galvanic action or

corrosion by painting contact surfaces with bituminous coating or by other permanent separation as recommended by sheet metal manufacturer or cited sheet metal standard.

1. Coat concealed side of uncoated-aluminum and stainless-steel sheet metal flashing and trim with bituminous coating where flashing and trim contact wood, ferrous metal, or cementitious construction.
 2. Underlayment: Where installing sheet metal flashing and trim directly on cementitious or wood substrates, install underlayment and cover with slip sheet.
- C. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at maximum of 10 feet with no joints within 24 inches of corner or intersection.
1. Form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with sealant concealed within joints.
 2. Use lapped expansion joints only where indicated on Drawings.
- D. Fasteners: Use fastener sizes that penetrate substrate not less than recommended by fastener manufacturer to achieve maximum pull-out resistance.
- E. Conceal fasteners and expansion provisions where possible in exposed work and locate to minimize possibility of leakage. Cover and seal fasteners and anchors as required for a tight installation.
- F. Seal joints as required for watertight construction.
1. Use sealant-filled joints unless otherwise indicated. Embed hooked flanges of joint members not less than 1 inch into sealant. Form joints to completely conceal sealant. When ambient temperature at time of installation is between 40 and 70 deg F, set joint members for 50 percent movement each way. Adjust setting proportionately for installation at higher ambient temperatures. Do not install sealant-type joints at temperatures below 40 deg F.
 2. Prepare joints and apply sealants to comply with requirements in Section 079200 "Joint Sealants."
- G. Rivets: Rivet joints in uncoated aluminum where necessary for strength.

3.4 WALL FLASHING INSTALLATION

- A. General: Install sheet metal wall flashing to intercept and exclude penetrating moisture according to cited sheet metal standard unless otherwise indicated. Coordinate installation of wall flashing with installation of wall-opening components such as windows, doors, and louvers.
- B. Through-Wall Flashing: Installation of through-wall flashing is specified in Section 042000 "Unit Masonry".
- C. Reglets: Installation of reglets is specified in Section 077100 "Roof Specialties"

- D. Opening Flashings in Frame Construction: Install continuous head, sill, jamb, and similar flashings to extend 4 inches beyond wall openings minimum, unless noted otherwise on drawings.

3.5 MISCELLANEOUS FLASHING INSTALLATION

- A. Equipment Support Flashing: Coordinate installation of equipment support flashing with installation of roofing and equipment. Weld or seal flashing with elastomeric sealant to equipment support member.
- B. Overhead-Piping Safety Pans: Suspend pans from structure above, independent of other overhead items such as equipment, piping, and conduit, unless otherwise indicated on Drawings. Pipe and install drain line to plumbing waste or drainage system.

3.6 ERECTION TOLERANCES

- A. Installation Tolerances: Shim and align sheet metal flashing and trim within installed tolerance of 1/4 inch in 20 feet on slope and location lines indicated on Drawings and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.
- B. Installation Tolerances: Shim and align sheet metal flashing and trim within installed tolerances specified in MCA's "Guide Specification for Residential Metal Roofing."

3.7 CLEANING AND PROTECTION

- A. Clean exposed metal surfaces of substances that interfere with uniform oxidation and
- B. Clean and neutralize flux materials. Clean off excess solder.
- C. Clean off excess sealants.
- D. Remove temporary protective coverings and strippable films as sheet metal flashing and trim are installed unless otherwise indicated in manufacturer's written installation instructions. On completion of sheet metal flashing and trim installation, remove unused materials and clean finished surfaces as recommended by sheet metal flashing and trim manufacturer. Maintain sheet metal flashing and trim in clean condition during construction.
- E. Replace sheet metal flashing and trim that have been damaged or that have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION

SECTION 07 7100 - ROOF SPECIALTIES

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. Roof-edge flashings.
 - 2. Roof-edge drainage systems.
 - 3. Reglets and counterflashings.
 - 4. Section 06 1000 "Rough Carpentry" for wood nailers, curbs, and blocking.
 - 5. Section 07 6200 "Sheet Metal Flashing and Trim" for custom- and site-fabricated sheet metal flashing and trim.
 - 6. Section 07 9200 "Joint Sealants" for field-applied sealants between roof specialties and adjacent materials.

1.3 PERFORMANCE REQUIREMENTS

- A. General Performance: Roof specialties shall withstand exposure to weather and resist thermally induced movement without failure, rattling, leaking, or fastener disengagement due to defective manufacture, fabrication, installation, or other defects in construction.
- B. SPRI Wind Design Standard: Manufacture and install copings and roof-edge flashings tested according to SPRI ES-1 and capable of resisting the following design pressures:
 - 1. Design Pressure: As indicated on Drawings.
- C. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes to prevent buckling, opening of joints, hole elongation, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Provide clips that resist rotation and avoid shear stress as a result of thermal movements. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
 - 1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
- B. Shop Drawings: For roof specialties. Include plans, elevations, expansion-joint locations, keyed details, and attachments to other work. Distinguish between plant- and field-assembled work. Include the following:
 - 1. Details for expansion and contraction; locations of expansion joints, including direction of expansion and contraction.
 - 2. Pattern of seams and layout of fasteners, cleats, clips, and other attachments.
 - 3. Details of termination points and assemblies, including fixed points.
 - 4. Details of special conditions.
- C. Samples for Initial Selection: For each type of roof specialty indicated with factory-applied color finishes.

1.5 INFORMATIONAL SUBMITTALS

- A. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for copings and roof-edge flashings.
- B. Warranty: Sample of special warranty.

1.6 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For roofing specialties to include in maintenance manuals.

1.7 QUALITY ASSURANCE

- A. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for fabrication and installation.
 - 1. Build mockup of typical roof edge, including gutter and downspout, approximately 10 feet long, including supporting construction, seams, attachments, underlayment, and accessories.
 - 2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
 - 3. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.
- B. Preinstallation Conference: Conduct conference at Project site.
 - 1. Meet with , Architect, Installer, and installers whose work interfaces with or affects roof specialties including installers of roofing materials and accessories.

2. Examine substrate conditions for compliance with requirements, including flatness and attachment to structural members.
3. Review special roof details, roof drainage, and condition of other construction that will affect roof specialties.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Do not store roof specialties in contact with other materials that might cause staining, denting, or other surface damage. Store roof specialties away from uncured concrete and masonry.
- B. Protect strippable protective covering on roof specialties from exposure to sunlight and high humidity, except to extent necessary for the period of roof specialties installation.

1.9 WARRANTY

- A. Special Warranty on Painted Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace roof specialties that show evidence of deterioration of factory-applied finishes within specified warranty period.
 1. Fluoropolymer Finish: Deterioration includes, but is not limited to, the following:
 - a. Color fading more than 5 Hunter units when tested according to ASTM D 2244.
 - b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
 - c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.
 2. Finish Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 EXPOSED METALS

- A. Aluminum Sheet: ASTM B 209, alloy as standard with manufacturer for finish required, with temper to suit forming operations and performance required.
 1. Surface: Smooth, flat finish.
 2. Exposed Coil-Coated Finishes: Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - a. Two-Coat Fluoropolymer: AAMA 620. System consisting of primer and fluoropolymer color topcoat containing not less than 70 percent PVDF resin by weight.

- b. Concealed Surface: Pretreat with manufacturer's standard white or light-colored acrylic or polyester backer finish, consisting of prime coat and wash coat with a minimum total dry film thickness of 0.5 mil.
- B. Aluminum Extrusions: ASTM B 221, alloy and temper recommended by manufacturer for type of use and finish indicated, finished as follows:
- 1. Exposed High-Performance Organic Finish: Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - a. Two-Coat Fluoropolymer: AAMA 2604. System consisting of primer and fluoropolymer color topcoat containing not less than 70 percent PVDF resin by weight.

2.2 CONCEALED METALS

- A. Aluminum Sheet: ASTM B 209, alloy and temper recommended by manufacturer for type of use and structural performance indicated, mill finished.
- B. Aluminum Extrusions: ASTM B 221, alloy and temper recommended by manufacturer for type of use and structural performance indicated, mill finished.
- C. Stainless-Steel Sheet: ASTM A 240/A 240M or ASTM A 666, Type 304.

2.3 UNDERLAYMENT MATERIALS

- A. Self-Adhering, High-Temperature Sheet: Minimum 30 to 40 mils thick, consisting of slip-resisting polyethylene-film top surface laminated to layer of butyl or SBS-modified asphalt adhesive, with release-paper backing; cold applied. Provide primer when recommended by underlayment manufacturer.
 - 1. Thermal Stability: ASTM D 1970; stable after testing at 240 deg F.
 - 2. Low-Temperature Flexibility: ASTM D 1970; passes after testing at minus 20 deg F.
 - 3. Products: Subject to compliance with requirements, provide one of the following:
 - a. Grace Construction Products, a unit of W. R. Grace & Co.; Ultra.
 - b. Henry Company; Blueskin PE200 HT.

2.4 MISCELLANEOUS MATERIALS

- A. General: Provide materials and types of fasteners, protective coatings, sealants, and other miscellaneous items required by manufacturer for a complete installation.

- B. Fasteners: Manufacturer's recommended fasteners, suitable for application and designed to meet performance requirements. Furnish the following unless otherwise indicated:
 - 1. Exposed Penetrating Fasteners: Gasketed screws with hex washer heads matching color of sheet metal.
 - 2. Fasteners for Aluminum: Aluminum or Series 300 stainless steel.
 - 3. Fasteners for Stainless-Steel Sheet: Series 300 stainless steel.
- C. Elastomeric Sealant: ASTM C 920, elastomeric silicone polymer sealant of type, grade, class, and use classifications required by roofing-specialty manufacturer for each application.
- D. Bituminous Coating: Cold-applied asphalt emulsion complying with ASTM D 1187.

2.5 ROOF-EDGE DRAINAGE SYSTEMS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Hickman Company, W. P.
 - 2. Merchant & Evans, Inc.
 - 3. Metal-Fab Manufacturing, LLC.
- B. Gutters: Manufactured in uniform section lengths not exceeding 12 feet, with matching corner units, ends, outlet tubes, and other accessories. Elevate back edge at least 1 inch above front edge. Furnish flat-stock gutter straps, gutter brackets, expansion joints, and expansion-joint covers fabricated from same metal as gutters.
 - 1. Fabricate from the following exposed metal:
 - a. Formed Aluminum: 0.040 inch thick.
 - 2. Gutter Profile: As indicated on drawings.
 - 3. Gutter Supports: Gutter brackets and Straps with finish matching the gutters.
- C. Downspouts: Plain round complete with smooth-curve elbows, manufactured from the following exposed metal. Furnish with metal hangers, from same material as downspouts, and anchors.
 - 1. Formed Aluminum: 0.040 inch thick.

2.6 REGLETS AND COUNTERFLASHINGS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Hickman Company, W. P.
 - 2. Metal-Era, Inc.

3. Metal-Fab Manufacturing, LLC.
- B. Reglets: Manufactured units formed to provide secure interlocking of separate reglet and counterflashing pieces, from the following exposed metal:
1. Formed Aluminum: 0.050 inch thick.
 2. Surface-Mounted Type: Provide reglets with slotted holes for fastening to substrate, with neoprene or other suitable weatherproofing washers, and with channel for sealant at top edge.
 3. Stucco Type, Embedded: Provide reglets with upturned fastening flange and extension leg of length to match thickness of applied finish materials.
 4. Concrete Type, Embedded: Provide temporary closure tape to keep reglet free of concrete materials, special fasteners for attaching reglet to concrete forms, and guides to ensure alignment of reglet section ends.
 5. Masonry Type, Embedded: Provide reglets with offset top flange for embedment in masonry mortar joint.
- C. Counterflashings: Manufactured units of heights to overlap top edges of base flashings by 4 inches and in lengths not exceeding 12 feet designed to snap into [reglets] [or] [through-wall-flashing receiver] and compress against base flashings with joints lapped, from the following exposed metal:
1. Formed Aluminum: 0.032 inch thick.
- D. Accessories:
1. Flexible-Flashing Retainer: Provide resilient plastic or rubber accessory to secure flexible flashing in reglet where clearance does not permit use of standard metal counterflashing or where reglet is provided separate from metal counterflashing.
 2. Counterflashing Wind-Restraint Clips: Provide clips to be installed before counterflashing to prevent wind uplift of counterflashing lower edge.
- E. Aluminum Finish: Mill .

2.7 GENERAL FINISH REQUIREMENTS

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Protect mechanical and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- C. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, to verify actual locations, dimensions, and other conditions affecting performance of the Work.
- B. Examine walls, roof edges, and parapets for suitable conditions for roof specialties.
- C. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 UNDERLAYMENT INSTALLATION

- A. Self-Adhering Sheet Underlayment: Install wrinkle free. Apply primer if required by underlayment manufacturer. Comply with temperature restrictions of underlayment manufacturer for installation; use primer rather than nails for installing underlayment at low temperatures. Apply in shingle fashion to shed water. Overlap edges not less than 3-1/2 inches. Roll laps with roller. Cover underlayment within 14 days.

3.3 INSTALLATION, GENERAL

- A. General: Install roof specialties according to manufacturer's written instructions. Anchor roof specialties securely in place, with provisions for thermal and structural movement. Use fasteners, solder, protective coatings, separators, sealants, and other miscellaneous items as required to complete roof-specialty systems.
 - 1. Install roof specialties level, plumb, true to line and elevation; with limited oil-canning and without warping, jogs in alignment, buckling, or tool marks.
 - 2. Provide uniform, neat seams with minimum exposure of solder and sealant.
 - 3. Install roof specialties to fit substrates and to result in watertight performance. Verify shapes and dimensions of surfaces to be covered before manufacture.
 - 4. Torch cutting of roof specialties is not permitted.
 - 5. Do not use graphite pencils to mark metal surfaces.
- B. Metal Protection: Protect metals against galvanic action by separating dissimilar metals from contact with each other or with corrosive substrates by painting contact surfaces with bituminous coating or by other permanent separation as recommended by manufacturer.
 - 1. Coat concealed side of roof specialties with bituminous coating where in contact with wood, ferrous metal, or cementitious construction.
 - 2. Underlayment: Where installing metal flashing directly on cementitious or wood substrates, install a course of self-adhering, high-temperature sheet underlayment.

3. Bed flanges in thick coat of asphalt roofing cement where required by manufacturers of roof specialties for waterproof performance.
- C. Expansion Provisions: Allow for thermal expansion of exposed roof specialties.
 1. Space movement joints at a maximum of 12 feet with no joints within 18 inches of corners or intersections unless otherwise shown on Drawings.
 2. When ambient temperature at time of installation is between 40 and 70 deg F, set joint members for 50 percent movement each way. Adjust setting proportionately for installation at higher ambient temperatures.
- D. Fastener Sizes: Use fasteners of sizes that will penetrate substrate not less than recommended by fastener manufacturer to achieve maximum pull-out resistance.
- E. Seal joints with elastomeric sealant as required by roofing-specialty manufacturer.
- F. Seal joints as required for watertight construction. Place sealant to be completely concealed in joint. Do not install sealants at temperatures below 40 deg F.

3.4 ROOF-EDGE FLASHING INSTALLATION

- A. Install cleats, cants, and other anchoring and attachment accessories and devices with concealed fasteners.
- B. Anchor roof edgings with manufacturer's required devices, fasteners, and fastener spacing to meet performance requirements.

3.5 ROOF-EDGE DRAINAGE-SYSTEM INSTALLATION

- A. General: Install components to produce a complete roof-edge drainage system according to manufacturer's written instructions. Coordinate installation of roof perimeter flashing with installation of roof-edge drainage system.
- B. Gutters: Join and seal gutter lengths. Allow for thermal expansion. Attach gutters to firmly anchored gutter supports spaced not more than 24 inches apart. Attach ends with rivets and seal with sealant to make watertight. Slope to downspouts.
 1. Install gutter with expansion joints at locations indicated but not exceeding 50 feet apart. Install expansion joint caps.
- C. Downspouts: Join sections with manufacturer's standard telescoping joints. Provide hangers with fasteners designed to hold downspouts securely to walls and 1 inch away from walls; locate fasteners at top and bottom and at approximately 60 inches o.c.
 1. Provide elbows at base of downspout to direct water away from building.
 2. Connect downspouts to underground drainage system indicated.

3.6 REGLET AND COUNTERFLASHING INSTALLATION

- A. General: Coordinate installation of reglets and counterflashings with installation of base flashings.
- B. Embedded Reglets: See Section 033000 "Cast-in-Place Concrete" and Section 042000 "Unit Masonry" for installation of reglets.
- C. Surface-Mounted Reglets: Install reglets to receive flashings where flashing without embedded reglets is indicated on Drawings. Install at height so that inserted counterflashings overlap 4 inches over top edge of base flashings.
- D. Counterflashings: Insert counterflashings into reglets or other indicated receivers; ensure that counterflashings overlap 4 inches over top edge of base flashings. Lap counterflashing joints a minimum of 4 inches and bed with elastomeric sealant. Fit counterflashings tightly to base flashings.

3.7 CLEANING AND PROTECTION

- A. Clean exposed metal surfaces of substances that interfere with uniform oxidation and weathering.
- B. Clean and neutralize flux materials. Clean off excess solder and sealants.
- C. Remove temporary protective coverings and strippable films as roof specialties are installed. On completion of installation, clean finished surfaces including removing unused fasteners, metal filings, pop rivet stems, and pieces of flashing. Maintain roof specialties in a clean condition during construction.
- D. Replace roof specialties that have been damaged or that cannot be successfully repaired by finish touchup or similar minor repair procedures.

END OF SECTION 07 7100

SECTION 07 9200 - JOINT SEALANTS

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. Silicone joint sealants.
 - 2. Urethane joint sealants.
 - 3. Latex joint sealants.
 - 4. Acoustical joint sealants.

- B. Related Sections:

1.3 PRECONSTRUCTION TESTING

- A. Preconstruction Field-Adhesion Testing: Before installing sealants, field test their adhesion to Project joint substrates as follows:
 - 1. Locate test joints where indicated on Project or, if not indicated, as directed by Architect.
 - 2. Conduct field tests for each application indicated below:
 - a. Each kind of sealant and joint substrate indicated.
 - 3. Notify Architect seven days in advance of dates and times when test joints will be erected.
 - 4. Arrange for tests to take place with joint-sealant manufacturer's technical representative present.
 - a. Test Method: Test joint sealants according to Method A, Field-Applied Sealant Joint Hand Pull Tab, in Appendix X1 in ASTM C 1193 or Method A, Tail Procedure, in ASTM C 1521.
 - 1) For joints with dissimilar substrates, verify adhesion to each substrate separately; extend cut along one side, verifying adhesion to opposite side. Repeat procedure for opposite side.
 - 5. Report whether sealant failed to adhere to joint substrates or tore cohesively. Include data on pull distance used to test each kind of product and joint substrate.

- For sealants that fail adhesively, retest until satisfactory adhesion is obtained.
6. Evaluation of Preconstruction Field-Adhesion-Test Results: Sealants not evidencing adhesive failure from testing, in absence of other indications of noncompliance with requirements, will be considered satisfactory. Do not use sealants that fail to adhere to joint substrates during testing.

1.4 ACTION SUBMITTALS

- A. Product Data: For each joint-sealant product indicated.
- B. Samples for Initial Selection: Manufacturer's color charts consisting of strips of cured sealants showing the full range of colors available for each product exposed to view.
- C. Samples for Verification: For each kind and color of joint sealant required, provide Samples with joint sealants in 1/2-inch- wide joints formed between two 6-inch- long strips of material matching the appearance of exposed surfaces adjacent to joint sealants.
- D. Joint-Sealant Schedule: Include the following information:
 1. Joint-sealant application, joint location, and designation.
 2. Joint-sealant manufacturer and product name.
 3. Joint-sealant formulation.
 4. Joint-sealant color.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified Installer.
- B. Product Certificates: For each kind of joint sealant and accessory, from manufacturer.
- C. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, indicating that sealants comply with requirements.
- D. Preconstruction Compatibility and Adhesion Test Reports: From sealant manufacturer, indicating the following:
 1. Materials forming joint substrates and joint-sealant backings have been tested for compatibility and adhesion with joint sealants.
 2. Interpretation of test results and written recommendations for primers and substrate preparation needed for adhesion.
- E. Preconstruction Field-Adhesion Test Reports: Indicate which sealants and joint preparation methods resulted in optimum adhesion to joint substrates based on testing specified in "Preconstruction Testing" Article.
- F. Field-Adhesion Test Reports: For each sealant application tested.
- G. Warranties: Sample of special warranties.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of units required for this Project.
- B. Source Limitations: Obtain each kind of joint sealant from single source from single manufacturer.

1.7 PROJECT CONDITIONS

- A. Do not proceed with installation of joint sealants under the following conditions:
 - 1. When ambient and substrate temperature conditions are outside limits permitted by joint-sealant manufacturer or are below 40 deg F.
 - 2. When joint substrates are wet.
 - 3. Where joint widths are less than those allowed by joint-sealant manufacturer for applications indicated.
 - 4. Where contaminants capable of interfering with adhesion have not yet been removed from joint substrates.

1.8 WARRANTY

- A. Special Installer's Warranty: Manufacturer's standard form in which Installer agrees to repair or replace joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.
 - 1. Warranty Period: Two years from date of Substantial Completion.
- B. Special Manufacturer's Warranty: Manufacturer's standard form in which joint-sealant manufacturer agrees to furnish joint sealants to repair or replace those that do not comply with performance and other requirements specified in this Section within specified warranty period.
 - 1. Warranty Period: 20 years from date of Substantial Completion.
- C. Special warranties specified in this article exclude deterioration or failure of joint sealants from the following:
 - 1. Movement of the structure caused by structural settlement or errors attributable to design or construction resulting in stresses on the sealant exceeding sealant manufacturer's written specifications for sealant elongation and compression.
 - 2. Disintegration of joint substrates from natural causes exceeding design specifications.
 - 3. Mechanical damage caused by individuals, tools, or other outside agents.
 - 4. Changes in sealant appearance caused by accumulation of dirt or other atmospheric contaminants.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

- A. Compatibility: Provide joint sealants, backings, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by joint-sealant manufacturer, based on testing and field experience.
- B. VOC Content of Interior Sealants: Sealants and sealant primers used inside the weatherproofing system shall comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):
 - 1. Architectural Sealants: 250 g/L.
 - 2. Sealant Primers for Nonporous Substrates: 250 g/L.
 - 3. Sealant Primers for Porous Substrates: 775 g/L.
- C. Liquid-Applied Joint Sealants: Comply with ASTM C 920 and other requirements indicated for each liquid-applied joint sealant specified, including those referencing ASTM C 920 classifications for type, grade, class, and uses related to exposure and joint substrates.
 - 1. Suitability for Immersion in Liquids. Where sealants are indicated for Use I for joints that will be continuously immersed in liquids, provide products that have undergone testing according to ASTM C 1247. Liquid used for testing sealants is deionized water, unless otherwise indicated.
- D. Stain-Test-Response Characteristics: Where sealants are specified to be nonstaining to porous substrates, provide products that have undergone testing according to ASTM C 1248 and have not stained porous joint substrates indicated for Project.
- E. Suitability for Contact with Food: Where sealants are indicated for joints that will come in repeated contact with food, provide products that comply with 21 CFR 177.2600.
- F. Colors of Exposed Joint Sealants: As selected by Architect from manufacturer's full range.

2.2 SILICONE JOINT SEALANTS

- A. Single-Component, Nonsag, Neutral-Curing Silicone Joint Sealant: ASTM C 920, Type S, Grade NS, Class 100/50, for Use NT.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Dow Corning Corporation; 790.
 - b. GE Advanced Materials - Silicones; SilPruf LM SCS2700.

- c. Pecora Corporation; 890.
 - d. Tremco Incorporated; Spectrem 1.
- B. Single-Component, Nonsag, Neutral-Curing Silicone Joint Sealant: ASTM C 920, Type S, Grade NS, Class 50, for Use NT.
 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. BASF Building Systems; Omniseal 50.
 - b. Dow Corning Corporation; 791.
 - c. GE Advanced Materials - Silicones; .
 - d. May National Associates, Inc.; Bondaflex Sil 295.
 - e. Pecora Corporation; 895.
 - f. Polymeric Systems, Inc.; PSI-641.
 - g. Sika Corporation, Construction Products Division; SikaSil-C995.
 - h. Tremco Incorporated; Spectrem 2.
 - i.
- C. Single-Component, Nonsag, Neutral-Curing Silicone Joint Sealant: ASTM C 920, Type S, Grade NS, Class 25, for Use NT.
 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Dow Corning Corporation; 799.
 - b. GE Advanced Materials - Silicones; UltraGlaze SSG4000.
 - c. Tremco Incorporated; Tremsil 600.
- D. Mildew-Resistant, Single-Component, Nonsag, Neutral-Curing Silicone Joint Sealant: ASTM C 920, Type S, Grade NS, Class 25, for Use NT.
 1. Products: Subject to compliance with requirements, [provide the following] [provide one of the following] [available products that may be incorporated into the Work include, but are not limited to, the following]:
 - a. Dow Corning Corporation; 786 Mildew Resistant.
 - b. GE Silicones; Sanitary SCS 1700
 - c. Pecora Corporation; 898.
 - d. Tremco; Tremsil 600 White.
- E. Multicomponent, Nonsag, Traffic-Grade, Urethane Joint Sealant: ASTM C 920, Type M, Grade NS, Class 25, for Use T.
 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. BASF Building Systems; Sonolastic NP 2.
 - b. Pecora Corporation; Dynatred.

- c. Sika Corporation, Construction Products Division; Sikaflex - 2c NS.
- d. Tremco Incorporated; Vulkem 227.

2.3 LATEX JOINT SEALANTS

- A. Latex Joint Sealant: Acrylic latex or siliconized acrylic latex, ASTM C 834, Type OP, Grade NF.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. BASF Building Systems; Sonolac.
 - b. Pecora Corporation; AC-20+.
 - c. Tremco Incorporated; Tremflex 834.

2.4 ACOUSTICAL JOINT SEALANTS

- A. Acoustical Joint Sealant: Manufacturer's standard nonsag, paintable, nonstaining latex sealant complying with ASTM C 834. Product effectively reduces airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E 90.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Pecora Corporation; AC-20 FTR.
 - b. USG Corporation; SHEETROCK Acoustical Sealant.

2.5 JOINT SEALANT BACKING

- A. General: Provide sealant backings of material that are nonstaining; are compatible with joint substrates, sealants, primers, and other joint fillers; and are approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.
- B. Cylindrical Sealant Backings: ASTM C 1330, Type C (closed-cell material with a surface skin) Type O (open-cell material) Type B (bicellular material with a surface skin) or any of the preceding types, as approved in writing by joint-sealant manufacturer for joint application indicated, and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance.
- C. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint-filler materials or joint surfaces at back of joint. Provide self-adhesive tape where applicable.

2.6 MISCELLANEOUS MATERIALS

- A. Primer: Material recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.
- B. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials, free of oily residues or other substances capable of staining or harming joint substrates and adjacent nonporous surfaces in any way, and formulated to promote optimum adhesion of sealants to joint substrates.
- C. Masking Tape: Nonstaining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine joints indicated to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting joint-sealant performance.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint-sealant manufacturer's written instructions and the following requirements:
 - 1. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant, including dust, paints (except for permanent, protective coatings tested and approved for sealant adhesion and compatibility by sealant manufacturer), old joint sealants, oil, grease, waterproofing, water repellents, water, surface dirt, and frost.
 - 2. Clean porous joint substrate surfaces by brushing, grinding, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealants. Remove loose particles remaining after cleaning operations above by vacuuming or blowing out joints with oil-free compressed air. Porous joint substrates include the following:
 - a. Concrete.
 - b. Masonry.
 - c. Cast Stone
 - d. Unglazed surfaces of porcelain and ceramic tile.
 - e. Exterior insulation and finish systems.

3. Remove laitance and form-release agents from concrete.
 4. Clean nonporous joint substrate surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants. Nonporous joint substrates include the following:
 - a. Metal.
 - b. Glass.
 - c. Porcelain enamel.
 - d. Glazed surfaces of porcelain ceramic tile.
 - e.
- B. Joint Priming: Prime joint substrates where recommended by joint-sealant manufacturer or as indicated by preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.
- C. Masking Tape: Use masking tape where required to prevent contact of sealant or primer with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

3.3 INSTALLATION OF JOINT SEALANTS

- A. General: Comply with joint-sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.
- B. Sealant Installation Standard: Comply with recommendations in ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.
- C. Install sealant backings of kind indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.
 1. Do not leave gaps between ends of sealant backings.
 2. Do not stretch, twist, puncture, or tear sealant backings.
 3. Remove absorbent sealant backings that have become wet before sealant application and replace them with dry materials.
- D. Install bond-breaker tape behind sealants where sealant backings are not used between sealants and backs of joints.
- E. Install sealants using proven techniques that comply with the following and at the same time backings are installed:
 1. Place sealants so they directly contact and fully wet joint substrates.
 2. Completely fill recesses in each joint configuration.
 3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.

- F. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified in subparagraphs below to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.
1. Remove excess sealant from surfaces adjacent to joints.
 2. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.
 3. Provide concave joint profile per Figure 8A in ASTM C 1193, unless otherwise indicated.
 4. Provide flush joint profile where indicated per Figure 8B in ASTM C 1193.
 5. Provide recessed joint configuration of recess depth and at locations indicated per Figure 8C in ASTM C 1193.
 - a. Use masking tape to protect surfaces adjacent to recessed tooled joints.
- G. Acoustical Sealant Installation: At sound-rated assemblies and elsewhere as indicated, seal construction at perimeters, behind control joints, and at openings and penetrations with a continuous bead of acoustical sealant. Install acoustical sealant at both faces of partitions at perimeters and through penetrations. Comply with ASTM C 919 and with manufacturer's written recommendations.

3.4 FIELD QUALITY CONTROL

- A. Field-Adhesion Testing: Field test joint-sealant adhesion to joint substrates as follows:
1. Extent of Testing: Test completed and cured sealant joints as follows:
 - a. Perform 10 tests for the first [1000 feet] <Insert dimension> of joint length for each kind of sealant and joint substrate.
 - b. Perform 1 test for each 1000 feet of joint length thereafter or 1 test per each floor per elevation.
 2. Test Method: Test joint sealants according to Method A, Field-Applied Sealant Joint Hand Pull Tab, in Appendix X1 in ASTM C 1193 or Method A, Tail Procedure, in ASTM C 1521.
 - a. For joints with dissimilar substrates, verify adhesion to each substrate separately; extend cut along one side, verifying adhesion to opposite side. Repeat procedure for opposite side.
 3. Inspect tested joints and report on the following:
 - a. Whether sealants filled joint cavities and are free of voids.
 - b. Whether sealant dimensions and configurations comply with specified requirements.
 - c. Whether sealants in joints connected to pulled-out portion failed to adhere to joint substrates or tore cohesively. Include data on pull distance used to test each kind of product and joint substrate. Compare these results to

determine if adhesion passes sealant manufacturer's field-adhesion hand-pull test criteria.

4. Record test results in a field-adhesion-test log. Include dates when sealants were installed, names of persons who installed sealants, test dates, test locations, whether joints were primed, adhesion results and percent elongations, sealant fill, sealant configuration, and sealant dimensions.
5. Repair sealants pulled from test area by applying new sealants following same procedures used originally to seal joints. Ensure that original sealant surfaces are clean and that new sealant contacts original sealant.

- B. Evaluation of Field-Adhesion Test Results: Sealants not evidencing adhesive failure from testing or noncompliance with other indicated requirements will be considered satisfactory. Remove sealants that fail to adhere to joint substrates during testing or to comply with other requirements. Retest failed applications until test results prove sealants comply with indicated requirements.

3.5 CLEANING

- A. Clean off excess sealant or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved in writing by manufacturers of joint sealants and of products in which joints occur.

3.6 PROTECTION

- A. Protect joint sealants during and after curing period from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated joint sealants immediately so installations with repaired areas are indistinguishable from original work.

3.7 JOINT-SEALANT SCHEDULE

- A. Joint-Sealant Application: Exterior joints in horizontal traffic surfaces.
1. Joint Locations:
 - a. Control and expansion joints in brick pavers.
 - b. Isolation and contraction joints in cast-in-place concrete slabs.
 - c. Joints between different materials listed above.
 2. Urethane Joint Sealant: Multicomponent, nonsag, traffic grade, Class 50.
 3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.

- B. Joint-Sealant Application: Exterior joints in vertical surfaces and horizontal nontraffic surfaces.
1. Joint Locations:
 - a. Joints between plant-precast architectural concrete units.
 - b. Control and expansion joints in unit masonry.
 - c. Joints in exterior insulation and finish systems.
 - d. Joints between different materials listed above.
 - e. Perimeter joints between materials listed above and frames of doors/windows and louvers.
 - f. Control and expansion joints in ceilings and other overhead surfaces.
 2. Silicone Joint Sealant: Single component, nonsag, neutral curing, Class 100/50 .
 3. Joint-Sealant Color: [As indicated by manufacturer's designations] [Match Architect's sample] [As selected by Architect from manufacturer's full range of colors] <Insert color>.
- C. Joint-Sealant Application: Interior joints in horizontal traffic surfaces.
1. Joint Locations:
 - a. Isolation joints in cast-in-place concrete slabs.
 - b. Control and expansion joints in stone flooring.
 - c. Control and expansion joints in tile flooring.
 2. Silicone Joint Sealant: Single component, nonsag, traffic grade, neutral curing.
 3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.
- D. Joint-Sealant Application: Interior joints in vertical surfaces and horizontal nontraffic surfaces.
1. Joint Locations:
 - a. Control and expansion joints on exposed interior surfaces of exterior walls.
 - b. Perimeter joints of exterior openings where indicated.
 - c. Perimeter joints between interior wall surfaces and frames of interior doors/windows and elevator entrances.
 2. Joint Sealant: Latex.
 3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.
- E. Joint-Sealant Application: Mildew-resistant interior joints in vertical surfaces and horizontal nontraffic surfaces.
1. Joint Sealant Location:

- a. Joints between plumbing fixtures and adjoining walls, floors, and counters.
 - b. Tile control and expansion joints where indicated.
2. Joint Sealant: Mildew resistant, single component, nonsag, neutral curing, Silicone.
 3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.
- F. Joint-Sealant Application: Interior acoustical joints in vertical surfaces and horizontal nontraffic surfaces.
1. Joint Location:
 - a. Acoustical joints where indicated.
 2. Joint Sealant: Acoustical.
 3. Joint-Sealant Color: As selected by Architect from manufacturer's full range.

END OF SECTION 07 9200

SECTION 08 1432 - STILE AND RAIL DOORS (OPAQUE FINISH)

PART 1 – GENERAL

1.1 SUMMARY

A. Related Documents—

Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to the work specified in this section.

B. Section Includes:

1. Stile and Rail Doors
2. Factory Prefitting and Machining

C. Related Sections (Delete sections that are not applicable)

1. Section 06100– Rough Carpentry
2. Section 064600 – Wood Trim
3. Section 087100– Door Hardware

1.2 REFERENCES

A. It is the intent of the specification that all wood doors shall comply with the standards as listed. The latest published edition of each standard applies.

B. WDMA Interior Architectural Wood Stile & Rail Doors Standard

1. ANSI/WDMA I.S.6-A

C. Architectural Woodwork Institute

1. Architectural Woodwork Standards (AWS)

D. Building Code References

1. NFPA 80 – Standard for Fire Doors and Other Opening Protectives
2. NFPA 252 – Standard Methods of Fire Tests of Door Assemblies
3. NFPA 101 – Life Safety Code
4. IBC – International Building Code
5. (Insert Local Building codes enforced by the authority having jurisdiction)
 - a. UL 10B-Standard for Fire Tests of Door Assemblies (neutral pressure)
 - b. UL 10C-Standard for Positive Pressure Fire Tests of Doors
6. Intertek Warnock Hersey-Listed Product and Code Compliance Directory
7. QAI Laboratories-Listing Directory for Building Products
8. ADA Standards for Accessible Design (Current Edition)
9. California Air Resource Board (CARB) –formaldehyde emissions standard

10. Consumer Products Safety Commission (CPSC) 16 CFR 1201 – Standard for
Architectural Glazing

1.3 SUBMITTALS

- A. Shop Drawings: Comply with Division 1-Section 01 00 00. Data submitted shall be specific and shall include product data and printed information in sufficient detail and scope to verify compliance with requirements of the contract documents.
- B. Indicate:
1. Plans & Elevations
 2. Materials
 3. Surface Grain Directions
 4. Product Data: Submit door manufacturer's product construction data including: core construction, stile and rail details, panel and sticking details and any trim or glazing details as appropriate for doors specified.
 5. Assembly methods
 6. Joint details
 7. Fastening methods
 8. Accessories
 9. Door Sizes
- C. Product Performance: Provide documents showing compliance to the following WDMA attributes, validating the specified WDMA Performance Duty Level:
1. Adhesive Bonding Durability: WDMA TM-6
 2. Cycle Slam: WDMA TM-7
 3. Hinge Loading: WDMA TM-8
 4. Screw Holding: WDMA TM-10
 - a. Door Face
 - b. Vertical Door Edge
 - c. Horizontal Door Edge (applies when hardware is attached)
- D. Samples:
1. Submit (1) 12" X 12" construction sample as required by the architect showing door construction, panel and sticking details as specified.
 2. For factory finished doors-Submit (3) 5" X 5" veneer samples as required by the architect illustrating finish color and sheen.
 3. Storage and Handling: Doors shall be stored and handled in accordance with the manufacturer's recommendations and the WDMA—Appendix Section—"Care and Installation at Job Site."
 4. Warranty: Provide Manufacturer's standard warranty form, signed by manufacturer, in which manufacturer agrees to repair or replace doors that are defective in materials

or workmanship for the life of the original installation of the door.

- a. Provide lifetime warranty for all interior doors.

PART 2 – PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturers, subject to compliance with specifications:

1. Harring
2. Eggers Industries
3. Approved equal-as approved by owner and architect

2.2 DOOR CONSTRUCTION

A. Description: Interior Non-Rated Doors

1. Type: Harring veneered Stile & Rail panel doors. Profiles and dimensions shall be Harring standards unless otherwise noted in the drawings and elevations.
2. Door Thickness-Per plans or as indicated. Select from below.
 - a. Non fire-rated applications: 1-3/4"
3. Construction Type:
 - a. Cope & Stick; joinery using 1/2" X 4" dowels.
 - b. Joints to have minimum 1 dowel.
4. Construction Materials:
 - a. Stiles and Rails shall be constructed of Structural Composite Lumber (SCL), Particleboard or other similar core, edge banded with a minimum 3/4" hardwood, laminated with minimum 1/8" HDF.
 - b. Muntin bars shall have 1/4" X 2-1/2" dowels at every joint.
 - c. Pressure fit joints using a Type II Adhesive.
 - d. Raised panels shall be minimum thickness of 1-1/8" with raised of panel of solid lumber material matching face species, rim banded with mitered corners.
5. Face Stile and Rail Surface Material: 1/8" HDF-Factory Primed
6. Door Panel Top Design: (Select as needed, delete others)
 - a. Square Top
7. Panel Types: (Select as needed, delete others)
 - a. Raised Panel: Specify thickness of 1-1/8"
8. Panel Construction
 - a. Panels shall be manufactured with MDF or HDF material-Factory Primed. No wood veneers shall be utilized.
 - b. Raised panels shall be minimum thickness of 1-1/8"
9. Panel Material
 - a. Raised Panel: MDF
10. Sticking Types:
 - a. Ogee

2.3 DOOR FABRICATION

- A. Fabricate doors in accordance with one of the following Quality Assurance Standards.
(Select 1 from below)
 - 1. WDMA I.S.6A-Premium Grade Construction
 - 2. WDMA I.S.6A-Custom Grade
- B. Prefit and bevel doors 1/8" in 2", ensuring proper gaps are maintained on fire doors to comply with NFPA 80 requirements.
- C. All doors shall be machined for specified hardware that is not surface applied.

2.4 FINISHING

- A. Finish coating to be:
 - 1. Factory Primed (Water Based for Interior Doors, Lacquer for Exterior Doors)

PART 3 EXECUTION

1.1 EXAMINATION

- A. Examine doors and installed door frames, with Installer present, before hanging doors.
 - 1. Verify that installed frames comply with indicated requirements for type, size, location, and swing characteristics and have been installed with level heads and plumb jambs. Any deficiencies must be corrected prior to door installation.
 - 2. Reject doors with defects.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

1.2 INSTALLATION

- A. Hardware: For installation, see **Section 087100 "Door Hardware."**
- B. Installation Instructions: Install doors to comply with manufacturer's written instructions and referenced quality standard, and as indicated.
- C. Factory-Fitted Doors: Align in frames for uniform clearance at each edge.

1.3 ADJUSTING

- A. Operation: Correct any deficiency that prohibits the door from swinging or operating freely. Do not remove hinge screws after initial insertion. Shims used for alignment purposes must be inserted between hinge and frame. Do not insert shims between hinge and door.
- B. To prevent stile failure, insure that door closers are properly adjusted and do not limit the door opening swing. Limit door opening swing only with a properly located stop.
- C. Finished Doors: Replace doors that are damaged or that do not comply with requirements. Doors may be repaired or refinished if work complies with requirements and shows no evidence of repair or refinishing.

END OF SECTION

SECTION 08 1433 – STILE AND RAIL DOORS (TRANSPARENT FINISH)

PART 1 – GENERAL

1.1 SUMMARY

A. Related Documents—

Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to the work specified in this section.

B. Section Includes:

1. Stile and Rail Doors
2. Factory Finishing

C. Related Sections (Delete sections that are not applicable)

1. Section 06100– Rough Carpentry
2. Section 064600–Wood Trim
3. Section 087100 – Door Hardware

1.2 REFERENCES

A. It is the intent of the specification that all wood doors shall comply with the standards as listed. The latest published edition of each standard applies.

B. WDMA Interior Architectural Wood Stile & Rail Doors Standard

1. ANSI/WDMA I.S.6-A

C. Architectural Woodwork Institute

1. Architectural Woodwork Standards (AWS)

D. Building Code References

1. NFPA 80 – Standard for Fire Doors and Other Opening Protectives
2. NFPA 252 – Standard Methods of Fire Tests of Door Assemblies
3. NFPA 101 – Life Safety Code
4. IBC – International Building Code
5. (Insert Local Building codes enforced by the authority having jurisdiction)
 - a. UL 10B-Standard for Fire Tests of Door Assemblies (neutral pressure)
 - b. UL 10C-Standard for Positive Pressure Fire Tests of Doors
6. Intertek Warnock Hersey-Listed Product and Code Compliance Directory
7. QAI Laboratories-Listing Directory for Building Products
8. ADA Standards for Accessible Design (Current Edition)
9. California Air Resource Board (CARB) –formaldehyde emissions standard

10. Consumer Products Safety Commission (CPSC) 16 CFR 1201 – Standard for Architectural Glazing

1.3 SUBMITTALS

- A. Shop Drawings: Comply with Division 1-Section 01 00 00. Data submitted shall be specific and shall include product data and printed information in sufficient detail and scope to verify compliance with requirements of the contract documents.
- B. Indicate:
1. Plans & Elevations
 2. Materials
 3. Surface Grain Directions
 4. Product Data: Submit door manufacturer's product construction data including: core construction, stile and rail details, panel and sticking details and any trim or glazing details as appropriate for doors specified.
 5. Assembly methods
 6. Joint details
 7. Fastening methods
 8. Accessories
 9. Door Sizes
- C. Product Performance: Provide documents showing compliance to the following WDMA attributes, validating the specified WDMA Performance Duty Level:
1. Adhesive Bonding Durability: WDMA TM-6
 2. Cycle Slam: WDMA TM-7
 3. Hinge Loading: WDMA TM-8
 4. Screw Holding: WDMA TM-10
 - a. Door Face
 - b. Vertical Door Edge
 - c. Horizontal Door Edge (applies when hardware is attached)
- D. Samples:
1. Submit (1) 12" X 12" construction sample as required by the architect showing door construction, panel and sticking details as specified.
 2. For factory finished doors-Submit (3) 5" X 5" veneer samples as required by the architect illustrating finish color and sheen.
- E. Quality Assurance:
1. Manufacturer Qualifications: Shall be a company specializing in the manufacture of stile and rail doors with a minimum of 10 years' experience.
 2. Storage and Handling: Doors shall be stored and handled in accordance with the manufacturer's recommendations and the WDMA—Appendix Section—"Care

and Installation at Job Site.”

3. Warranty: Provide Manufacturer’s standard warranty form, signed by manufacturer, in which manufacturer agrees to repair or replace doors that are defective in materials or workmanship for the life of the original installation of the door.
 - a. Provide lifetime warranty for all interior doors.
 - b. Provide three year warranty for all exterior doors.

PART 2 – PRODUCTS

2.1 MANUFACTURERS

- A. Acceptable Manufacturers, subject to compliance with specifications:
 1. Harring
 2. Eggers Industries
 3. Approved equal-as approved by owner and architect

2.2 DOOR CONSTRUCTION

A. Description: Exterior Doors

2. Door Thickness-Select from the below a. 1-3/4”
3. Construction Type
 - a. Cope & Stick; joinery using 1/2” x 4” dowels.
 - b. Joints to have minimum 1 dowel.
4. Construction Materials:
 - a. Stiles shall be construction of Structural Composite Lumber (SCL) laminated with a minimum 1/8” veneer, concealing SCL.
 - b. Rails shall be of solid lumber construction.
 - c. Muntin bars shall have 1/4” x 2-1/2” dowels at every joint.
 - d. Pressure fit joints using a Type I Adhesive and silicone caulk to prevent moisture penetration.
 - e. Flat panels shall be constructed of an exterior grade core with a minimum overall thickness of 5/8”.
 - f. Raised panels shall be constructed of an exterior grade core with a minimum overall thickness of 1-5/8”.
5. Veneer: Veneers to be 1/8” thickness, Grade A
 - a. Pine
6. Door Panel Top Design:
 - a. Square Top
7. Panel Types:
 - a. Rim Banded Raised Panel: 1-5/8”
8. Panel Construction:
 - a. Panels shall be manufactured as 5-ply construction with 1/32” crossbands,

in addition to face veneer.

9. Panel Material
 - a. Rim Banded Raised Panel: Exterior MDF
10. Sticking Types: (Select as needed, delete others)
 - a. Ogee – 7/8” wide muntin trim at exterior and interior of glass adhered to glass unit

2.3 DOOR FABRICATION

- A. Fabricate doors in accordance with one of the following Quality Assurance Standards.
(Select 1 from below)
 1. WDMA I.S.6A-Premium Grade Construction
 2. WDMA I.S.6A-Custom Grade
- B. Veneer to be Grade A unless specified as other
- C. Prefit and bevel doors 1/8” in 2”, ensuring proper gaps are maintained on fire doors to comply with NFPA 80 requirements.
- D. All doors shall be machined for specified hardware that is not surface applied.
- E. Doors shall be factory glazed with glass as specified unless otherwise indicated.
 1. Indicate glass type clear insulated unit
 2. Indicate glass thickness as required to meet criteria

2.4 FINISHING

- A. All doors shall be factory finished with manufacturers’ standard Conversion Varnish and standard sheen. (Unless otherwise indicated).
- B. Finish coating to be: (Select 1 of the below)
 1. Clear
 2. Color from Manufacturers standard offering
 3. Match architect’s sample

PART 3 EXECUTION

1.1 EXAMINATION

- A. Examine doors and installed door frames, with Installer present, before hanging doors.
 1. Verify that installed frames comply with indicated requirements for type, size, location, and swing characteristics and have been installed with level heads and plumb jambs. Any deficiencies must be corrected prior to door installation.
 2. Reject doors with defects.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

1.2 INSTALLATION

- A. Hardware: For installation, see **Section 087100 “Door Hardware.**
- B. Installation Instructions: Install doors to comply with manufacturer’s written instructions and referenced quality standard, and as indicated.
- C. Job-Fitted Doors: Align and fit doors in frames with uniform clearances and bevels as

indicated below; do not trim stiles and rails in excess of limits set by manufacturer or permitted for fire-rated doors. Machine doors for hardware. Seal edges of doors, edges of cutouts, and mortises after fitting and machining.

1. Clearances: Provide 1/8 inch (3.2 mm) at heads, jambs, and between pairs of doors. Provide 1/8 inch (3.2 mm) from bottom of door to top of decorative floor finish or covering unless otherwise indicated. Where threshold is shown or scheduled, provide 1/4 inch (6.4 mm) from bottom of door to top of threshold unless otherwise indicated.
 2. Bevel non-fire-rated doors 1/8 inch in 2 inches (3-1/2 degrees) at lock and hinge edges.
- D. Factory-Finished Doors: Do not trim factory finished doors for width.

1.3 ADJUSTING

- A. Operation: Correct any deficiency that prohibits the door from swinging or operating freely. Do not remove hinge screws after initial insertion. Shims used for alignment purposes must be inserted between hinge and frame. Do not insert shims between hinge and door. To prevent stile failure, insure that door closers are properly adjusted and do not limit the door opening swing. Limit door opening swing only with a properly located stop.
- B. Finished Doors: Replace doors that are damaged or that do not comply with requirements. Doors may be repaired or refinished if work complies with requirements and shows no evidence of repair or refinishing.

END OF SECTION

SECTION 08 2140 - ALUMINUM-CLAD WOOD COMMERCIAL OUT-SWING FRENCH DOORS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Aluminum-clad wood commercial out-swing French hinged doors. See alternates

1.2 RELATED SECTIONS

- A. Section 07920 - Joint Sealants
- B. Section 08710 - Door Hardware.

1.3 REFERENCES

- A. American Architectural Manufacturers Association (AAMA):
 1. AAMA 502 - Voluntary Specification for Field Testing of Windows and Sliding Doors.
 2. AAMA 2603 - Voluntary Specification, Performance Requirements and Test Procedures for Pigmented Organic Coatings on Aluminum Extrusions and Panels.
 3. AAMA 2605 - Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels.
- B. American Society for Testing and Materials (ASTM):
 1. ASTM B 117 - Operating Salt Spray (Fog) Apparatus.
 2. ASTM C 1036 - Flat Glass.
 3. ASTM C 1048 - Heat-Treated Flat Glass – Kind HS, Kind FT Coated and Uncoated Glass.
 4. ASTM D 1149 - Rubber Deterioration – Surface Ozone Cracking in a Chamber.
 5. ASTM D 2803 - Filiform Corrosion Resistance of Organic Coatings on Metal.
 6. ASTM D 3656 - Insect Screening and Louver Cloth Woven from Vinyl-Coated Glass Yarns.
 7. ASTM D 4060 - Abrasion Resistance of Organic Coatings by the Taber Abraser.
 8. ASTM E 283 - Rate of Air Leakage Through Exterior Windows, Curtain Walls and Doors Under Specified Pressure Difference Across the Specimen.
 9. ASTM E 330 - Structural Performance of Exterior Windows, Curtain Walls and Doors by Uniform Static Air Pressure Difference.
 10. ASTM E 547 - Water Penetration of Exterior Windows, Curtain Walls and Doors by Cyclic Static Air Pressure Differential.
 11. ASTM G 85 - Modified Salt Spray (Fog) Testing.
- C. Window and Door Manufacturers Association (WDMA):
 1. ANSI/AAMA/NWDA 101/I.S.2 - Voluntary Specifications for Aluminum, Vinyl (PVC) and Wood Windows and Glass Doors.
 2. ANSI/AAMA/NWDA 101/I.S.2/NAFS-02 - Voluntary Performance Specification for Windows, Skylights and Glass Doors.
 3. WDMA I.S.4 - Industry Standard for Water-Repellent Preservative Non-Pressure Treatment for Millwork.

1.5 SUBMITTALS

- A. Comply with Division 1 requirements.
- B. Product Data: Submit manufacturer's product data, including installation instructions.

- C. Shop Drawings: Submit manufacturer's shop drawings, indicating dimensions, construction, component connections and locations, anchorage methods and locations, hardware locations, and installation details.
- D. Samples: Submit full-size or partial full-size sample of door illustrating glazing system, quality of construction, and color of finish.
- E. Warranty: Submit manufacturer's standard warranty.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Delivery: Deliver materials to site undamaged in manufacturer's or sales branch's original, unopened containers and packaging, with labels clearly identifying manufacturer and product name. Include installation instructions.
- B. Storage: Store materials in an upright position, off ground, under cover, and protected from weather, direct sunlight, and construction activities.
- C. Handling: Protect materials and finish during handling and installation to prevent damage.

PART 2 PRODUCTS

2.1 MANUFACTURER

- A. Basis of Design - Pella Corporation, 102 Main Street, Pella, Iowa 50219. Toll Free (800) 54-PELLA. Phone (641) 621-1000. Website www.pella.com.
- B. Approved manufacturer of products to match this specification and the drawings:
 - 1. Jeld-Wen
 - 2. Andersen
 - 3. Marvin

2.2 ALUMINUM-CLAD WOOD COMMERCIAL OUT-SWING FRENCH HINGED DOORS

- A. Aluminum-Clad Wood Commercial Out-Swing French Hinged Doors: Architect Series factory-assembled aluminum-clad wood doors with outward-swing door panels installed in frame.
- B. Frame:
 - 1. Select woods, water-repellent, preservative-treated with EnduraGuard[®] in accordance with WDMA I.S.-4. EnduraGuard includes water-repellency, three active fungicides and an insecticide applied to the frame.
 - 2. Interior Exposed Surfaces: Pine veneered and edge-banded with no visible fastener holes.
 - 3. Exterior Surfaces: Clad with aluminum at head and jambs.
 - 4. Metal Sill: Solid aluminum, ADA approved, low profile.
 - a. Finish: Light Bronze anodized
 - 5. Overall Frame Depth: 5-7/8 inches (149 mm).
- C. Door Panel:
 - 1. Select woods, water-repellent, preservative-treated with EnduraGuard in accordance with WDMA I.S.-4. EnduraGuard includes water-repellency, three active fungicides and an insecticide applied to the panel.
 - 2. Panels: Three-ply construction. Randomly finger-jointed blocks laminated with water-resistant glue.
 - 3. Interior Exposed Surfaces: Pine core veneered with [Pine] [Mahogany] [Alder] [Douglas Fir], pine glass stops.
 - 4. Exterior Surfaces: Clad with aluminum.

5. Intermediate Bar: 5-1/4 inches high.
6. Corners: Urethane-sealed and secured with metal fasteners.
7. Sash Thickness: 2-1/16 inches (52 mm).

D. Weather Strip:

1. Panel mounted, dual-durometer extruded polymer, one-piece design.

2.3 GLAZING

A. Glazing:

1. Float Glass: ASTM C 1036, Quality 1.
 - a. Tempered Glass: ASTM C 1048.
2. Type: Urethane-glazed 13/16-inch, dual-seal, fully tempered, insulating glass, clear
4. Integral Light Technology Glazing and Grilles:
 - a. Insulating glass contains non-glare spacer between the panes of glass.
 - b. Grid: Adhered to glass on double pane and a metal spacer on triple pane
 - c. Room Side Grilles: 7/8" wide ogee profile that are solid Clear Pine .]
 - d. Exterior Grilles: Extruded aluminum 7/8" ogee profile. Dimension to match room side grilles.
 - e. Bars shall be adhered to both sides of insulating glass with VHB acrylic adhesive tape and aligned with non-glare grid.
 - f. Finish: Finish color matches interior and exterior finish colors.

2.5 HARDWARE

A. Hinges:

1. Doors 6' 10" and under frame height will have three (3) ball-bearing hinges.
2. Doors over 6' 10" frame height up to and including 8' 0" frame height will have four (4) ball bearing hinges.
3. Finish: compliments the finish of the sill.

2.6 TOLERANCES

A. Doors shall accommodate the following opening tolerances:

1. Vertical Dimensions Between High and Low Points: Plus 1/8 inch, minus 0 inch.
2. Width Dimensions: Plus 1/8 inch, minus 0 inch.
3. Building Columns or Masonry Openings: Plus or minus 1/8 inch from plumb.

2.7 FINISH

A. Exterior Finish System: Pella EnduraClad Plus.

1. Exterior aluminum surfaces shall be finished with the following multi-stage system:
 - a. Clean and etch aluminum surface of oxides.
 - b. Pre-treat with chrome phosphate conversion coating.
 - c. Pre-treat with chromic acid sealer/rinse.
 - d. Top coat with baked-on 70% fluoropolymer-based enamel.
2. Color: as selected from full range of standard colors_____.
3. Performance Requirements: Exterior aluminum finishes shall meet or exceed all performance requirements of AAMA 2605.

B. Interior Finish: Unfinished, ready for site finishing

PART 3 EXECUTION

3.1 EXAMINATION

- A. Examine areas to receive doors. Notify Architect of conditions that would adversely affect installation or subsequent use. Do not proceed with installation until unsatisfactory conditions are corrected.

3.2 INSTALLATION

- A. Install doors in accordance with manufacturer's instructions and approved shop drawings.
- B. Install doors to be weather-tight and freely operating.
- C. Maintain alignment with adjacent work.
- D. Secure assembly to framed openings, plumb and square, without distortion.
- E. Integrate door system installation with exterior weather-resistant barrier using flashing/sealant tape. Apply and integrate flashing/sealant tape with weather-resistant barrier using watershed principles in accordance with door manufacturer's instructions.
- F. Place interior seal around door perimeter to maintain continuity of building thermal and air barrier using backer rod and sealant.
- G. Seal door to exterior wall cladding with sealant and related backing materials at perimeter of assembly.
- H. Leave doors closed.

3.4 CLEANING

- A. Clean door frames and glass in accordance with Division 1 requirements.
- B. Do not use harsh cleaning materials or methods that would damage finish.
- C. Remove labels and visible markings.

3.5 PROTECTION

- A. Protect installed doors to ensure that, except for normal weathering, doors will be without damage or deterioration at time of substantial completion.

END OF SECTION

SECTION 08 3113 - ACCESS DOORS AND FRAMES

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. Access doors and frames for walls and ceilings.

- B. Related Requirements:

- 1. Section 233300 "Air Duct Accessories" for heating and air-conditioning duct access doors.

1.3 ACTION SUBMITTALS

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

- 1. Include construction details, fire ratings, materials, individual components and profiles, and finishes.

- B. Shop Drawings:

- 1. Include plans, elevations, sections, details, and attachments to other work.
- 2. Detail fabrication and installation of access doors and frames for each type of substrate.

- C. Samples: For each door face material, at least 3 by 5 inches in size, in specified finish.

- D. Product Schedule: Provide complete access door and frame schedule, including types, locations, sizes, latching or locking provisions, and other data pertinent to installation.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Fire-Rated Access Doors and Frames: Units complying with NFPA 80 that are identical to access door and frame assemblies tested for fire-test-response

characteristics according to the following test method and that are listed and labeled by UL or another testing and inspecting agency acceptable to authorities having jurisdiction:

1. NFPA 252 or UL 10B for fire-rated access door assemblies installed vertically.
2. NFPA 288 for fire-rated access door assemblies installed horizontally.

2.2 ACCESS DOORS AND FRAMES FOR WALLS AND CEILINGS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
- B. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated or comparable product by one of the following:
 1. Babcock-Davis.
 2. J. L. Industries, Inc.; Div. of Activar Construction Products Group.
 3. **MIFAB, Inc. Basis-of-design Mifab Part # M D W # # # # (non-rated frameless, flush with standard screwdriver latch) Size per HVAC needs.**
 4. Larsen's Manufacturing Company.
- C. Source Limitations: Obtain each type of access door and frame from single source from single manufacturer.
- D. Flush Access Doors with Exposed Flanges :
 1. Assembly Description: Fabricate door to fit flush to frame. Provide manufacturer's standard-width exposed flange, proportional to door size.
 2. Locations: Wall and ceiling.
 3. Door Size: As indicated on drawings.
 4. Uncoated Steel Sheet for Door: Nominal 0.060 inch, 16 gage.
 - a. Finish: Factory prime.
 - b. Finish: Factory prime
 5. Frame Material: Same material, thickness, and finish as door.
 6. Hinges: Manufacturer's standard.
 7. Hardware: Lock

2.3 MATERIALS

- A. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.
- B. Steel Sheet: Uncoated or electrolytic zinc coated, ASTM A 879/A 879M, with cold-rolled steel sheet substrate complying with ASTM A 1008/A 1008M, Commercial Steel (CS), exposed.
- C. Frame Anchors: Same type as door face.

- D. Inserts, Bolts, and Anchor Fasteners: Hot-dip galvanized steel according to ASTM A 153/A 153M or ASTM F 2329.

2.4 FABRICATION

- A. General: Provide access door and frame assemblies manufactured as integral units ready for installation.
- B. Metal Surfaces: For metal surfaces exposed to view in the completed Work, provide materials with smooth, flat surfaces without blemishes. Do not use materials with exposed pitting, seam marks, roller marks, rolled trade names, or roughness.
- C. Doors and Frames: Grind exposed welds smooth and flush with adjacent surfaces. Furnish attachment devices and fasteners of type required to secure access doors to types of supports indicated.
 - 1. Provide mounting holes in frames for attachment of units to metal or wood framing.
- D. Latching Mechanisms: Furnish number required to hold doors in flush, smooth plane when closed.
 - 1. For cylinder locks, furnish two keys per lock and key all locks alike.

2.5 FINISHES

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- C. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.
- D. Steel and Metallic-Coated-Steel Finishes:
 - 1. Factory Prime: Apply manufacturer's standard, fast-curing, lead- and chromate-free, universal primer immediately after surface preparation and pretreatment.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Comply with manufacturer's written instructions for installing access doors and frames.
- B. Install doors flush with adjacent finish surfaces or recessed to receive finish material.

3.3 ADJUSTING

- A. Adjust doors and hardware, after installation, for proper operation.
- B. Remove and replace doors and frames that are warped, bowed, or otherwise damaged.

END OF SECTION 083113

SECTION 08 5520 - ALUMINUM-CLAD WOOD DOUBLE-HUNG AND FIXED WINDOWS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Aluminum-clad wood double-hung and fixed sash windows. See alternates

1.2 RELATED SECTIONS

- B. Section 07920 - Joint Sealants: Sealants

1.3 REFERENCES

- A. American Architectural Manufacturers Association (AAMA):
 1. AAMA 502 - Voluntary Specification for Field Testing of Windows and Sliding Doors.
 2. AAMA 2603 - Voluntary Specification, Performance Requirements and Test Procedures for Pigmented Organic Coatings on Aluminum Extrusions and Panels.
 3. AAMA 2605 - Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels.
- B. American Society for Testing and Materials (ASTM):
 1. ASTM B 117 - Operating Salt Spray (Fog) Apparatus.
 2. ASTM C 1036 - Flat Glass.
 3. ASTM C 1048 - Heat-Treated Flat Glass – Kind HS, Kind FT Coated and Uncoated Glass.
 4. ASTM D 1149 - Rubber Deterioration – Surface Ozone Cracking in a Chamber.
 5. ASTM D 2803 - Filiform Corrosion Resistance of Organic Coatings on Metal.
 6. ASTM D 3656 - Insect Screening and Louver Cloth Woven from Vinyl-Coated Glass Yarns.
 7. ASTM D 4060 - Abrasion Resistance of Organic Coatings by the Taber Abraser.
 8. ASTM E 283 - Rate of Air Leakage Through Exterior Windows, Curtain Walls and Doors Under Specified Pressure Difference Across the Specimen.
 9. ASTM E 330 - Structural Performance of Exterior Windows, Curtain Walls and Doors by Uniform Static Air Pressure Difference.
 10. ASTM E 547 - Water Penetration of Exterior Windows, Curtain Walls and Doors by Cyclic Static Air Pressure Differential.
 11. ASTM G 85 - Modified Salt Spray (Fog) Testing.
- C. Screen Manufacturers Association (SMA):
 1. SMA 1201 - Specifications for Insect Screens for Windows, Sliding Doors and Swinging Doors.
- D. Window and Door Manufacturers Association (WDMA):
 1. ANSI/AAMA/NWWDA 101/I.S.2 - Voluntary Specifications for Aluminum, Vinyl (PVC) and Wood Windows and Glass Doors.
 2. ANSI/AAMA/NWWDA 101/I.S.2/NAFS-02 - Voluntary Performance Specification for Windows, Skylights and Glass Doors.
 3. WDMA I.S.4 - Industry Standard for Water-Repellent Preservative Non-Pressure Treatment for Millwork.

1.4 PERFORMANCE REQUIREMENTS

- A. Windows shall be Hallmark certified to a rating of H-LC-PG specifications in accordance with ANSI/AAMA/NWWDA 101/I.S.2/A440-08 or ANSI/AAMA/NWWDA 101/I.S.2/A440-11.
- B. Window Unit Air Leakage, ASTM E 283, 1.57 psf (25 mph): 0.3 cfm per square foot of frame or less.

- C. Window Unit Water Penetration: No water penetration through window unit when tested in accordance with ASTM E 547, under static pressure of 7.5 psf (52 mph)] after 4 cycles of 5 minutes each, with water being applied at a rate of 5 gallons per hour per square foot.

1.5 SUBMITTALS

- A. Comply with Division 1 requirements.
- B. Product Data: Submit manufacturer's product data, including installation instructions.
- C. Shop Drawings: Submit manufacturer's shop drawings, indicating dimensions, construction, component connections and locations, anchorage methods and locations, hardware locations, and installation details.
- D. Samples: Submit full-size or partial full-size sample of window illustrating glazing system, quality of construction, and color of finish.
- E. Warranty: Submit manufacturer's standard warranty.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Delivery: Deliver materials to site undamaged in manufacturer's or sales branch's original, unopened containers and packaging, with labels clearly identifying manufacturer and product name. Include installation instructions.
- B. Storage: Store materials in an upright position, off ground, under cover, and protected from weather, direct sunlight, and construction activities.
- C. Handling: Protect materials and finish during handling and installation to prevent damage.

PART 2 PRODUCTS

2.1 MANUFACTURER

- A. Basis of Design Pella Corporation, 102 Main Street, Pella, Iowa 50219. Toll Free (800) 54-PELLA. Phone (641) 621-1000. Website www.pella.com.
- B. Approved manufacturers to match these specifications and the drawings:
 - 1. Andersen
 - 2. Jeld-Wen
 - 3. Marvin

2.2 ALUMINUM-CLAD WOOD DOUBLE-HUNG AND FIXED WINDOWS

- A. Aluminum-Clad Wood Double-Hung and Fixed Windows: Architect Series factory-assembled aluminum-clad wood double-hung and fixed sash windows. Sash shall tilt to interior without removal for cleaning at double hung windows.
- B. Frame:

1. Select softwood, water-repellent, preservative-treated with EnduraGuard® in accordance with WDMA I.S.-4. EnduraGuard includes water-repellency, three active fungicides and an insecticide applied to the frame.
2. Interior Exposed Surfaces: Factory painted..
3. Exterior Surfaces: Clad with aluminum.
4. Overall Frame Depth: 5 inches (127 mm).

C. Sash:

1. Select softwood, water water-repellent, preservative-treated with EnduraGuard in accordance with WDMA I.S.-4. EnduraGuard includes water-repellency, three active fungicides and an insecticide applied to the sash.
2. Interior Exposed Surfaces: Factory painted..
3. Exterior Surfaces: Clad with aluminum, lap-jointed at corners.
4. Corners: Mortised and tenoned, glued and secured with metal fasteners.
5. Operable sash tilt to interior for cleaning or removal.
6. Sash Thickness: 1-3/4 inches (44 mm)

D. Weather Stripping:

1. Water-stop santoprene wrapped foam at head and sill.
2. Thermal-plastic elastomer bulb with slip coating set into lower sash for tight contact at checkrail.
3. Vinyl-wrapped foam inserted into jambliner or jambliner components to seal to sides of sash.

2.3 GLAZING

A. Glazing:

1. Float Glass: ASTM C 1036, Quality 1.
 - a. Tempered Glass: ASTM C 1048.
2. Type: Silicone-glazed 11/16-inch dual-seal, tempered, insulating glass, clear
 - c. Room Side Grilles: 7/8"wide ogee profile that are solid
 - d. Exterior Grilles: Extruded aluminum 7/8" ogee profile. Dimension to match room side grilles.
 - e. Bars shall be adhered to both sides of insulating glass with VHB acrylic adhesive tape and aligned with foam grid.
 - f. Finish: factory painted

2.4 OPTIONS

A. Insect Screens: Standard full

1. Compliance: ASTM D 3656 and SMA 1201.
2. Screen Cloth: Vinyl-coated fiberglass, 18/16 mesh.
3. Set in aluminum frame fitted to inside of window.
4. Complete with necessary hardware.
5. Screen Frame Finish: Baked enamel.
 - a. Color: Finish to match exterior window cladding.

2.5 HARDWARE

A. Balances:

1. Block-and-tackle balances.

2. Balances are attached to frame and connected to sash with polyester cord.

B. Locking System:

1. Spoon-shaped sash lock.
2. One installed on units with frame width less than 37 inches, 2 locks installed on units with frame width of 37 inches or greater.
3. Oil rubbed bronze finish

C. Sash Lifts:

1. Sash lift furnished for field installation.
2. One sash lift on units with frame width less than 37 inches, 2 sash lifts on units with frame width of 37 inches or greater.

2.6 TOLERANCES

A. Windows shall accommodate the following opening tolerances:

1. Vertical Dimensions Between High and Low Points: Plus 1/4 inch, minus 0 inch.
2. Width Dimensions: Plus 1/4 inch, minus 0 inch.
3. Building Columns or Masonry Openings: Plus or minus 1/4 inch from plumb.

2.7 FINISH.

A. Exterior Finish System: Pella EnduraClad Plus.

1. Exterior aluminum surfaces shall be finished with the following multi-stage system:
 - a. Clean and etch aluminum surface of oxides.
 - b. Pre-treat with chrome phosphate conversion coating.
 - c. Pre-treat with chromic acid sealer/rinse.
 - d. Top coat with baked-on 70% fluoropolymer-based enamel.
2. Color: selected from full range of standard colors_____.
3. Performance Requirements: Exterior aluminum finishes shall meet or exceed all performance requirements of AAMA 2605.

C. Interior Finish: Factory painted

2.8 INSTALLATION ACCESSORIES

A. Flashing/Sealant Tape: Pella SmartFlash.

1. Aluminum-foil-backed butyl window and door flashing tape.
2. Maximum Total Thickness: 0.013 inch.
3. UV resistant.
4. Verify sealant compatibility with sealant manufacturer.

B. Interior Insulating-Foam Sealant: Low-expansion, low-pressure polyurethane insulating window and door foam sealant.

C. Exterior Perimeter Sealant: "Pella Window and Door Installation Sealant" or equivalent high quality, multi-purpose sealant as specified in the joints sealant section

PART 3 EXECUTION

3.1 EXAMINATION

- A. Examine areas to receive windows. Notify Architect of conditions that would adversely affect installation or subsequent use. Do not proceed with installation until unsatisfactory conditions are corrected.

3.2 INSTALLATION

- A. Install windows in accordance with manufacturer's instructions and approved shop drawings.
- B. Install windows to be weather-tight and freely operating.
- C. Maintain alignment with adjacent work.
- D. Secure assembly to framed openings, plumb and square, without distortion.
- E. Integrate window system installation with exterior weather-resistant barrier using flashing/sealant tape. Apply and integrate flashing/sealant tape with weather-resistant barrier using watershed principles in accordance with window manufacturer's instructions.
- F. Place interior seal around window perimeter to maintain continuity of building thermal and air barrier using backer rod and sealant or insulating-foam sealant.
- G. Seal window to exterior wall cladding with sealant and related backing materials at perimeter of assembly.
- H. Leave windows closed and locked.

3.33.4 CLEANING

- A. Clean window frames and glass in accordance with Division 1 requirements.
- B. Do not use harsh cleaning materials or methods that would damage finish.
- C. Remove labels and visible markings.

3.5 PROTECTION

- A. Protect installed windows to ensure that, except for normal weathering, windows will be without damage or deterioration at time of substantial completion.

END OF SECTION

SECTION 08 7100 - DOOR HARDWARE

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Work under this section includes furnishing and the installation of finish and security hardware specified herein and as noted on drawings for a complete and operational system. This section may include electrified door hardware components and low energy automatic door operators.

Items include, but are not limited to:

1. Hinges/Continuous Hinges
2. Flush Bolts
3. Exit Devices
4. Locksets and Cylinders
5. Push Plates - Pulls
6. Closers
7. Kick, Mop and Protection Plates
8. Stops, Wall Bumpers, Overhead Controls
9. Thresholds, Gasketing and Door Bottoms
10. Silencers
11. Miscellaneous Trim and Accessories

B. RELATED SECTIONS:

1. Division 06 - Carpentry
2. Section 08 14 00 - Wood Doors
3. Section 08 21 40 - Entrance Clad Pre-Hung Doors

C. Alternates

1. Refer to Division 01 in the project manual for project alternates.

1.02 REFERENCES

- A. Publications listed herein are part of this specification to the extent referenced.

1. National Fire Protection Association:
 - a. NFPA 80 - Standard for Fire Doors, as adopted.
 - b. NFPA 70 - National Electrical Code
 - c. NFPA 101 - Life Safety Code as adopted.
 - d. NFPA 105 - Recommended Practice for the Installation of Smoke-control Door Assemblies
 - e. NFPA 252-Standard Methods of Fire Tests of Door Assemblies
2. Door and Hardware Institute:
 - a. Installation Guide for Doors and Hardware
 - b. Abbreviations and Symbols
 - c. Hardware for Labeled Fire Doors
 - d. Hardware Reinforcements on Steel Doors and Frames
 - e. WDHS-3 Recommended Hardware Locations for Wood Flush Doors
 - f. Processing Hardware Schedules and Templates
3. American National Standards Institute: ANSI / BHMA A156 Series
4. Americans with Disabilities Act Accessibility Guidelines (ADAAG)
5. Underwriters Laboratories, Inc.
 - a. UL Standard 10C Positive Pressure Fire Tests of Door Assemblies
 - b. UL Standard 1784 Air Leakage Test of Door Assemblies

6. Building Codes:
 - a. IBC as currently adopted by Colleton County
 - b. Local Authority Having Jurisdiction.

1.03 GENERAL REQUIREMENTS

- A. Provide items, articles, materials, operations and methods listed, mentioned or scheduled herein or on drawings, in quantities as required to complete project. Provide hardware that functions properly. Prior to furnishing hardware, advise Architect of items that will not operate properly, are improper for conditions, or will not remain permanently anchored.

1.04 SUBMITTALS

- A. Hardware Schedule: Submit 5 copies of the hardware schedule in vertical format as illustrated by: "Sequence of Format for the Hardware Schedule", as published by the Door and Hardware Institute. Schedules which do not comply will be returned for correction before checking.
 1. Organize the hardware schedule into hardware sets/headings/groups indicating complete designations of every item needed for each door or opening.
 2. Organize door hardware sets in the same order as published in Part 3 of this specification.
 3. Doors of different sizes or where hinges, locks, or closers are different, a separate heading/set shall be used. No labeled opening shall be combined with non-labeled openings.
 4. Content:
 - a. Type, style, function, size, label, hand, and finish for each door hardware item
 - b. Name and manufacturer of each item
 - c. Fastenings and other pertinent attachment information
 - d. Location of each door hardware set, cross-referenced to the Drawings, both on floor plans and in the door/frame schedule.
 - e. Explanation of abbreviations, symbols, and codes contained in the schedule
 - f. Mounting locations for door hardware
 - g. Door and frame sizes and materials.
- B. Hardware schedule shall clearly indicate architect's hardware group and manufacturer of each item proposed.
- C. The schedule shall be reviewed prior to submission by a certified Architectural Hardware Consultant (AHC), who shall affix his or her seal, attesting to the completeness and correctness of the schedule.
 1. Provide 2 copies of illustrations from manufacturer's catalogs and data in brochure form.
 2. Check specified hardware for suitability and adaptability to details and surrounding conditions. Indicate unsuitable or incompatible items and proposed substitutions in hardware schedule.
 3. Provide listing of manufacturer's template numbers for each item of hardware in hardware schedule.
 4. Furnish related trades with copies of final approved hardware schedule. Submit necessary templates and schedules as soon as possible to hollow metal, wood door, and aluminum door fabricators in accordance with schedule they require for fabrication.
 5. Samples: Lever design or finish sample: Provide 3 samples if requested by architect.
- D. Installation Instructions: Provide manufacturer's written installation and adjustment instructions for finish hardware. Send installation instructions to site with hardware.
- E. Templates: Submit templates and "reviewed Hardware Schedule" to door and frame supplier and others as applicable to enable proper and accurate sizing and locations of cutouts and reinforcing.

- F. Contract Closeout Submittals: Comply with Section 01700 including specific requirements indicated below.
1. Operating and maintenance manuals: Submit 3 sets containing the following:
 2. Complete information in care, maintenance, and adjustment, and data on repair and replacement parts, and information on preservation of finishes, as provided by the hardware manufacturers.
 3. Catalog pages for each product.
 4. Name, address, and phone number of local representative for each manufacturer.
 5. Parts list for each product.
 6. Copy of final approved hardware schedule, edited to reflect "As installed".
 7. Copy of final keying schedule.
 8. One complete set of special tools required for maintenance and adjustment of hardware, including changing of cylinders.

1.05 QUALITY ASSURANCE

- A. General Contractor's Investigation: Prior to Contract Execution, the General Contractor shall have thoroughly investigated the entities that will be performing work or supplying materials, products, equipment, or systems for this project, to ensure that they comply with all of the qualifications and requirements mentioned or implied in the Contract Documents. If it is later determined that any of the previously mentioned entities do not comply with the qualifications and requirements specified in the Contract Documents, the General Contractor will be required to replace that entity with a qualified entity at no increase in Contract Sum or Contract Time.
- B. Manufacturer: Obtain each type of hardware (ie. latch and locksets, hinges, closers) from single manufacturer, although several may be indicated as offering products complying with requirements.
- C. Qualifications of the Hardware Supplier: A recognized architectural door hardware supplier, with warehousing facilities, who has been furnishing hardware and installation in the Project's vicinity for a period of not less than 4 years. The supplier shall be, or shall employ, an Architectural Hardware Consultant (AHC) who is available, at reasonable times during the course of the work, for consultation about the Project's hardware requirements, to the Owner, Architect, and Contractor. An Architectural Hardware Consultant (AHC) shall prepare all hardware and access control schedules. This Supplier shall be responsible for proper coordination of all finish hardware items and access control items with related sections to insure compatibility of products.
1. Hardware supplier shall be an authorized, direct factory distributor of all door hardware products specified herein to insure compliance and service of these products.
 2. Hardware supplier shall meet with Owner to finalize keying requirements and to obtain final instructions in writing.
- D. Qualifications of Installer: The hardware installer shall have documented experience in the installation of hardware of similar quantities and types as required for this project. The installer's qualifications shall be submitted to the architect, in writing, for approval by the architect before any work shall commence.
- E. Fire-Rated Openings: Furnish door hardware for fire-rated openings that complies with NFPA Standard No. 80 and requirements of the Authorities Having Jurisdiction. Furnish only items, of door hardware, that are listed and are identical to products tested by UL, ITS-WH, FM, or other testing and inspecting organization acceptable to the Authorities Having Jurisdiction, for use on types and sizes of doors indicated, in compliance with the requirements of fire-rated door and door frame labels.

Project requires door assemblies and components that are compliant with positive pressure and S Label requirements. Specifications must be cross-referenced and coordinated with door and frame manufacturers to ensure that total door opening engineering is compatible with UL10C Standard for Positive Pressure Fire Tests of Door Assemblies.

Where emergency exit devices are required on fire-rated doors (with supplementary marking on doors' UL or FM labels including "Fire Door to be Equipped with Fire Exit Hardware") provide UL/WHI or FM label on exit devices indicating "Fire Exit Hardware".

- F. Substitutions: All substitution requests are required to be submitted prior to the bid date and complying with the procedures and time frame as outlined in Division 01, General Requirements. Approval of submitted products is at the discretion of the architect and his hardware consultant.
- G. At the Project's Completion, the Owner's Representative shall accompany the Architect and General Contractor during the Door Hardware and Access Control Items punch list phase of the project close-out, insuring the Owner's Representative is familiar with all applications and systems, as installed. Refer to additional requirements under 3.0 EXECUTION.
- H. Pre-Installation Meeting: Prior to door hardware installation, the General Contractor / Construction Manager shall request a hardware installation meeting to be held at the project location. This meeting shall convene prior to the installation/hanging of the doors. The types of hardware this meeting shall include are: locksets, exit devices, and door closers. The manufacturer's representatives of the above listed products, in conjunction with the hardware supplier for this project, shall conduct the installation training. All hardware installers shall be required to attend this meeting to receive certificate of authorized training. This meeting shall serve as door openings coordination and review of all shop drawings from related trades prior to the hardware installation. The Hardware Supplier shall include any related meeting costs in their proposal.

1.06 DELIVERY, STORAGE AND HANDLING

- A. Tag each item or package separately with identification related to final hardware schedule, and include basic installation instructions with each item or package.
- B. Packaging of door hardware is the responsibility of the supplier. As material is received by the hardware supplier from various manufacturers, sort and repackage in containers clearly marked with appropriate hardware set numbers to match the set numbers of the approved hardware schedule. Two or more identical sets may be packed in the same container.
- C. The door hardware supplier shall deliver all individually packaged hardware items in a timely fashion to the place of installation (Shop or Project Site); direct factory shipments are not acceptable unless agreed upon beforehand. Hardware supplier shall coordinate delivery times and schedules with the contractor.
- D. The General Contractor, door hardware supplier, and installers shall count, coordinate, and store all door hardware and access control items herein, verifying complete counts of all items scheduled and furnished. The contractor must report all shortages (discrepancies with shipping documents) within five (5) working days. The manufacturers' and Owner's representatives will inspect the installation of the door hardware during that phase of construction. Any deficiencies in installation of all materials included herein shall be corrected before installation continues.
- E. The General Contractor shall provide a secure lock-up for the door hardware and security equipment delivered to the Project, but not yet installed. Control handling and installation of the hardware items that are not immediately replaceable, so that completion of the work will not be delayed by hardware losses, both before and after installation.

1.07 WARRANTY

- A. All materials must be warranted against defects in workmanship and materials for a period of one (1) year from date of acceptance of this project, unless otherwise noted. Any evidence of misuse or abuse voids all warranties. These warranties shall be each manufacturers' standard written warranty.
- B. Special Warranties:
 - 1. Butts: Life of the Door Opening (original installation).
 - 2. Mortise Latchsets and Locksets: Three (3) Year Period.
 - 3. Exit Devices: Three (3) Year Period.
 - 4. Door Closers: Thirty (30) Year Period.
 - 5. Balance of hardware: One (1) year Period.
- C. Any manufacturer whose standard written warranty does not equal or exceed the requirements listed above must provide a letter stating that they will extend their warranty to comply with the requirements of this specification.
- D. All of the manufacturer's fasteners and attachments supplied with each hardware item must be installed to maintain the manufacturer's fire listing and/or warranty.
- E. Refer to Section 01 - Closeout Procedures for additional warranty requirements.

1.08 MAINTENANCE

- A. Maintenance Tools and Instructions: General Contractor shall furnish a complete set of specialized tools and maintenance instructions as needed for the Owner's continued adjustment, maintenance, and removal and replacement of door hardware.

PART 2 PRODUCTS

2.1 BUTTS AND HINGES

- 1. Provide full mortise, template, button tip hinges with non-rising loose pins and ball type bearings.
 - 2. Out-swing exterior doors shall be furnished with stainless steel or bronze hinges with non-removable pins.
 - 3. Interior doors shall be furnished with non-removable pins as specified in the following HW Groups/Sets.
 - 4. Furnish hinges of sufficient throw where needed to clear trim or permit doors to swing 180 degrees.
- B. Quantity:
- 1. Two hinges per leaf for openings through 60 inches high.
 - 2. One additional hinge per leaf for each additional 30 inches in height or fraction thereof.
 - 3. Four hinges for Dutch doors up to 90 inches in height.
- C. Acceptable manufacturers:
- | | | |
|--------|--------|---------|
| Ives | Bommer | Stanley |
| 5BB1 | BB5000 | FBB179 |
| 5BB1 | BB5001 | FBB191 |
| 5BB1HW | BB5004 | FBB168 |
| 5BB1HW | BB5005 | FBB199 |

2.2 FLUSH BOLTS AND DUSTPROOF STRIKES

- A. Provide automatic and manual flush bolts with forged bronze face plates, extruded brass levers, and with wrought brass guides. Provide 12 inch steel or brass rods at doors up to 90 inches in height. Top rods at manual flush bolts for doors over 90 inches in height shall be increased by 6 inches for each additional 6 inches of door height.
- B. Acceptable manufacturers:
- | | | |
|-------|--------|-------|
| Ives | Trimco | Burns |
| FB41T | 3815 | 7942 |
| FB458 | 3915 | 590 |

2.3 LOCKSETS - MORTISE

- A. Provide lock functions specified in Hardware Groups, with following provisions:
1. Cylinders: Refer to "KEYING" article, herein.
 2. Locksets shall be manufactured from heavy gauge steel, 1/8" minimum lock case thickness, containing components of steel with a Zinc dichromate plating for corrosion resistance.
 3. Locksets are to have a standard 2 3/4" backset with a full 3/4" throw. Deadbolt shall be a full 1" throw, constructed of stainless steel.
 4. Lock shall be easily handed without opening the lock case.
 5. Lock trim shall be through-bolted to door to assure correct alignment a proper operation.
 6. Furnish "Knurled" or "Tactile" outside levers as indicated in the door Hardware Sets. "Abrasive" outside levers shall not be acceptable.
- B. Basis of design: Schlage Mortise Series L9000 x 12A Series.
- Acceptable Manufacturers:
- | | |
|--------|------|
| Corbin | Best |
| ML2000 | 45H |

2.4 EXIT DEVICES

- A. Provide exit device series and functions as specified in Hardware Groups. Von Duprin product numbers are referenced in the Hardware Groups.
- B. All exit devices shall be UL listed for panic. Exit devices for labeled doors shall be UL listed as "Fire Exit Hardware".
- C. Where lever trim is specified, provide lever design to match lockset levers.
- D. Provide lever trim with breakaway feature.
- E. Provide cylinders for exit devices with locking trim and cylinder dogging.
- F. Provide exit devices with stainless steel touch bars. Load bearing plastic parts are not acceptable.
- G. Provide exit devices with cast metal, flush end caps.
- H. Provide deadlocking latchbolt feature for exit devices.
- I. Provide roller strikes on all rim exit devices.
- J. Provide cylinder dogging feature for non-rated exit devices.
- K. Provide keyed removable mullions, with cylinders, as specified in the Hardware Groups.
- L. Basis of Design: Von Duprin 35A series

Acceptable Manufacturers: Precision Apex Series

2.5 KEYING

- A. Provide for Master key for all cylinders and/or cores, and key in groups, unless otherwise specified. Provide for factory keying, with the manufacturer retaining permanent keying records.
- B. Provide for three master keys for each master keyed set. Provide two change keys for each lock. Provide 2 control keys for core removal as required for removable core. Provide one extra key blank per cylinder. Stamp keys "DO NOT DUPLICATE." Keys and cylinders/cores shall be marked with applicable blind code for identification. Visual key control marks or codes shall not include actual key cuts.
- C. Meet with the Owner to finalize keying requirements and obtain keying instructions in writing. The Keying Schedule shall be established in compliance with specific requirements from the Owner. Submit proposed keying schedule to the GC and the Architect. If requested, meet with Owner and Architect to review schedule.
- D. Provide removable core cylinders, with patented key control, at exterior door cylinders. Furnish with temporary keyed brass construction cores, unless otherwise indicated. Furnish three construction keys to the General Contractor. Permanent cores and keys shall be furnished to the Owner's Representative and installed by the General Contractor, as directed by the Owner, upon completion of the project. All other locks shall be furnished with conventional cylinders.

2.6 DOOR TRIM

- A. Push Plates:
 - 1. Ives type 8200 3.5 inches by 15 inch unless otherwise indicated.
- B. Pull Plates:
 - 1. Ives type 8303 3.5 inches by 15 inches unless otherwise indicated.
- C. Pulls:
 - 1. Ives Series 8181 x 18" x TB.
 - 2. Where required, mount back to back with push bars.
- D. Kick Plates and Armor Plates: Ives 8400 Series, minimum of 0.050 inch thick, beveled 4 edges.
 - 1. At single doors provide width two inches less than door width on stop side and one inch less than door width on pull side.
 - 2. At pairs of doors provide width one inch less than door width on both sides.
 - 3. Height of 8 inches, unless otherwise indicated.
 - 4. Provide plates with countersunk screw holes.
- E. Acceptable Manufacturers and Types:
Ives Trimco Burns

2.7 DOOR CLOSERS

- A. Acceptable Manufacturers and Types of Large Bore Exposed Closers:

LCN	Sargent	Norton
4050 Series	351 Series	7500 Series

1. Provide door closers conforming to ANSI/BHMA A156.4 Grade 1 requirements by BHMA certified independent testing laboratory.
2. Provide door closers with fully hydraulic, full rack and pinion action with cast aluminum cylinder.
3. Closer Body: 1-1/2 inch (38 mm) diameter, with 11/16 inch (17 mm) diameter heat-treated pinion journal and full complement bearings.
4. Hydraulic Fluid: Fireproof, passing requirements of UL10C, and requiring no seasonal closer adjustment for temperatures ranging from 120 degrees F to -30 degrees F.
5. Spring Power: Continuously adjustable over full range of closer sizes, and providing reduced opening force as required by accessibility codes and standards.
6. Hydraulic Regulation: By tamper-proof, non-critical valves, with separate adjustment for latch speed, general speed, and back check.
7. Pressure Relief Valve (PRV) Technology: not permitted.
8. Provide stick on and special templates, drop plates, mounting brackets, or adapters for arms as required for details, overhead stops, and other door hardware items interfering with closer mounting.

B. Acceptable Manufacturers and Types of Medium Bore Exposed Closers:

LCN	Sargent	Norton
1450 Series	1331 Series	8501/8501BF Series

1. Provide door closers conforming to ANSI/BHMA A156.4 Grade 1 requirements by BHMA certified independent testing laboratory.
2. Provide door closers with fully hydraulic, full rack and pinion action with cast aluminum cylinder.
3. Closer Body: 1-1/4 inch (32 mm) diameter, with 5/8 inch (16 mm) diameter heat-treated pinion journal and full complement bearings.
4. Hydraulic Fluid: Fireproof, passing requirements of UL10C, and requiring no seasonal closer adjustment for temperatures ranging from 120 degrees F to -30 degrees F.
5. Spring Power: Continuously adjustable over full range of closer sizes, and providing reduced opening force as required by accessibility codes and standards.
6. Hydraulic Regulation: By tamper-proof, non-critical valves, with separate adjustment for latch speed, general speed, and back check.
7. Pressure Relief Valve (PRV) Technology: not permitted.
8. Provide stick on and special templates, drop plates, mounting brackets, or adapters for arms as required for details, overhead stops, and other door hardware items interfering with closer mounting.

2.8 OVERHEAD STOPS

- A. Provide overhead stops for interior doors equipped with regular arm surface type closer for doors that open against equipment, casework, sidelights, other objects that would make wall stops inappropriate.
- B. Provide sex bolt attachments for mineral core door application.
- C. Acceptable Manufacturers

Glynn Johnson	Rixson	Sargent
450	10 Series	1540 Series

2.9 WALL STOPS AND HOLDERS

- A. Acceptable Manufacturers and Types:

Ives Trimco Door Controls

- B. Provide a wall stop for each door leaf unless otherwise specified, or where conditions require the use of an overhead stop.
- C. Floor or base stops shall be used only where definitely specified or absolutely unavoidable.

2.10 THRESHOLDS

- A. Except as otherwise indicated, thresholds shall be furnished as part of the exterior pre-hung doors.

2.11 WEATHERSTRIPPING

- A. Except as otherwise indicated, weatherstripping shall be furnished as part of the exterior pre-hung doors.

2.12 SILENCERS

- A. Acceptable Manufacturers and types:
Ives Steelcraft Don-Jo
SR64 Q146 1608
- B. Provide grey rubber silencers featuring pneumatic design that, once installed, forms an air pocket to absorb shock and reduce noise of door closing.
- C. Provide three (3) silencers per hollow metal strike jamb; two (2) per hollow metal double door head. Omit at doors scheduled to receive perimeter weatherstripping or smoke gasket.
- D. Silencers shall meet ANSI/BHMA A156.16, L03011

2.13 KEY CABINET

- A. Provide key cabinets by Lund Equipment, Telkee Incorporated, or Key Control.
- B. Lund Deluxe wall type cabinet, Series 1200.
- C. Provide cabinet with one hook for each lock or cylinder plus at least 50 percent extra hooks.
- D. Provide each hook with one non-removable security key tag and one snap-on link duplicate key tag.
- E. Provide tools, instruction sheets and accessories required to complete installation.
- F. Owner will place keys in key cabinet and complete index cards furnished with key system.

2.14 FASTENERS

- A. Including, but not limited to, wood or machine screws, bolts, nuts, anchors, etc. of proper type, material, and finish required for installation of hardware.
- B. Use phillips head for exposed screws. Do not use aluminum screws to attach hardware.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Site Verification: Examine doors, frames and related items with the installer for conditions that would prevent the proper application of finish hardware. Do not proceed until defects are corrected. Examine existing door and frames, which shall remain as part of the project, to verify existing preps for new hardware.
- B. Commencement of hardware installation constitutes acceptance of conditions and responsibility for satisfactory performance.

3.2 INSTALLATION

- A. Mount hardware units at heights indicated in the following applicable publications, except as specifically indicated or required to comply with governing regulations and, except as otherwise indicated, by the Architect.
 - 1. "Recommended Locations for Builders Hardware for Standard Steel Doors and Frames" by the Door and Hardware Institute.
- B. Install each hardware item in compliance with the manufacturer's instructions and recommendations. Where cutting and fitting is required to install hardware onto or into surfaces that are later to be painted or finished in another way, coordinate removal, storage, and reinstallation or application of surface protection with finishing work specified in the Division 09 Sections. Do not install surface-mounted items until finishes have been completed on the substrates involved.
- C. Sets units level, plumb, and true to line and location. Adjust and reinforce the attachment substrate as necessary for proper installation and operation.
- D. Where scheduled, door pulls shall be through-bolted with bolt heads concealed behind push plates.
- E. Drill and countersink units that are not factory prepared for anchorage fasteners. Space fasteners and anchors in accordance with industry standards.
- F. The hardware installer shall be responsible for installation of all mechanical and electromechanical hardware items contained within this specification, in accordance with the manufacturer's technical installation guidance, and in addition to all applicable code requirements.
- G. Install floor-mounted or wall-mounted stops as scheduled. An overhead stop shall be provided where floor or wall stops cannot be used. Place door stops in a position that they permit the maximum door swing, but do not present a hazard or obstruction. Floor stops shall be installed with risers as needed to accommodate required height between the finish floor and the bottom of the door.

3.3 FIELD QUALITY CONTROL

- A. After installation has been completed, provide services of qualified hardware consultant to check Project to determine proper application of finish hardware according to schedule. Also check operation and adjustment of hardware items.
- B. Adjust door control devices to compensate for final operation of heating and ventilating equipment.

3.4 ADJUSTING AND CLEANING

- A. At final completion, hardware shall be left clean and free from disfigurement. Make final adjustment to door closers and other items of hardware. Where hardware is found defective repair or replace or otherwise correct as directed.

- B. Adjust door closers to meet opening force requirements of ADA: 5.0 lbs for non-rated doors. All fire-rated doors shall have the minimum opening force allowable, but shall allow the door to close and positively latch to meet the fire door requirements.
- C. Final Adjustment: Wherever hardware installation is made more than one month prior to acceptance or occupancy of space or area, return to work during week prior to acceptance or occupancy, and make final check and adjustment of hardware items in such space or area. Clean operating items as necessary to restore proper function and finish of hardware and doors.
- D. Instruct Owner's personnel in proper adjustment and maintenance of door hardware and hardware finishes.
- E. Clean adjacent surfaces soiled by hardware installation.

3.5 PROTECTION

- A. Provide for proper protection of items of hardware until Owner accepts Project as complete.

3.6 HARDWARE GROUPS

- A. The following schedule of hardware groups shall be considered a guide only, and the supplier is cautioned to refer to general conditions, special conditions, and the preamble to this section. It shall be the hardware supplier's responsibility to furnish all required hardware.
- B. Refer to the door schedule for hardware group required at each door opening.

HARDWARE SET NO. 01 - PRE-HUNG DOOR UNIT

FOR USE ON MARK/DOOR #(S):

101A 106D

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
1	EA	PANIC HARDWARE	CD-3527A-EO	643E	VON
1	EA	PANIC HARDWARE	CD-3527A-NL-OP-388	643E	VON
1	EA	RIM CYLINDER	20-057-ICX	613	SCH
2	EA	MORTISE CYLINDER	20-061-ICX	613	SCH
3	EA	FSIC CORE	23-030	606	SCH
2	EA	DECORATIVE PULL	8181 16" STD	613	IVE
2	EA	SURFACE CLOSER	4050 SCUSH	695	LCN
2	EA	PA MOUNTING PLATE	4050-18PA	695	LCN
2	EA	CUSH SHOE SUPPORT	4050-30	695	LCN
2	EA	KICK PLATE	8400 8" X 2" LDW B-CS	613	IVE
1		BALANCE OF HARDWARE BY DOOR SUPPLIER HINGES, THRESHOLD, & WEATHERSTRIP			

HARDWARE SET NO. 02 - EXISTING OPENING

FOR USE ON MARK/DOOR #(S):

101B

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
1	EA	THRESHOLD	655A-MSLA-10	A	ZER
1			EXISTING DOOR, FRAME AND HARDWARE TO REMAIN		

HARDWARE SET NO. 03 - PRE-HUNG DOOR UNIT

FOR USE ON MARK/DOOR #(S):

103B 104A

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
1	EA	PANIC HARDWARE	CD-3527A-NL-OP-388	643E	VON
1	EA	RIM CYLINDER	20-057-ICX	613	SCH
1	EA	MORTISE CYLINDER	20-061-ICX	613	SCH
2	EA	FSIC CORE	23-030	606	SCH
1	EA	DECORATIVE PULL	8181 16" STD	613	IVE
1	EA	SURFACE CLOSER	4050 SCUSH	695	LCN
1	EA	PA MOUNTING PLATE	4050-18PA	695	LCN
1	EA	CUSH SHOE SUPPORT	4050-30	695	LCN
1	EA	KICK PLATE	8400 8" X 2" LDW B-CS	613	IVE
			BALANCE OF HARDWARE BY DOOR SUPPLIER		

HARDWARE SET NO. 04 - PRE-HUNG DOOR UNIT

FOR USE ON MARK/DOOR #(S):

106B 106C

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
1	EA	PANIC HARDWARE	CD-3527A-EO	643E	VON
1	EA	MORTISE CYLINDER	20-061-ICX	613	SCH
1	EA	FSIC CORE	23-030	606	SCH
1	EA	DECORATIVE PULL	8181 16" STD	613	IVE
1	EA	SURFACE CLOSER	4050 SCUSH	695	LCN
1	EA	PA MOUNTING PLATE	4050-18PA	695	LCN
1	EA	CUSH SHOE SUPPORT	4050-30	695	LCN
1	EA	KICK PLATE	8400 8" X 2" LDW B-CS	613	IVE
1			BALANCE OF HARDWARE BY DOOR SUPPLIER		

HARDWARE SET NO. 05 - GATE

FOR USE ON MARK/DOOR #(S):
GATE1

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
1	EA	MORTISE CYLINDER	20-001 118	643E	SCH
1			BALANCE OF HARDWARE BY DOOR SUPPLIER		
			ALL HARDWARE BY GATE SUPPLIER.		

HARDWARE SET NO. 06

FOR USE ON MARK/DOOR #(S):
103

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5	640	IVE
1	EA	OFFICE/ENTRY LOCK	L9050P 12A	643E	SCH
1	EA	SURFACE CLOSER	1250 AS REQ SLIM REG ARM	695	LCN
1	EA	FLOOR STOP	FS439	704	IVE
3	EA	SILENCER	SR65	GRY	IVE

HARDWARE SET NO. 07

FOR USE ON MARK/DOOR #(S):
103A

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5	640	IVE
1	EA	OFFICE/ENTRY LOCK	L9050P 12A	643E	SCH
1	EA	FLOOR STOP	FS439	704	IVE
3	EA	SILENCER	SR65	GRY	IVE

HARDWARE SET NO. 08

FOR USE ON MARK/DOOR #(S):
104 104B 115

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5	640	IVE
1	EA	OFFICE/ENTRY LOCK	L9050P 12A	643E	SCH

1	EA	SURFACE CLOSER	1250 AS REQ SLIM REG ARM @104, 115 PA @104B	695	LCN
1	EA	WALL STOP	WS406/407CVX	613	IVE
3	EA	SILENCER	SR65	GRY	IVE

HARDWARE SET NO. 09

FOR USE ON MARK/DOOR #(S):

106

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
6	EA	HINGE	5BB1 4.5 X 4.5	640	IVE
1	EA	AUTO FLUSH BOLT	FB41T	613	IVE
1	EA	CLASSROOM LOCK	L9070P 03A	643E	SCH
1	EA	COORDINATOR	COR X FL	315AN	IVE
2	EA	SURFACE CLOSER	1250 EDA SLIM	695	LCN
2	EA	KICK PLATE	8400 8" X 2" LDW B-CS	613	IVE
2	EA	SILENCER	SR65	GRY	IVE

HARDWARE SET NO. 10

FOR USE ON MARK/DOOR #(S):

107

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
6	EA	HINGE	5BB1 4.5 X 4.5	640	IVE
1	EA	MANUAL FLUSH BOLT	FB458	613	IVE
			TOP MOUNT ONLY		
1	EA	STOREROOM LOCK	L9080P 03A	643E	SCH
2	EA	SILENCER	SR65	GRY	IVE

HARDWARE SET NO. 11

FOR USE ON MARK/DOOR #(S):

108A 108B 108C

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
6	EA	HINGE	5BB1 4.5 X 4.5	640	IVE
2	EA	ROLLER LATCH	RL32	613	IVE
2	EA	HALF DUMMY TRIM	L0170 03A	643E	SCH
2	EA	SILENCER	SR65	GRY	IVE

HARDWARE SET NO. 12

FOR USE ON MARK/DOOR #(S):

111 112

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5	640	IVE
1	EA	PUSH PLATE	8200 3.5" X 15"	613	IVE
1	EA	PULL PLATE	8303 8" 3.5" X 15"	613	IVE
1	EA	SURFACE CLOSER	1250 AS REQ SLIM	695	LCN
1	EA	KICK PLATE	8400 8" X 2" LDW B-CS	613	IVE
1	EA	WALL STOP	WS406/407CVX	613	IVE
3	EA	SILENCER	SR65	GRY	IVE

HARDWARE SET NO. 13

FOR USE ON MARK/DOOR #(S):

111A 112A 114

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5	640	IVE
1	EA	STOREROOM LOCK	AL80PD NEP	613	SCH
1	EA	WALL STOP	WS406/407CVX	613	IVE
3	EA	SILENCER	SR65	GRY	IVE

HARDWARE SET NO. 14

FOR USE ON MARK/DOOR #(S):

113

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5	640	IVE
1	EA	STOREROOM LOCK	AL80PD NEP	613	SCH
1	EA	SURFACE CLOSER	1250 AS REQ SLIM	695	LCN
1	EA	WALL STOP	WS406/407CVX	613	IVE
3	EA	SILENCER	SR65	GRY	IVE

HARDWARE SET NO. 15

FOR USE ON MARK/DOOR #(S):

116 118

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5	640	IVE
1	EA	OFFICE/ENTRY LOCK	L9050P 12A	643E	SCH
1	EA	WALL STOP	WS406/407CVX	613	IVE
3	EA	SILENCER	SR65	GRY	IVE

HARDWARE SET NO. 16

FOR USE ON MARK/DOOR #(S):

119 120

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5	640	IVE
1	EA	PRIVACY	LT40 12C 626 613	626	SCH
1	EA	WALL STOP	WS406/407CVX	613	IVE
3	EA	SILENCER	SR65	GRY	IVE

END OF SECTION

SECTION 08 9000 - LOUVERS AND VENTS

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 DEFINITIONS

- A. Louver Terminology: Definitions of terms for metal louvers contained in AMCA 501 apply to this Section unless otherwise defined in this Section or in referenced standards.

1.3 PERFORMANCE REQUIREMENTS

- A. Structural Performance: Louvers shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated without permanent deformation of louver components, noise or metal fatigue caused by louver blade rattle or flutter, or permanent damage to fasteners and anchors. Wind pressures shall be considered to act normal to the face of the building.
 - 1. Wind Loads: Determine loads based on pressures as indicated on Drawings.
- B. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes, without buckling, opening of joints, overstressing of components, failure of connections, or other detrimental effects.
- C. Louver Performance Ratings: Provide louvers complying with requirements specified, as demonstrated by testing manufacturer's stock units identical to those provided, except for length and width according to AMCA 500-L.

1.4 QUALITY ASSURANCE

- A. Source Limitations: Obtain louvers and vents from single source from a single manufacturer where indicated to be of same type, design, or factory-applied color finish.
- B. Welding: Qualify procedures and personnel according to the following:
 - 1. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum."
 - 2. AWS D1.3, "Structural Welding Code - Sheet Steel."
 - 3. AWS D1.6, "Structural Welding Code - Stainless Steel."
- C. SMACNA Standard: Comply with recommendations in SMACNA's "Architectural

Sheet Metal Manual" for fabrication, construction details, and installation procedures.

1.5 PROJECT CONDITIONS

- A. Field Measurements: Verify actual dimensions of openings by field measurements before fabrication.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Fasteners: Use types and sizes to suit unit installation conditions.
 - 1. Use tamper-resistant screws for exposed fasteners unless otherwise indicated.
 - 2. For fastening aluminum, use aluminum or 300 series stainless-steel fasteners.
 - 3. For fastening galvanized steel, use hot-dip-galvanized steel or 300 series stainless-steel fasteners.
 - 4. For fastening stainless steel, use 300 series stainless-steel fasteners.
 - 5. For color-finished louvers, use fasteners with heads that match color of louvers.
- B. Postinstalled Fasteners for Concrete and Masonry: Torque-controlled expansion anchors, made from stainless-steel components, with capability to sustain, without failure, a load equal to 4 times the loads imposed, for concrete, or 6 times the load imposed, for masonry, as determined by testing per ASTM E 488, conducted by a qualified independent testing agency.
- C. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.

2.2 FABRICATION, GENERAL

- A. Assemble louvers in factory to minimize field splicing and assembly. Disassemble units as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation.
- B. Maintain equal louver blade spacing, including separation between blades and frames at head and sill, to produce uniform appearance.
- C. Fabricate frames, including integral sills, to fit in openings of sizes indicated, with allowances made for fabrication and installation tolerances, adjoining material tolerances, and perimeter sealant joints.
 - 1. Frame Type: Interior flange unless otherwise indicated.
- D. Include supports, anchorages, and accessories required for complete assembly.
- E. Provide subsills made of same material as louver for recessed louvers.

- F. Join frame members to each other and to fixed louver blades with fillet welds, threaded fasteners, or both, as standard with louver manufacturer unless otherwise indicated or size of louver assembly makes bolted connections between frame members necessary.

2.3 FIXED, EXTRUDED-ALUMINUM LOUVERS

A. Horizontal Fixed Blade Louver

- 1. 4" deep channel, .081" thick Aluminum frame and blades. Minimum 50% open area. Basis-of-Design Product: Subject to compliance with requirements, provide one of the following:
 - a. American Warming and Ventilating, Inc.; a Mestek company. Model "LE-21"
 - b. Nystrom Building Products.
- 2. Provide insect screen over entire open area at interior of louver.
- 3. Provide blank off panel at interior of louver.
 - a. Panel finish same type and color as louver finish.
 - b. Provide two rows of 1/8" openings at 3/4" o.c. at top of panel for air flow.

2.4 FINISHES, GENERAL

- A. High-Performance Organic Finish: 3 -coat fluoropolymer finish complying with AAMA 2605 and containing not less than 70 percent PVDF resin by weight in both color coat and clear topcoat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - 1. Color and Gloss: As selected by Architect from manufacturer's full range including metallic colors.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and openings, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Coordinate setting drawings, diagrams, templates, instructions, and directions for installation of anchorages that are to be embedded in concrete or masonry construction. Coordinate delivery of such items to Project site.

3.3 INSTALLATION

- A. Locate and place louvers and vents level, plumb, and at indicated alignment with adjacent work.
- B. Use concealed anchorages where possible. Provide brass or lead washers fitted to screws where required to protect metal surfaces and to make a weathertight connection.
- C. Form closely fitted joints with exposed connections accurately located and secured.
- D. Provide perimeter reveals and openings of uniform width for sealants and joint fillers, as indicated.
- E. Repair finishes damaged by cutting, welding, soldering, and grinding. Restore finishes so no evidence remains of corrective work. Return items that cannot be refinished in the field to the factory, make required alterations, and refinish entire unit or provide new units.
- F. Protect unpainted galvanized and nonferrous-metal surfaces that will be in contact with concrete, masonry, or dissimilar metals from corrosion and galvanic action by applying a heavy coating of bituminous paint or by separating surfaces with waterproof gaskets or nonmetallic flashing.
- G. Install concealed gaskets, flashings, joint fillers, and insulation as louver installation progresses, where weathertight louver joints are required. Comply with Division 07 Section "Joint Sealants" for sealants applied during louver installation.

3.4 ADJUSTING AND CLEANING

- A. Clean exposed surfaces of louvers and vents that are not protected by temporary covering, to remove fingerprints and soil during construction period. Do not let soil accumulate during construction period.
- B. Before final inspection, clean exposed surfaces with water and a mild soap or detergent not harmful to finishes. Thoroughly rinse surfaces and dry.
- C. Restore louvers and vents damaged during installation and construction so no evidence remains of corrective work. If results of restoration are unsuccessful, as determined by Architect, remove damaged units and replace with new units.
 - 1. Touch up minor abrasions in finishes with air-dried coating that matches color and gloss of, and is compatible with, factory-applied finish coating.

END OF SECTION 08 9000

SECTION 09 2900 - GYPSUM BOARD

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. Interior gypsum board.
 - 2. Sound attenuation blanket
 - 3. Wall to Wall and Ceiling to Ceiling gypsum board expansion joint

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Samples of expansion joint material and full range of colors for selection

1.4 DELIVERY, STORAGE AND HANDLING

- A. Store materials inside under cover and keep them dry and protected against weather, condensation, direct sunlight, construction traffic, and other potential causes of damage. Stack panels flat and supported on risers on a flat platform to prevent sagging.

1.5 FIELD CONDITIONS

- A. Environmental Limitations: Comply with ASTM C 840 requirements or gypsum board manufacturer's written recommendations, whichever are more stringent.
- B. Do not install paper-faced gypsum panels until installation areas are enclosed and conditioned.
- C. Do not install panels that are wet, those that are moisture damaged, and those that are mold damaged.
 - 1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.

2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

PART 2 - PRODUCTS

2.1 GYPSUM BOARD, GENERAL

- A. Size: Provide maximum lengths and widths available that will minimize joints in each area and that correspond with support system indicated.

2.2 INTERIOR GYPSUM BOARD

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. American Gypsum.
2. CertainTeed Corp.
3. Georgia-Pacific Gypsum LLC.
4. Lafarge North America Inc.
5. National Gypsum Company.
6. USG Corporation.

- B. Gypsum Board, Type X: ASTM C 1396/C 1396M.

1. Thickness: 5/8 inch.
2. Long Edges: Tapered.

- C. Gypsum Ceiling Board: ASTM C 1396/C 1396M.

1. Thickness: 1/2 inch.
2. Long Edges: Tapered.

- D. Moisture- and Mold-Resistant Gypsum Board: ASTM C 1396/C 1396M. With moisture- and mold-resistant core and paper surfaces.

1. Core: 5/8 inch, Type X.
2. Long Edges: Tapered.
3. Mold Resistance: ASTM D 3273, score of 10 as rated according to ASTM D 3274.

2.3 SOUND ATTENUATION BLANKET

- A. Sound Attenuation Blankets: ASTM C 665, Type I (blankets without membrane facing) produced by combining thermosetting resins with mineral fibers manufactured from glass, slag wool, or rock wool.

2.4 TRIM ACCESSORIES

- A. Interior Trim: ASTM C 1047.
 - 1. Material: Galvanized or aluminum-coated steel sheet, rolled zinc, or paper-faced galvanized steel sheet.
 - 2. Shapes:
 - a. Cornerbead.
 - b. Bullnose bead.
 - c. LC-Bead: J-shaped; exposed long flange receives joint compound.
 - d. L-Bead: L-shaped; exposed long flange receives joint compound.
 - e. U-Bead: J-shaped; exposed short flange does not receive joint compound.
 - f. Wall to Wall and Ceiling to Ceiling expansion joint. Exposed metal to be mill finish aluminum ready for painting. Source: Balco 6GW series or approved equal.
 - g. Wall to Ceiling expansion joint. Exposed metal to be mill finish aluminum ready for painting. Source: Balco 6GWC series or approved equal.

2.5 JOINT TREATMENT MATERIALS

- A. General: Comply with ASTM C 475/C 475M.
- B. Joint Tape:
 - 1. Interior Gypsum Board: Paper.
- C. Joint Compound for Interior Gypsum Board: For each coat use formulation that is compatible with other compounds applied on previous or for successive coats.
 - 1. Prefilling: At open joints, rounded or beveled panel edges, and damaged surface areas, use setting-type taping compound.
 - 2. Embedding and First Coat: For embedding tape and first coat on joints, fasteners, and trim flanges, use setting-type taping compound.
 - 3. Fill Coat: For second coat, use setting-type, sandable topping compound.
 - 4. Finish Coat: For third coat, use drying-type, all-purpose compound.

2.6 AUXILIARY MATERIALS

- A. General: Provide auxiliary materials that comply with referenced installation standards and manufacturer's written recommendations.
- B. Steel Drill Screws: ASTM C 1002, unless otherwise indicated.
 - 1. For fastening cementitious backer units, use screws of type and size recommended by panel manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and substrates including welded hollow-metal frames and framing, with Installer present, for compliance with requirements and other conditions affecting performance.
- B. Examine panels before installation. Reject panels that are wet, moisture damaged, and mold damaged.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 APPLYING AND FINISHING PANELS, GENERAL

- A. Comply with ASTM C 840.
- B. Install ceiling panels across framing to minimize the number of abutting end joints and to avoid abutting end joints in central area of each ceiling. Stagger abutting end joints of adjacent panels not less than one framing member.
- C. Install panels with face side out. Butt panels together for a light contact at edges and ends with not more than 1/16 inch of open space between panels. Do not force into place.
- D. Locate edge and end joints over supports, except in ceiling applications where intermediate supports or gypsum board back-blocking is provided behind end joints. Do not place tapered edges against cut edges or ends. Stagger vertical joints on opposite sides of partitions. Do not make joints other than control joints at corners of framed openings.
- E. Form control and expansion joints with space between edges of adjoining gypsum panels.
- F. Cover both faces of support framing with gypsum panels in concealed spaces (above ceilings, etc.), except in chases braced internally.
 - 1. Unless concealed application is indicated or required for sound, fire, air, or smoke ratings, coverage may be accomplished with scraps of not less than 8 sq. ft. in area.
 - 2. Fit gypsum panels around ducts, pipes, and conduits.
 - 3. Where partitions intersect structural members projecting below underside of floor/roof slabs and decks, cut gypsum panels to fit profile formed by structural members; allow 1/4- to 3/8-inch- wide joints to install sealant.
- G. Isolate perimeter of gypsum board applied to non-load-bearing partitions at structural abutments, except floors. Provide 1/4- to 1/2-inch- wide spaces at these locations and trim edges with edge trim where edges of panels are exposed. Seal joints between edges and abutting structural surfaces with acoustical sealant.

- H. Wood Framing: Install gypsum panels over wood framing, with floating internal corner construction. Do not attach gypsum panels across the flat grain of wide-dimension lumber, including floor joists and headers. Float gypsum panels over these members or provide control joints to counteract wood shrinkage.
- I. Install sound attenuation blankets before installing gypsum panels unless blankets are readily installed after panels have been installed on one side.

3.3 INSTALLING TRIM ACCESSORIES

- A. General: For trim with back flanges intended for fasteners, attach to framing with same fasteners used for panels. Otherwise, attach trim according to manufacturer's written instructions.

3.4 FINISHING GYPSUM BOARD

- A. General: Treat gypsum board joints, interior angles, edge trim, control joints, penetrations, fastener heads, surface defects, and elsewhere as required to prepare gypsum board surfaces for decoration. Promptly remove residual joint compound from adjacent surfaces.
- B. Prefill open joints, rounded or beveled edges and damaged surface areas.
- C. Apply joint tape over gypsum board joints, except for trim products specifically indicated as not intended to receive tape.
- D. Glass-Mat Faced Panels: Finish according to manufacturer's written instructions.

3.5 PROTECTION

- A. Protect adjacent surfaces from drywall compound and promptly remove from floors and other non-drywall surfaces. Repair surfaces stained, marred, or otherwise damaged during drywall application.
- B. Protect installed products from damage from weather, condensation, direct sunlight, construction, and other causes during remainder of the construction period.
- C. Remove and replace panels that are wet, moisture damaged, and mold damaged.
 - 1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
 - 2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

END OF SECTION 09 2900

SECTION 09 3000 - TILING

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.

B. Allowances

1.2 SUMMARY

A. Section Includes: Refer to Finish Schedule as shown in the Drawings.

1. Porcelain floor tile at toilet rooms.
2. Ceramic tile at toilet room walls and base.
3. Stone thresholds.
4. Crack isolation membrane.
5. Metal edge strips.

1.3 DEFINITIONS

A. General: Definitions in the ANSI A108 series of tile installation standards and in ANSI A137.1 apply to Work of this Section unless otherwise specified.

B. ANSI A108 Series: ANSI A108.01, ANSI A108.02, ANSI A108.1A, ANSI A108.1B, ANSI A108.1C, ANSI A108.4, ANSI A108.5, ANSI A108.6, ANSI A108.8, ANSI A108.9, ANSI A108.10, ANSI A108.11, ANSI A108.12, ANSI A108.13, ANSI A108.14, ANSI A108.15, ANSI A108.16, and ANSI A108.17, which are contained in "American National Standard Specifications for Installation of Ceramic Tile."

C. Module Size: Actual tile size plus joint width indicated.

D. Face Size: Actual tile size, excluding spacer lugs.

1.4 PERFORMANCE REQUIREMENTS

A. Static Coefficient of Friction: For tile installed on walkway surfaces, provide products with the following values as determined by testing identical products per ASTM C 1028:

1.5 ACTION SUBMITTALS

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

B. Samples for Verification:

1. Full-size units of each type and composition of tile and for each color and finish required.
2. Assembled samples mounted on a rigid panel, with grouted joints, for each type and composition of tile and for each color and finish required. Make samples at least 12 inches square, but not fewer than 4 tiles. Use grout of type and in color or colors approved for completed Work.
3. Full-size units of each type of trim and accessory for each color and finish required.
4. Stone thresholds in 6-inch lengths.
5. Metal edge strips in 6-inch lengths.

1.6 QUALITY ASSURANCE

A. Source Limitations for Tile: Obtain tile of each type and color or finish from one source or producer.

1. Obtain tile of each type and color or finish from same production run and of consistent quality in appearance and physical properties for each contiguous area.

B. Source Limitations for Setting and Grouting Materials: Obtain ingredients of a uniform quality for each mortar, adhesive, and grout component from one manufacturer and each aggregate from one source or producer.

C. Source Limitations for Other Products: Obtain each of the following products specified in this Section from a single manufacturer for each product:

1. Stone thresholds.
2. Crack isolation membrane.
3. Joint sealants.
4. Metal edge strips.

D. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.

1. Build mockup of each type of floor tile installation.
2. Build mockup of each type of wall tile installation.
3. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

E. Preinstallation Conference: Conduct conference at Project site.

1. Review requirements in ANSI A108.01 for substrates and for preparation by other trades.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver and store packaged materials in original containers with seals unbroken and labels intact until time of use. Comply with requirements in ANSI A137.1 for labeling tile packages.
- B. Store tile and cementitious materials on elevated platforms, under cover, and in a dry location.
- C. Store aggregates where grading and other required characteristics can be maintained and contamination can be avoided.
- D. Store liquid materials in unopened containers and protected from freezing.
- E. Handle tile that has temporary protective coating on exposed surfaces to prevent coated surfaces from contacting backs or edges of other units. If coating does contact bonding surfaces of tile, remove coating from bonding surfaces before setting tile.

1.8 PROJECT CONDITIONS

- A. Environmental Limitations: Do not install tile until construction in spaces is complete and ambient temperature and humidity conditions are maintained at the levels indicated in referenced standards and manufacturer's written instructions.

PART 2 - PRODUCTS

2.1 PRODUCTS, GENERAL

- A. ANSI Ceramic Tile Standard: Provide tile that complies with ANSI A137.1 for types, compositions, and other characteristics indicated.
 - 1. Provide tile complying with Standard grade requirements unless otherwise indicated.
- B. ANSI Standards for Tile Installation Materials: Provide materials complying with ANSI A108.02, ANSI standards referenced in other Part 2 articles, ANSI standards referenced by TCA installation methods specified in tile installation schedules, and other requirements specified.
- C. Low-Emitting Materials: Tile flooring systems shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
- D. Factory Blending: For tile exhibiting color variations within ranges, blend tile in factory and package so tile units taken from one package show same range in colors as those taken from other packages and match approved Samples.

E. Mounting: For factory-mounted tile, provide back- or edge-mounted tile assemblies as standard with manufacturer unless otherwise indicated.

1. Where tile is indicated for installation in wet areas, do not use back- or edge-mounted tile assemblies unless tile manufacturer specifies in writing that this type of mounting is suitable for installation indicated and has a record of successful in-service performance.

F. Factory-Applied Temporary Protective Coating: Where indicated under tile type, protect exposed surfaces of tile against adherence of mortar and grout by precoating with continuous film of petroleum paraffin wax, applied hot. Do not coat unexposed tile surfaces.

2.2 TILE PRODUCTS

A. As selected by the Architect, using the allowance.

2.3 THRESHOLDS

A. General: Fabricate to sizes and profiles indicated or required to provide transition between adjacent floor finishes.

B. Marble Thresholds: ASTM C 503, with a minimum abrasion resistance of 10per ASTM C 1353 or ASTM C 241 and with honed finish. Refer to Drawings for dimensions.

1. Description:
 - a. Color: White
 - b. Full depth and width of frame opening

2.4 SETTING MATERIALS

A. Dry-Set Portland Cement Mortar (Thin Set): ANSI A118.1.

2.5 GROUT MATERIALS

A. Water-Cleanable Epoxy Grout: ANSI A118.3 with a VOC content of 65 g/L or less when calculated according to 40 CFR 59, Subpart D.

2.6 MISCELLANEOUS MATERIALS

1. Tile underlayment membrane under all tile: Schluter - Ditra.
2. Preformed aluminum control joints with rubber movement zone: Schluter-Dilex-KSN aluminum; color as selected by architect; 7/16-inch exposed joint.
3. Preformed aluminum edging at all locations where tile meets other conditions and at inside and outside corners:

- a. Wall tile Edges: Schluter Quadec; Anodized Aluminum.

2.7 MIXING MORTARS AND GROUT

- A. Mix mortars and grouts to comply with referenced standards and mortar and grout manufacturers' written instructions.
- B. Add materials, water, and additives in accurate proportions.
- C. Obtain and use type of mixing equipment, mixer speeds, mixing containers, mixing time, and other procedures to produce mortars and grouts of uniform quality with optimum performance characteristics for installations indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions where tile will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of installed tile.
 - A. Verify that substrates for setting tile are firm, dry, clean, free of coatings that are incompatible with tile-setting materials including curing compounds and other substances that contain soap, wax, oil, or silicone; and comply with flatness tolerances required by ANSI A108.01 for installations indicated.
 - B. Verify that concrete substrates for tile floors installed with adhesives, bonded mortar bed, or thin-set mortar comply with surface finish requirements in ANSI A108.01 for installations indicated.
 1.
 - a. Verify that surfaces that received a steel trowel finish have been mechanically scarified.
 - a. b. Verify that protrusions, bumps, and ridges have been removed by sanding or grinding.
 - C. Verify that installation of grounds, anchors, recessed frames, electrical and mechanical units of work, and similar items located in or behind tile has been completed.
 - D. Verify that joints and cracks in tile substrates are coordinated with tile joint locations; if not coordinated, adjust joint locations in consultation with Architect.
 - E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Fill cracks, holes, and depressions in concrete substrates for tile floors installed with

adhesives or thin-set mortar with trowelable leveling and patching compound specifically recommended by tile-setting material manufacturer.

B. Where indicated, prepare substrates to receive waterproofing by applying a reinforced mortar bed that complies with ANSI A108.1A and is sloped 1/4 inch per foot toward drains.

C. Blending: For tile exhibiting color variations, verify that tile has been factory blended and packaged so tile units taken from one package show same range of colors as those taken from other packages and match approved Samples. If not factory blended, either return to manufacturer or blend tiles at Project site before installing.

D. Field-Applied Temporary Protective Coating: If indicated under tile type or needed to prevent grout from staining or adhering to exposed tile surfaces, precoat them with continuous film of temporary protective coating, taking care not to coat unexposed tile surfaces.

3.3 TILE INSTALLATION

A. Comply with TCA's "Handbook for Ceramic Tile Installation" for TCA installation methods specified in tile installation schedules. Comply with parts of the ANSI A108 Series "Specifications for Installation of Ceramic Tile" that are referenced in TCA installation methods, specified in tile installation schedules, and apply to types of setting and grouting materials used and as follows:

1. All locations: TCA Method F113-01: Thin set

B. Extend tile work into recesses and under or behind equipment and fixtures to form complete covering without interruptions unless otherwise indicated. Terminate work neatly at obstructions, edges, and corners without disrupting pattern or joint alignments.

C. Accurately form intersections and returns. Perform cutting and drilling of tile without marring visible surfaces. Carefully grind cut edges of tile abutting trim, finish, or built-in items for straight aligned joints. Fit tile closely to electrical outlets, piping, fixtures, and other penetrations so plates, collars, or covers overlap tile.

D. Provide manufacturer's standard trim shapes where necessary to eliminate exposed tile edges.

E. Jointing Pattern: Lay tile in pattern as shown on Drawings unless otherwise indicated. Lay out tile work and center tile fields in both directions in each space or on each wall area. Lay out tile work to minimize the use of pieces that are less than half of a tile. Provide uniform joint widths unless otherwise indicated.

F. Expansion Joints: Provide expansion joints and other sealant-filled joints, including control, contraction, and isolation joints, where indicated. Form joints during installation of setting materials, mortar beds, and tile. Do not saw-cut joints after installing tiles.

1. Where joints occur in concrete substrates, locate joints in tile surfaces directly above them.
2. Prepare joints and apply sealants to comply with requirements in Division 07

Section "Joint Sealants."

G. Stone Thresholds: Install stone thresholds in same type of setting bed as adjacent floor unless otherwise indicated.

3.4 Metal Edge Strips: Install where exposed edge of tile flooring meets carpet, wood, or other flooring and at lobby stair nosing.

3.5 CLEANING AND PROTECTING

A. Cleaning: On completion of placement and grouting, clean all ceramic tile surfaces so they are free of foreign matter.

1. Remove grout residue from tile as soon as possible.
2. Clean grout smears and haze from tile according to tile and grout manufacturer's written instructions but no sooner than 10 days after installation. Use only cleaners recommended by tile and grout manufacturers and only after determining that cleaners are safe to use by testing on samples of tile and other surfaces to be cleaned. Protect metal surfaces and plumbing fixtures from effects of cleaning. Flush surfaces with clean water before and after cleaning.
3. Remove temporary protective coating by method recommended by coating manufacturer and that is acceptable to tile and grout manufacturer. Trap and remove coating to prevent drain clogging.

B. Protect installed tile work with kraft paper or other heavy covering during construction period to prevent staining, damage, and wear. If recommended by tile manufacturer, apply coat of neutral protective cleaner to completed tile walls and floors.

C. Prohibit foot and wheel traffic from tiled floors for at least seven days after grouting is completed.

D. Before final inspection, remove protective coverings and rinse neutral protective cleaner from tile surfaces.

END OF SECTION 09 3000

SECTION 09 6400 - WOOD FLOORING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

1. Section Includes:
 1. Field-finished wood flooring.

1.3 ACTION SUBMITTALS

1. Product Data: For each type of product indicated.
2. Samples for Initial Selection: Manufacturer's color charts showing the full range of colors and finishes available for wood flooring.
3. Samples for Verification: For each type of wood flooring and accessory, with stain color and finish required, approximately 12 inches long and of same thickness and material indicated for the Work and showing the full range of normal color and texture variations expected.

1.4 QUALITY ASSURANCE

1. Hardwood Flooring: Comply with NOFMA's "Official Flooring Grading Rules" for species, grade, and cut.
 1. Certification: Provide flooring that carries NOFMA grade stamp on each bundle or piece.

1.5 DELIVERY, STORAGE, AND HANDLING

1. Deliver wood flooring materials in unopened cartons or bundles.
2. Protect wood flooring from exposure to moisture. Do not deliver wood flooring until after concrete, masonry, plaster, ceramic tile, and similar wet work is complete and dry.
3. Store wood flooring materials in a dry, warm, ventilated, weathertight location.

1.6 PROJECT CONDITIONS

1. Conditioning period begins not less than seven days before wood flooring installation, is continuous through installation, and continues not less than seven days after wood flooring installation.
 1. Environmental Conditioning: Maintain an ambient temperature between 65 and 75 deg F and relative humidity planned for building occupants in spaces to receive wood flooring during the conditioning period.
 2. Wood Flooring Conditioning: Move wood flooring into spaces where it will be installed, no later than the beginning of the conditioning period.
 - a. Do not install flooring until it adjusts to relative humidity of, and is at same temperature as, space where it is to be installed.
 - b. Open sealed packages to allow wood flooring to acclimatize immediately on moving flooring into spaces in which it will be installed.
2. After conditioning period, maintain relative humidity and ambient temperature planned for building occupants.

PART 2 - PRODUCTS

2.1 FIELD-FINISHED WOOD FLOORING

1. Wood Underlayment: One layer of ¾ inch CDS plywood; topped with 15# non-bituminous felt.
2. Solid-Wood Flooring: Kiln dried to 6 to 9 percent maximum moisture content, tongue and groove and end matched, and with backs channeled.

1. Species and Grade: Select Clear Pine for field finishing.
2. Cut: Quarter/rift sawn.
3. Thickness: ¾ inch.
4. Face Width: 6-inches.
5. Lengths: Manufacturer's standard.

Clear Urethane Floor Finish System– Sherwin Williams, Bonna, or Benjamin Moore
A. Floor Sealer: Pliable, penetrating type.
B. Minimum of Three Finish Coats: Formulated for multicoat application on wood flooring.

3. Wood Filler: Compatible with finish system components and recommended by filler and finish manufacturers for use indicated. If required to match approved Samples, provide pigmented filler.

2.2 ACCESSORY MATERIALS

1. Wood Flooring Adhesive: Mastic recommended by flooring and adhesive manufacturers for application indicated.
2. Trowelable Leveling and Patching Compound: Latex-modified, hydraulic-cement-based formulation approved by wood flooring manufacturer.
3. Fasteners: As recommended by manufacturer, but not less than that recommended in NWFA's "Installation Guidelines: Wood Flooring."
4. Reducer Strips: To match wood flooring. 2 inches wide, tapered, and in thickness required to match height of flooring.

PART 3 - EXECUTION

3.1 EXAMINATION

1. Examine substrates, areas and conditions, with Installer present, for compliance with requirements for maximum moisture content, installation tolerances, and other conditions affecting performance of wood flooring.
2. Proceed with installation only after unsatisfactory conditions have been corrected.
3. Concrete Slabs: Verify that concrete substrates are dry and moisture-vapor emissions are within acceptable levels according to manufacturer's written instructions.
 1. Moisture Testing: Perform tests so that each test area does not exceed 200 sq. ft., and perform no fewer than two tests in each installation area and with test areas evenly spaced in installation areas.
 - a. Perform tests recommended by manufacturer. Proceed with installation only after substrates pass testing.

3.2 PREPARATION

1. Concrete Slabs: Grind high spots and fill low spots to produce a maximum 1/8-inch deviation in any direction when checked with a 10-foot straight edge.
 1. Use trowelable leveling and patching compounds, according to manufacturer's written instructions, to fill cracks, holes, and depressions in substrates.
2. Remove coatings, including curing compounds, and other substances on substrates that are incompatible with installation adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by manufacturer. Do not use solvents.
3. Broom or vacuum clean substrates to be covered immediately before product installation. After cleaning, examine substrates for moisture, alkaline salts, carbonation, or dust. Proceed with installation only after unsatisfactory conditions have been corrected.

3.3 INSTALLATION

1. Comply with flooring manufacturer's written installation instructions, but not less than applicable recommendations in NWFA's "Installation Guidelines: Wood Flooring."
2. Wood Sleepers and Subfloor: Install according to requirements in Division 06 Section "Rough Carpentry."]
3. Provide expansion space at walls and other obstructions and terminations of flooring as indicated on Drawings.
4. Solid-Wood Flooring: Blind nail or staple flooring to substrate.
 1. For flooring of face width more than 3 inches:
 - a. Install countersunk screws at each end of each piece in addition to blind nailing. Cover screw heads with wood plugs glued flush with flooring.
 - b. Install no fewer than two countersunk nails at each end of each piece, spaced not more than 16 inches along length of each piece, in addition to blind nailing. Fill holes with matching wood filler.

3.4 FIELD FINISHING

1. Machine-sand flooring to remove offsets, ridges, cups, and sanding-machine marks that would be noticeable after finishing. Vacuum and tack with a clean cloth immediately before applying finish.
 1. Comply with applicable recommendations in NWFA's "Installation Guidelines: Wood Flooring."
2. Fill open-grained hardwood.
3. Fill and repair wood flooring seams and defects.
4. Apply floor-finish materials in number of coats recommended by finish manufacturer for application indicated, but not less than one coat of floor sealer and three finish coats.
 1. Apply stains to achieve an even color distribution matching approved Samples.
 2. For water-based finishes, use finishing methods recommended by finish manufacturer to minimize grain raise.
5. Cover wood flooring before finishing.
6. Do not cover wood flooring after finishing until finish reaches full cure, and not before seven days after applying last finish coat.

3.5 PROTECTION

1. Protect installed wood flooring during remainder of construction period with covering of heavy kraft paper or other suitable material. Do not use plastic sheet or film that might cause condensation.
 1. Do not move heavy and sharp objects directly over kraft-paper-covered wood flooring.

Protect flooring with plywood or hardboard panels to prevent damage from storing or moving objects over flooring.

END OF SECTION 09 6400

SECTION 095100 - ACOUSTICAL PANEL CEILINGS

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 acoustical panels and exposed suspension systems for ceilings.
- B. Related Requirements:
 - 1. Section 09 2900 "Gypsum Board" to coordinate perimeter trim integral with gypsum wallboard trim.
- C. Products furnished, but not installed under this Section, include anchors, clips, and other ceiling attachment devices to be cast in concrete.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Samples: For each exposed product and for each color and texture specified, 6 inches (150 mm) in size.
 - 1. Acoustical Panel: Set of 6-inch- (150-mm-) square Samples of each type, color, pattern, and texture.
 - 2. Exposed Suspension-System Members, Moldings, and Trim: Set of 6-inch- (150-mm-) long Samples of each type, finish, and color.

1.4 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Reflected ceiling 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. Suspended ceiling components.
 - 2. Structural members to which suspension systems will be attached.
 - 3. Size and location of initial access modules for acoustical panels.
 - 4. Items penetrating finished ceiling including the following:
 - a. Lighting fixtures.

- b. Air outlets and inlets.
- c. Speakers.
- d. Sprinklers.
- e. Access panels.

5. Perimeter moldings.

- B. Evaluation Reports: For each acoustical panel ceiling suspension system and anchor and fastener type , from ICC-ES.

1.5 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For finishes to include in maintenance manuals.

1.6 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

- 1. Acoustical Ceiling Panels: Full-size panels equal to 10 percent of quantity installed.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver acoustical panels, suspension-system components, and accessories to Project site in original, unopened packages and store them in a fully enclosed, conditioned space where they will be protected against damage from moisture, humidity, temperature extremes, direct sunlight, surface contamination, and other causes.
- B. Before installing acoustical panels, permit them to reach room temperature and a stabilized moisture content.
- C. Handle acoustical panels carefully to avoid chipping edges or damaging units in any way.

1.8 FIELD CONDITIONS

- A. Environmental Limitations: Do not install acoustical panel ceilings until spaces are enclosed and weatherproof, wet work in spaces is complete and dry, work above ceilings is complete, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

- 1. Pressurized Plenums: Operate ventilation system for not less than 48 hours before beginning acoustical panel ceiling installation.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Seismic Performance: Acoustical ceiling shall withstand the effects of earthquake motions as indicated in Documents and Soils Report.
- B. Surface-Burning Characteristics: Comply with ASTM E 84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - 1. Flame-Spread Index: Comply with ASTM E 1264 for Class A materials.
 - 2. Smoke-Developed Index: 450 or less.

2.2 ACOUSTICAL PANELS, GENERAL

- A. Source Limitations:
 - 1. Acoustical Ceiling Panel: Obtain each type from single source from single manufacturer.
 - 2. Suspension System: Obtain each type from single source from single manufacturer.
- B. Acoustical Panel Standard: Provide manufacturer's standard panels of configuration indicated that comply with ASTM E 1264 classifications as designated by types, patterns, acoustical ratings, and light reflectances unless otherwise indicated.
 - 1. Mounting Method for Measuring NRC: Type E-400; plenum mounting in which face of test specimen is 15-3/4 inches (400 mm) away from test surface according to ASTM E 795.
- C. Acoustical Panel Colors and Patterns: Match appearance characteristics indicated for each product type.
 - 1. Where appearance characteristics of acoustical panels are indicated by referencing pattern designations in ASTM E 1264 and not manufacturers' proprietary product designations, provide products selected by Architect from each manufacturer's full range that comply with requirements indicated for type, pattern, color, light reflectance, acoustical performance, edge detail, and size.

2.3 ACOUSTICAL PANELS "ACT-1"

- A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Finish Legend or comparable product by one of the following:
 - 1. Armstrong World Industries, Inc.
 - 2. CertainTeed Corp.
 - 3. Chicago Metallic Corporation.

4. USG Interiors, Inc.; Subsidiary of USG Corporation.
- B. Classification: Provide panels complying with ASTM E 1264 for type, form, and pattern as follows:
 1. Type and Form: Mineral Fiber, Factory Applied Latex coating, Wet Formed
 2. Pattern: C,D
- C. Color:
 1. White
- D. LR: Not less than 0.80.
- E. NRC: Not less than 0.55
- F. CAC: Not less than 30
- G. Edge/Joint Detail: Angled Tegular
- H. Thickness: 5/8 inch (15 mm)
- I. Modular Size:
 1. 24 by 24 inches
- J. Broad Spectrum Antimicrobial Fungicide and Bactericide Treatment: Provide acoustical panels treated with manufacturer's standard antimicrobial formulation that inhibits fungus, mold, mildew, and gram-positive and gram-negative bacteria and showing no mold, mildew, or bacterial growth when tested according to ASTM D 3273 and evaluated according to ASTM D 3274 or ASTM G 21.

2.4 METAL SUSPENSION SYSTEMS, GENERAL

- A. Metal Suspension-System Standard: Provide manufacturer's standard direct-hung metal suspension systems of types, structural classifications, and finishes indicated that comply with applicable requirements in ASTM C 635/C 635M.
- B. Attachment Devices: Size for five times the design load indicated in ASTM C 635/C 635M, Table 1, "Direct Hung," unless otherwise indicated. Comply with seismic design requirements.
 1. Power-Actuated Fasteners in New/Existing Composite Slabs/Concrete: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other accessory devices for attaching hangers of type indicated and with capability to sustain, without failure, a load equal to 10 times that imposed by ceiling construction, as determined by testing according to ASTM E 1190, conducted by a qualified testing and inspecting agency.
- C. Wire Hangers, Braces, and Ties: Provide wires complying with the following requirements:

1. Zinc-Coated, Carbon-Steel Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper.
2. Size: Select wire diameter so its stress at three times hanger design load (ASTM C 635/C 635M, Table 1, "Direct Hung") will be less than yield stress of wire, but provide not less than 0.106-inch- (2.69-mm) diameter wire.

2.5 METAL SUSPENSION SYSTEM - All APC/ACT systems

- A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Finish Legend or comparable product by one of the following:
1. Armstrong World Industries, Inc.
 2. CertainTeed Corp.
 3. Chicago Metallic Corporation.
 4. USG Interiors, Inc.; Subsidiary of USG Corporation.
- B. Wide-Face, Capped, Double-Web, Steel Suspension System: Main and cross runners roll formed from cold-rolled steel sheet; prepainted, electrolytically zinc coated, or hot-dip galvanized according to ASTM A 653/A 653M, not less than G30 (Z90) coating designation; with prefinished 02/11-inch- (24-mm-) wide metal caps on flanges.
1. Structural Classification: Heavy-duty system.
 2. End Condition of Cross Runners: Override (stepped) type.
 3. Face Design: Flat, flush.
 4. Cap Material: Steel cold-rolled sheet.
 5. Cap Finish: Painted white

2.6 METAL EDGE MOLDINGS AND TRIM Insert drawing designation

- A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
1. Armstrong World Industries, Inc.
 2. CertainTeed Corp.
 3. Chicago Metallic Corporation.
 4. Fry Reglet Corporation.
 5. Gordon, Inc.
 6. USG Interiors, Inc.; Subsidiary of USG Corporation.
 7. Pittcon Industries
- B. Roll-Formed, Sheet-Metal Edge Moldings and Trim: Type and profile indicated or, if not indicated, manufacturer's standard moldings for edges and penetrations that comply with seismic design requirements; formed from sheet metal of same material, finish, and color as that used for exposed flanges of suspension-system runners.
1. Provide manufacturer's standard edge moldings that fit acoustical panel edge details and suspension systems indicated and that match width and configuration of exposed runners unless otherwise indicated.

2. For lay-in panels with reveal edge details, provide stepped edge molding that forms reveal of same depth and width as that formed between edge of panel and flange at exposed suspension member
- C. Extruded-Aluminum Edge Moldings and Trim: Where indicated, provide manufacturer's extruded-aluminum edge moldings and trim of profile indicated or referenced by manufacturer's designations, including splice plates, corner pieces, and attachment and other clips, complying with seismic design requirements and the following:
1. Aluminum Alloy: Alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated, and with not less than the strength and durability properties of aluminum extrusions complying with ASTM B 221 (ASTM B 221M) for Alloy and Temper 6063-T5.
 2. Baked-Enamel or Powder-Coat Finish: Minimum dry film thickness of 1.5 mils (0.04 mm). Comply with ASTM C 635/C 635M and coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.
 3. See Gypsum Board section for trim incorporated into gypsum wallboard supporting APC/ACT ceilings.

2.7 ACOUSTICAL SEALANT

- A. Acoustical Sealant: Manufacturer's standard sealant complying with ASTM C 834 and effective in reducing airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E 90.
1. Exposed and Concealed Joints: Nonsag, paintable, nonstaining latex sealant.
 2. Concealed Joints: Nondrying, nonhardening, nonskinning, nonstaining, gunnable, synthetic-rubber sealant.
 3. Acoustical sealant shall have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, including structural framing to which acoustical panel ceilings attach or abut, with Installer present, for compliance with requirements specified in this and other Sections that affect ceiling installation and anchorage and with requirements for installation tolerances and other conditions affecting performance of acoustical panel ceilings.
- B. Examine acoustical panels before installation. Reject acoustical panels that are wet, moisture damaged, or mold damaged.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Measure each ceiling area and establish layout of acoustical panels to balance border widths at opposite edges of each ceiling. Avoid using less-than-half-width panels at borders, and comply with layout shown on reflected ceiling plans.

3.3 INSTALLATION

- A. General: Install acoustical panel ceilings to comply with ASTM C 636/C 636M and seismic design requirements indicated, according to manufacturer's written instructions and CISCA's "Ceiling Systems Handbook."
- B. Suspend ceiling hangers from building's structural members and as follows:
 - 1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structure or of ceiling suspension system.
 - 2. Splay hangers only where required to miss obstructions; offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
 - 3. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with location of hangers at spacings required to support standard suspension-system members, install supplemental suspension members and hangers in form of trapezes or equivalent devices.
 - 4. Secure wire hangers to ceiling-suspension members and to supports above with a minimum of three tight turns. Connect hangers directly either to structures or to inserts, eye screws, or other devices that are secure and appropriate for substrate and that will not deteriorate or otherwise fail due to age, corrosion, or elevated temperatures.
 - 5. Secure flat, angle, channel, and rod hangers to structure, including intermediate framing members, by attaching to inserts, eye screws, or other devices that are secure and appropriate for both the structure to which hangers are attached and the type of hanger involved. Install hangers in a manner that will not cause them to deteriorate or fail due to age, corrosion, or elevated temperatures.
 - 6. New Composite Slabs: Do not support ceilings directly from permanent metal forms or floor deck. Fasten hangers to cast-in-place hanger inserts, postinstalled mechanical or adhesive anchors, or power-actuated fasteners that extend through forms into concrete.
 - 7. When steel framing does not permit installation of hanger wires at spacing required, install carrying channels or other supplemental support for attachment of hanger wires.
 - 8. Do not attach hangers to steel deck tabs.
 - 9. Do not attach hangers to steel roof deck or existing slabs. Attach hangers to structural members.
 - 10. Space hangers not more than 48 inches (1200 mm) o.c. along each member supported directly from hangers unless otherwise indicated; provide hangers not more than 8 inches (200 mm) from ends of each member.
 - 11. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards and publications.

- C. Secure bracing wires to ceiling suspension members and to supports with a minimum of four tight turns. Suspend bracing from building's structural members as required for hangers, without attaching to permanent metal forms, steel deck, or steel deck tabs. Fasten bracing wires into concrete with cast-in-place or postinstalled anchors.
- D. Install edge moldings and trim of type indicated at perimeter of acoustical ceiling area and where necessary to conceal edges of acoustical panels.
 - 1. Apply acoustical sealant in a continuous ribbon concealed on back of vertical legs of moldings before they are installed.
 - 2. Screw attach moldings to substrate at intervals not more than 16 inches (400 mm) o.c. and not more than 3 inches (75 mm) from ends, leveling with ceiling suspension system to a tolerance of 1/8 inch in 12 feet (3.2 mm in 3.6 m). Miter corners accurately and connect securely.
 - 3. Do not use exposed fasteners, including pop rivets, on moldings and trim.
- E. Install suspension-system runners so they are square and securely interlocked with one another. Remove and replace dented, bent, or kinked members.
- F. Install acoustical panels with undamaged edges and fit accurately into suspension-system runners and edge moldings. Scribe and cut panels at borders and penetrations to provide a neat, precise fit.
 - 1. Arrange directionally patterned acoustical panels as follows:
 - a. As indicated on reflected ceiling plans.
 - b. Install panels in a basket-weave pattern.
 - 2. For square-edged panels, install panels with edges fully hidden from view by flanges of suspension-system runners and moldings.
 - 3. For reveal-edged panels on suspension-system runners, install panels with bottom of reveal in firm contact with top surface of runner flanges.
 - 4. For reveal-edged panels on suspension-system members with box-shaped flanges, install panels with reveal surfaces in firm contact with suspension-system surfaces and panel faces flush with bottom face of runners.
 - 5. Paint cut edges of panel remaining exposed after installation; match color of exposed panel surfaces using coating recommended in writing for this purpose by acoustical panel manufacturer.
 - 6. Protect lighting fixtures and air ducts to comply with requirements indicated for fire-resistance-rated assembly.

3.4 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to perform tests and inspections and prepare test reports.
- B. Perform the following tests and inspections of completed installations of acoustical panel ceiling hangers and anchors and fasteners in successive stages. Do not proceed with installations of acoustical panel ceiling hangers for the next area until test results for previously completed installations show compliance with requirements.

1. Extent of Each Test Area: When installation of ceiling suspension systems on each floor has reached 20 percent completion but no panels have been installed.
 - a. Within each test area, testing agency will select one of every 10 power-actuated fasteners and postinstalled anchors used to attach hangers to concrete and will test them for 200 lbf (890 N) of tension; it will also select one of every two postinstalled anchors used to attach bracing wires to concrete and will test them for 440 lbf (1957 N) of tension.
 - b. When testing discovers fasteners and anchors that do not comply with requirements, testing agency will test those anchors not previously tested until 20 pass consecutively and then will resume initial testing frequency.
- C. Acoustical panel ceiling hangers and anchors and fasteners will be considered defective if they do not pass tests and inspections.
- D. Prepare test and inspection reports.

3.5 CLEANING

- A. Clean exposed surfaces of acoustical panel ceilings, including trim, edge moldings, and suspension-system members. Comply with manufacturer's written instructions for cleaning and touchup of minor finish damage. Remove and replace ceiling components that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

END OF SECTION 095100

SECTION 09 6513 - RESILIENT BASE AND ACCESSORIES

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. Resilient base.
- 2. Resilient molding accessories.

- B. Related Sections:

- 1. Section 096519 "Resilient Tile Flooring" for resilient floor tile.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Samples for Initial Selection: For each type of product indicated.

1.4 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Furnish not less than 10 linear feet for every 500 linear feet or fraction thereof, of each type, color, pattern, and size of resilient product installed.

1.5 QUALITY ASSURANCE

- A. Fire-Test-Response Characteristics: As determined by testing identical products according to ASTM E 648 or NFPA 253 by a qualified testing agency.
 - 1. Critical Radiant Flux Classification: Class I, not less than 0.45 W/sq. cm.
- B. Mockups: Provide resilient products with mockups specified in other Sections.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Store resilient products and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 50 deg F or more than 90 deg F.

1.7 PROJECT CONDITIONS

- A. Maintain ambient temperatures within range recommended by manufacturer, but not less than 70 deg F or more than 95 deg F, in spaces to receive resilient products during the following time periods:
 - 1. 48 hours before installation.
 - 2. During installation.
 - 3. 48 hours after installation.
- B. Until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than 55 deg F or more than 95 deg F.
- C. Install resilient products after other finishing operations, including painting, have been completed.

PART 2 - PRODUCTS

2.1 RESILIENT BASE

- A. Resilient Base:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Armstrong World Industries, Inc.
 - b. Johnsonite.
 - c. Roppe Corporation, USA.
- B. Resilient Base Standard: ASTM F 1861.
 - 1. Material Requirement: Type TS (rubber, vulcanized thermoset) or Type TP (rubber, thermoplastic).
 - 2. Manufacturing Method: Group I (solid, homogeneous).
 - 3. Style: Cove (base with toe).
- C. Minimum Thickness: 0.125 inch.
- D. Height: 4 inches.
- E. Lengths: Coils in manufacturer's standard length.

- F. Outside Corners: Job formed or preformed.
- G. Inside Corners: Job formed or preformed.
- H. Finish: As selected by Architect from manufacturer's full range.
- I. Colors: As selected by Architect from full range of industry colors.

2.2 RESILIENT MOLDING ACCESSORY

- A. Resilient Molding Accessory:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by same manufacturer as resilient base.
- B. Description: Transition strips.
- C. Material: Rubber.
- D. Profile and Dimensions: As indicated.
- E. Colors: [As selected by Architect from full range of industry colors.
- F. Adhesives: Water-resistant type recommended by manufacturer to suit resilient products and substrate conditions indicated.
 - 1. Adhesives shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24)[, except that adhesive for rubber stair treads shall have a VOC content of 60 g/L or less].

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, with Installer present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.
- B. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of resilient products.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Prepare substrates according to manufacturer's written instructions to ensure adhesion of resilient products.

- B. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound and remove bumps and ridges to produce a uniform and smooth substrate.
- C. Do not install resilient products until they are same temperature as the space where they are to be installed.
 - 1. Move resilient products and installation materials into spaces where they will be installed at least 48 hours in advance of installation.
- D. Sweep and vacuum clean substrates to be covered by resilient products immediately before installation.

3.3 RESILIENT BASE INSTALLATION

- A. Comply with manufacturer's written instructions for installing resilient base.
- B. Apply resilient base to walls, columns, pilasters, casework and cabinets in toe spaces, and other permanent fixtures in rooms and areas where base is required.
- C. Install resilient base in lengths as long as practicable without gaps at seams and with tops of adjacent pieces aligned.
- D. Tightly adhere resilient base to substrate throughout length of each piece, with base in continuous contact with horizontal and vertical substrates.
- E. Do not stretch resilient base during installation.
- F. Preformed Corners: Install preformed corners before installing straight pieces.
- G. Job-Formed Corners:
 - 1. Outside Corners: Use straight pieces of maximum lengths possible. Form without producing discoloration (whitening) at bends.
 - 2. Inside Corners: Use straight pieces of maximum lengths possible.
- H. Resilient Molding Accessories: Butt to adjacent materials and tightly adhere to substrates throughout length of each piece. Install reducer strips at edges of carpet and resilient floor tiles that would otherwise be exposed.

3.4 CLEANING AND PROTECTION

- A. Comply with manufacturer's written instructions for cleaning and protection of resilient products.
- B. Perform the following operations immediately after completing resilient product installation:
 - 1. Remove adhesive and other blemishes from exposed surfaces.
 - 2. Damp-mop surfaces to remove marks and soil.

- C. Protect resilient products from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.
- D. Cover resilient products until Substantial Completion.

END OF SECTION 09 6513

SECTION 09 6519 - RESILIENT TILE FLOORING

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. Vinyl composition floor tile.
- B. Related Sections:
 - 1. Section 096513 "Resilient Base and Accessories" for resilient base, reducer strips, and other accessories installed with resilient floor coverings.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: For each type of floor tile. Include floor tile layouts, edges, columns, doorways, enclosing partitions, built-in furniture, cabinets, and cutouts.
 - 1. Show details of special patterns.
- C. Samples for Initial Selection: For each type of floor tile indicated.
- D. Samples for Verification: Full-size units of each color and pattern of floor tile required.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified Installer.

1.5 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For each type of floor tile to include in maintenance manuals.

1.6 MATERIALS MAINTENANCE SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Floor Tile: Furnish 1 box for every 50 boxes or fraction thereof, of each type, color, and pattern of floor tile installed.

1.7 QUALITY ASSURANCE

- A. Installer Qualifications: A qualified installer who employs workers for this Project who are competent in techniques required by manufacturer for floor tile installation[and seaming method] indicated.
 - 1. Engage an installer who employs workers for this Project who are trained or certified by manufacturer for installation techniques required.
- B. Store floor tile and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 50 deg F or more than 90 deg F. Store floor tiles on flat surfaces.

1.8 PROJECT CONDITIONS

- A. Maintain ambient temperatures within range recommended by manufacturer, but not less than 70 deg F or more than 95 deg F, in spaces to receive floor tile during the following time periods:
 - 1. 48 hours before installation.
 - 2. During installation.
 - 3. 48 hours after installation.
- B. Until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than 55 deg F or more than 95 deg F.
- C. Close spaces to traffic during floor tile installation.
- D. Close spaces to traffic for 48 hours after floor tile installation.
- E. Install floor tile after other finishing operations, including painting, have been completed.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. FloorScore Compliance: Resilient tile flooring shall comply with requirements of FloorScore Standard.

2.2 VINYL COMPOSITION FLOOR TILE

- A. Products: Subject to compliance with requirements, provide the following:
 - 1. Basis of Design: Armstrong World Industries, Inc.; Standard Excelon.
- B. Tile Standard: ASTM F 1066, Class 2, through-pattern tile.
- C. Wearing Surface: Smooth.
- D. Thickness: 0.125 inch.
- E. Size: 12 by 12 inches.
- F. Colors and Patterns: As selected by Architect from full range of industry colors.

2.3 INSTALLATION MATERIALS

- A. Trowelable Leveling and Patching Compounds: Latex-modified, portland cement based or blended hydraulic-cement-based formulation provided or approved by manufacturer for applications indicated.
- B. Adhesives: Water-resistant type recommended by manufacturer to suit floor tile and substrate conditions indicated.
 - 1. Adhesives shall comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):
 - a. VCT and Asphalt Tile Adhesives: Not more than 50 g/L.
- C. Floor Polish: Provide protective liquid floor polish products as recommended by manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, with Installer present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.
- B. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of floor tile.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Prepare substrates according to manufacturer's written instructions to ensure adhesion of resilient products.
- B. Concrete Substrates: Prepare according to ASTM F 710.
 - 1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
 - 2. Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by manufacturer. Do not use solvents.
 - 3. Alkalinity and Adhesion Testing: Perform tests recommended by manufacturer. Proceed with installation only after substrates pass testing.
 - 4. Moisture Testing: Perform tests recommended by manufacturer and as follows. Proceed with installation only after substrates pass testing.
 - a. Perform anhydrous calcium chloride test, ASTM F 1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. in 24 hours.
 - b. Perform relative humidity test using in situ probes, ASTM F 2170. Proceed with installation only after substrates have a maximum 75% relative humidity level measurement.
- C. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound and remove bumps and ridges to produce a uniform and smooth substrate.
- D. Do not install floor tiles until they are same temperature as space where they are to be installed.
 - 1. Move resilient products and installation materials into spaces where they will be installed at least 48 hours in advance of installation.
- E. Sweep and vacuum clean substrates to be covered by resilient products immediately before installation.

3.3 FLOOR TILE INSTALLATION

- A. Comply with manufacturer's written instructions for installing floor tile.
- B. Lay out floor tiles from center marks established with principal walls, discounting minor offsets, so tiles at opposite edges of room are of equal width. Adjust as necessary to avoid using cut widths that equal less than one-half tile at perimeter.
 - 1. Lay tiles in pattern indicated.
- C. Match floor tiles for color and pattern by selecting tiles from cartons in the same sequence as manufactured and packaged, if so numbered. Discard broken, cracked, chipped, or deformed tiles.

1. Lay tiles in pattern of colors and sizes indicated, with grain running in direction as directed by Architect .
- D. Scribe, cut, and fit floor tiles to butt neatly and tightly to vertical surfaces and permanent fixtures including built-in furniture, cabinets, pipes, outlets, and door frames.
- E. Extend floor tiles into toe spaces, door reveals, closets, and similar openings. Extend floor tiles to center of door openings.
- F. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on floor tiles as marked on substrates. Use chalk or other nonpermanent, nonstaining marking device.
- G. Adhere floor tiles to flooring substrates using a full spread of adhesive applied to substrate to produce a completed installation without open cracks, voids, raising and puckering at joints, telegraphing of adhesive spreader marks, and other surface imperfections.

3.4 CLEANING AND PROTECTION

- A. Comply with manufacturer's written instructions for cleaning and protection of floor tile.
- B. Perform the following operations immediately after completing floor tile installation:
 1. Remove adhesive and other blemishes from exposed surfaces.
 2. Sweep and vacuum surfaces thoroughly.
 3. Damp-mop surfaces to remove marks and soil.
- C. Protect floor tile products from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.
- D. Floor Polish: Remove soil, visible adhesive, and surface blemishes from floor tile surfaces before applying liquid floor polish.
 1. Apply three coat(s).
- E. Cover floor tile until Substantial Completion.

END OF SECTION 09 6519

SECTION 09 6623 – EPOXY TERRAZZO FLOORING

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the contract, including general and supplementary conditions and division 1 specification sections, apply to this section.
- B. General contractor or other is to provide water, 220 volt single phase 100 amp breaker & 480 volt 3 phase 60 amp breaker electrical services with hookups and disconnects within 200 feet of any terrazzo area are to be provided by others at no cost to this subcontractor.
- C. Testing should be conducted according to ASTM F2170 only (determining relative humidity in concrete slabs using in situ probes. The General Contractor is responsible for scheduling and conducting an independent tester.)

1.02 SUMMARY

- A. Section Includes:
 - 1. Thin-set epoxy terrazzo flooring including preparation of substrates. New terrazzo flooring where indicated and integration with existing terrazzo as shown on drawings.
 - 2. Related accessories
- B. Related Sections:
 - 1. Section 03300, Cast-in-Place Concrete

1.03 SUBMITTALS

- A. Manufacturer's product data for each type of terrazzo and accessory: System will be evaluated on the basis of standards. For tests not listed in published data, manufacturer shall supply missing data according to standard referenced.
 - 1. Physical properties
 - 2. Performance properties
 - 3. Specified tests
 - 4. Material Safety Data Sheet
 - 5. Manufacturer's standard warranty
- B. Shop Drawings: Include terrazzo installation requirements. Include plans, elevations, sections, component details, and attachments to other work. Show layout of the following:
 - 1. Divider strips
 - 2. Control- and expansion-joint strips
 - 3. Precast terrazzo jointing and edge configurations including anchorage details
 - 4. Terrazzo patterns
- C. Samples for initial selection: Manufacturer's color plates showing the full range of colors and patterns available for each terrazzo type indicated.
- D. Samples for Verification: Match architect's samples for each type, material, color, and pattern of terrazzo and accessory required showing the full range of color, texture, and pattern variations expected. Label each terrazzo sample to identify manufacturer's matrix color and aggregate types, sizes, and proportions. Prepare samples of same thickness and from same material to be used for the work in size indicated below:
 - 1. Epoxy Terrazzo: Minimum 6" x 6" (152.4 mm x 152.4 mm) sample of each color and type of terrazzo.
 - 2. Accessories: 6" length (152.4 mm) of each kind of divider strip, stop strip, and control joint strip required.
- E. Manufacturer Experience:
 - 1. Submit proof of Associate membership in NTMA.
 - 2. Provide a list of at least 5 epoxy terrazzo projects installed during the previous 5 years using material being submitted for this project and of the same scope, complexity, and at least 75% of the square footage.

3. Manufacturer must provide history of providing primary epoxy materials to at least 5 NTMA Contractors in good standing for a minimum of 10 years.
- F. Qualification Data: For qualified Installer.
 1. Submit proof of Contractor membership in NTMA and provide a list of at least 5 epoxy terrazzo projects installed during the previous 5 years using material being submitted for this project and of the same scope, complexity, and at least 75% of the square footage.
 2. Terrazzo contractor must have received at least 2 NTMA Honor Awards (not Honorable Mentions) for quality workmanship within the previous 5 years.
- G. Material Test Reports: For moisture and / or relative humidity of substrate
- H. Maintenance Data: Submit 3] copies of NTMA maintenance recommendations and [] copies of manufacturer's instructions

1.04 QUALITY ASSURANCE

- A. Installer Qualifications: A qualified installer who is acceptable to architect and epoxy terrazzo manufacturer to install manufacturer's products.
 1. Engage a terrazzo contractor with a minimum of 5 epoxy terrazzo projects installed during the previous 5 years using material being submitted for this project and of the same scope, complexity, and at least 75% of the square footage.
 2. Engage an installer who is a Contractor member of NTMA
- B. Source Limitations:
 1. Obtain primary epoxy terrazzo flooring system materials including membranes, primers, moisture vapor primers, resins, and hardening agents from a single manufacturer with proof of NTMA membership
 2. Manufacturer must provide history of providing primary materials for a minimum of 10 years
 3. Obtain aggregates, divider strips, sealers, cleaners from source recommended by primary materials manufacturer
- C. Pre-installation Conference: Conduct conference at project site to comply with requirements in section 01200 – Project Meetings. Review methods and procedures related to terrazzo including, but not limited to, the following:
 1. Inspect and discuss installation procedures, joint details, jobsite conditions, substrate specification, vapor barrier details, and coordination with other trades
 2. Review and finalize construction, schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays
 3. Review special terrazzo designs and patterns
 4. Review dust control procedures
 5. Review plans for concrete curing and site drying to enable timely achievement of suitable slab moisture conditions
- D. NTMA Standards: Comply with NTMA's "Terrazzo Specifications and Design Guide" and with written recommendations for terrazzo type indicated unless more stringent requirements are specified
- E. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution
 1. Build mockups for terrazzo including accessories
 - a. Size: Minimum 100 sq. ft. (9.3 sq. m.) of typical poured-in-place flooring [condition for each color and pattern **in locations directed by Architect**. Approved mockup may become part of the completed work if undistributed at time of substantial completion

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials to project site in supplier's original wrappings and containers, labeled with source or manufacturer name, material, or product brand name, and lot number, if any.
- B. Store materials in their original, undamaged packages and containers, inside a well-ventilated area protected from weather, moisture, soiling, extreme temperatures, and humidity.

1. Storage temperatures should be between 60°F to 80°F
- A. PROJECT CONDITIONS: Terrazzo contractor shall, prior to surface preparation:
 1. Evaluate slab condition, including slab moisture content and extent of any required repairs.
 2. Maintain the ambient room temperature at 60°F and floor/slab at 50°F or above for a period extending 72 hours before, during, and after floor installation. Concrete to receive epoxy terrazzo shall have cured for at least 28 days and be free of all curing compounds (unless moisture vapor primer is incorporated into the system). Test concrete substrate to determine acceptable moisture levels prior to installation.
- B. Acceptable Substrates:
 1. Flatness tolerance: Concrete subfloor shall be flat with a maximum variation from level of 1/4" in any 10 feet. Any irregularity of the surface requiring patching and / or leveling shall be done using an appropriate terrazzo fill and selected aggregates as recommended by NTMA resin systems.
 2. Concrete floor shall be prepared mechanically by shot blasting. Grinding of slab is not sufficient surface preparation. Surface preparation results should achieve a CSP3-CSP5 profile according to International Concrete Repair Institute Guideline No. 03732.
 3. Concrete floor shall receive a steel trowel finish.
 4. Concrete shall be cured a minimum of 28 days. No curing agents are to be used in areas to receive terrazzo.
 5. Concrete slab shall have an efficient moisture vapor barrier (suggested minimum: fiber reinforced 15 mils thickness) directly under the concrete slab. Moisture barrier shall NOT be punctured.
 6. Saw cutting of control joints must be done between 12 – 24 hours after placement of the structural concrete and at a minimum of 1/2 the concrete thickness.
- C. General contractor or owner to provide permanent lighting or, if permanent lighting is not in place, simulate permanent lighting conditions during terrazzo installation.
- D. General contractor or owner to provide protection from other trades prior to final acceptance by Owner.
- E. It is preferred that any drywall be installed after the terrazzo is rough ground. If schedule dictates otherwise, be installed 3/4" above the terrazzo thickness to prevent wicking during the polish grinding wet process.

PART 2 – PRODUCTS

2.01 EPOXY TERRAZZO

- A. Products: Systems Overview: Resin Systems Epoxy Matrix by: Acceptable Manufacturers:
 1. Terrazzo & Marble Supply Company
 2. General Polymers Brand of Sherwin-Williams
 3. Master Terrazzo Technologies
1. Primer: Moisture Vapor Primer
2. Physical properties of moisture mitigating primer shall have a maximum of 0.3 perms with 100% RH.
3. Flexible Reinforcing Membrane: Iso-Crack Epoxy Membrane, for substrate crack preparation and reflective crack reduction.
 - a. Reinforcement: Fiberglass scrim.
4. Epoxy Matrix: Epoxy matrix and in color required for mix indicated.
 - a. Physical properties without aggregates. All specimens cured for 7 days at 75°F plus or minus 2°F and 50% plus or minus 2% RH. This product shall meet the following requirements:

Property	Test Method	NTMA Requirements
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Hardness	ASTM D-2240 using Shore-D Durometer	60-85
Tensile Strength	ASTM D-638	3,000 psi min.
Compressive Strength	ASTM D-695 Specimen B cylinder	10,000 psi min.
Flexural Strength	ASTM D-790	Not specified
Chemical Resistance	ASTM D-1308 seven days at room temperature by immersion method	No deleterious effects: <ul style="list-style-type: none"> ▪ Distilled Water ▪ Mineral Oil ▪ Isopropanol ▪ Ethanol ▪ 0.025 Detergent Solution ▪ 1% Soap Solution ▪ 10% Sodium Hydroxide ▪ 10% Hydrochloric Acid ▪ 30% Sulfuric Acid ▪ 5% Acetic Acid

- b. Physical properties with aggregates. For epoxy matrix blended with 3 volumes of Georgia White marble blended 60% #1 chip and 40% #0 chip, ground and grouted with epoxy resin according to installation specifications, finishing to a nominal 1/4" thickness. All specimens cured for 7 days at 75°F plus or minus 2°F and 50% RH plus or minus 2% RH. This finished epoxy matrix shall meet the following requirements:

Property	Test Method	NTMA Requirements
Flammability	ASTM D-635	Self-extinguishing, extent of burning 0.25 inches max.
Thermal Coefficient of Linear Expansion	ASTM D-696	25x10 ⁻⁶ inches per inch per degrees to 140°F
Bond Strength	ACI COMM 403, Bulletin 59-43 (pages 1139-1141)	300 psi (100% concrete failure)

5. Aggregates [OPTION: Marble, glass, mother of pearl] Complying with NTMA gradation standards for mix indicated and containing no deleterious or foreign matter.
 - a. Abrasion and impact resistance: Less than 40% loss per ASTM C 131.
 - b. 24-Hour absorption rate: Less than 0.74%.
 - c. Dust content: Less than 1.0% by weight.
6. Finishing Grout: NTMA approved resin systems.
- B. Mix: Comply with NTMA's "Terrazzo Specifications and Design Guide" and manufacturer's written instructions for matrix and aggregate proportions and mixing.
 1. Color and Pattern Schedule: Where the following designations are indicated, provide specified terrazzo matrices matching architect's samples:
 - a. Basis of Design: David Allen Company MTT#9308

2.02 STRIP MATERIALS

- A. Thin-set Divider Strips: L-type.
 1. Material : match existing
 2. Guide for commonly used L-type divider strips for thin-set epoxy terrazzo systems:

System Height	Strip Height	Strip Width
		16 gauge
$\frac{3}{8}$ " System	$\frac{3}{8}$ "	$\frac{1}{8}$ " $\frac{1}{4}$ "

- B. Control-Joint Strips: Separate double L-type angles, positioned back to back with minimum $\frac{1}{8}$ " – $\frac{1}{4}$ " width between. (Single L-type angle, positioned adjacent to the joint is also acceptable.) Fill joint with 100% solids epoxy joint filler. Fill area between strips with elastomeric joint filler. Match material, thickness, and color of divider strips and depth required for topping thickness indicated. (For buried control joint): Fill saw cut concrete control joint with 100% solids epoxy filler, apply Iso-Crack Membrane 30-40 mils, embed 12" fiberglass fabric reinforcement. Saw cut control joints should be prefilled with hard epoxy and a single "L" divider with the vertical part placed precisely over the cut. If the saw cut control joint opening is $\frac{1}{4}$ " or wider, the strip treatment should be as a cold-pour construction below.
- C. Construction-Joint (Cold-Joint) Strips: Separate double L-type angles back to back with minimum $\frac{1}{8}$ " – $\frac{1}{4}$ " width between. Fill joint and area between strips with elastomeric joint filler. Match material, thickness, and color of divider strips and depth required for topping thickness indicated.
- D. Isolation-Joint Strips: Separate double L-type angles, positioned back to back with minimum $\frac{1}{8}$ " – $\frac{1}{4}$ " width between. Fill area between strips with elastomeric joint filler. Match material, thickness, and color of divider strips and depth required for topping thickness indicated.
- E. Accessory Strips: Match divider strip width, material, and color unless otherwise indicated. Use the following types of accessory strips if specified and detailed:
 - 1. Base-bead strips for exposed top of terrazzo base
 - 2. Edge-bead for exposed edges of terrazzo

2.03 MISCELLANEOUS ACCESSORIES

- A. Strip Adhesive: 100% solids epoxy resin adhesive
 - 1. Use adhesive that has a VOC content of 50g / L or less when calculated according to 40 CFR 59, subpart D (EPA Method 24)
- B. Patching and Fill Material: Fill and selected aggregates as recommended and approved by NTMA Resin Systems
- C. Joint Compound: Joint filler, color to be selected by architect to match / compliment terrazzo
- D. Cleaner: Clean with a neutral cleaner with pH factor between 7 – 10 specifically designed for terrazzo

PART 3 – EXECUTION

3.01 EXAMINATION

- A. Examine substrates and areas, with terrazzo contractor present, for compliance with requirements for installation tolerances and other conditions affecting performance.
- B. Proceed with installation only after unsatisfactory conditions, including level tolerances, have been corrected.

3.02 PREPARATION

- A. Clean substrates of substances, including oil, grease, and curing compounds, that might impair terrazzo bond. Provide clean, dry, and neutral substrate for terrazzo application. Concrete Slabs:
 - 1. Provide sound concrete surface free of laitance, glaze, efflorescence, curing compounds, form-release agents, dust, dirt, grease, oil, and other contaminants incompatible with terrazzo.
 - a. Prepare concrete mechanically by shot-blasting. Grinding of slab is not sufficient surface preparation, except for edges and corners not accessible with shot blasting equipment. Surface preparation results should achieve a CSP3-CSP5 profile according to International Concrete Repair Institute Guideline No. 03732.
 - b. Repair or flatten damaged and deteriorated concrete according to Terrazzo Resin Systems Technical Bulletin 008 Substrate Leveling Requirements for Thin-Set Epoxy Terrazzo

- c. Repair cracks and non-expansion joints greater than $\frac{1}{16}$ " (1.6 mm) wide according to Resin Systems Technical Bulletin 009 Crack Detailing and Joint Treatments Resin Thin-set Epoxy Terrazzo.
2. Verify that concrete substrates are visibly dry and free of moisture.
3. Moisture Testing:
 - a. Test for moisture according to ASTM F2170 (determining relative humidity in concrete slabs using in situ probes). Proceed with installation only after substrates have a maximum relative humidity measurement reading less than 80%. If relative humidity measurement reading is greater than or equal to 80%, moisture vapor primer (MVP) is recommended. Apply to terrazzo substrates according to resin systems MVP product data sheet. Request a Moisture Vapor Treatment price breakout as separate line item in bid regardless of whether it is used or not.

3.03 EPOXY TERRAZZO INSTALLATION

- A. General:
 1. Comply with NTMA's written recommendations for terrazzo and accessory installation.
 2. Place, rough grind, grout, cure grout, fine grind, and finish terrazzo according to resin systems epoxy matrix product data sheet and NTMA's "Terrazzo Specifications and Design Guide".
 3. Ensure that matrix components and fluids from grinding operations do not stain terrazzo by reacting with divider and control-joint strips.
 4. Delay fine grinding until heavy trade work is complete and construction traffic through area is restricted unless general contractor or owner is prepared to protect the final finish.
- B. Thickness: $\frac{3}{8}$ " (9.5 mm)
- C. Moisture Vapor Primer (MVP): Apply to terrazzo substrates according to resin systems moisture vapor primer product data sheet.
- D. Primer: Apply to terrazzo substrates according to resin systems primer product data sheet.
- E. Flexible Reinforcing Membrane for cracks only.
 1. Membrane application for isolated cracking. Route out all cracks and fill with 100% solids epoxy. Apply Iso-Crack Epoxy Membrane (spread at 40 mils thickness) across the crack allowing a minimum of 9 inches on either side. Embed fiberglass scrim into wet membrane and saturate with additional membrane. Allow for 5% of total terrazzo square footage in lineal feet of crack detailing.

Example: 10,000 SF – allow for 500 LF of crack detailing.
- F. Strip Materials:
 1. Divider and Accessory Strips:
 - a. Install strips in adhesive setting bed without voids below strips or mechanically anchor strips as required to attach strips to substrate.
 - b. Control-Joint Strips: Separate double L-type angles, positioned back to back with minimum $\frac{1}{8}$ " – $\frac{1}{4}$ " width between. (single L-type angle, positioned adjacent to the joint is also acceptable.) Fill joint with 100% solids epoxy joint filler. Fill area between strips with elastomeric joint filler. Match material, thickness, and color of divider strips and depth required for topping thickness indicated.
 - i. Buried Control Joint: Fill saw cut concrete control joint with 100% solids epoxy filler. Apply Terroxy Iso-Crack Membrane 30-40 mils, embed 12" fiberglass fabric reinforcement.
 - ii. Eliminate double L and filler at control joints unless opening at saw cut is $\frac{1}{4}$ " or greater.
 - c. Construction-Joint (Cold-Joint) Strips: Separate double L-type angles, positioned back to back with minimum $\frac{1}{8}$ " – $\frac{1}{4}$ " width between. Fill joint and area between strips with elastomeric joint filler. Match material, thickness, and color of divider strips and depth required for topping thickness indicated.
 - d. Isolation-Joint Strips: Separate double L-type angles, positioned back to back with minimum $\frac{1}{8}$ " – $\frac{1}{4}$ " width between. Fill area between strips with elastomeric joint filler.

Match material, thickness, and color of divider strips and depth required for topping thickness indicated.

- G. Placing Terrazzo:
 - 1. Mix epoxy matrix with chips and fillers in ratios directed by resin systems.
 - 2. Trowel-apply terrazzo mixture over epoxy primer to provide a dense flat surface to top of divider strips. Allow to cure per Resin Systems recommendations before rough grinding.
- H. Rough Grinding: Grind with 40 to 80 grit & 150 Diamond matrix stones until all terrazzo strips and marble chips are uniformly exposed.
- I. Grouting:
 - 1. Cleanse floor with clean water and rinse.
 - 2. Remove excess rinse water by wet vacuum, dry, and fill voids with resin systems epoxy matrix or clear resin.
 - 3. Allow grout to cure. Grout may be left on terrazzo until other trades work is completed. Remove excess grout with 150 grit diamonds and then follow with 200 grit diamonds.
- J. Polishing: Grinding with 400-grit diamonds until all grout is removed from surface. Repeat rough grinding, grout coat, and polishing if large terrazzo chip voids exist after initial polishing. Produce surface with a minimum of 70% aggregate exposure.

3.04 PRECAST TERRAZZO INSTALLATION

- A. Install precast units using method recommended by NTMA and manufacturer unless otherwise indicated.
- B. Seal joints between units with joint sealants.

3.05 CLEANING AND PROTECTION

- A. Cleaning: Remove grinding dust from installation and wash all surfaces with cleaner.
- B. After application of two coats of Acrylic (Water base) sealer in accordance with manufacturer's instructions, the work shall be ready for final inspection and acceptance by the Owner or his agent.
- C. The General Contractor shall protect terrazzo flooring from damage until project completion; any damage that does occur shall be the responsibility of the General Contractor to repair or replace to the satisfaction of the Architect.

END OF SECTION 09 6623

SECTION 09 6813 - TILE CARPETING

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.
- B. Allowances Section

1.2 SUMMARY

- A. Section includes modular, tufted carpet tile.

1.3 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.
 - 1. Review methods and procedures related to carpet tile installation including, but not limited to, the following:
 - a. Review delivery, storage, and handling procedures.
 - b. Review ambient conditions and ventilation procedures.
 - c. Review subfloor preparation procedures.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include manufacturer's written data on physical characteristics, durability, and fade resistance.
 - 2. Include installation recommendations for each type of substrate.
- B. Shop Drawings: Show the following:
 - 1. Columns, doorways, enclosing walls or partitions, built-in cabinets, and locations where cutouts are required in carpet tiles.
 - 2. Carpet tile type, color, and dye lot.
 - 3. Type of installation.
 - 4. Pattern of installation.
 - 5. Pattern type, location, and direction.
 - 6. Pile direction.
 - 7. Type, color, and location of insets and borders.
 - 8. Type, color, and location of edge, transition, and other accessory strips.

9. Transition details to other flooring materials.

C. Samples: For each of the following products and for each color and texture required. Label each Sample with manufacturer's name, material description, color, pattern, and designation indicated on Drawings and in schedules.

1. Carpet Tile: Full-size Sample.

D. Product Schedule: For carpet tile. Use same designations indicated on Drawings.

E. Sustainability: Provide the Statement of the Achievement Level the carpet has attained, based on specific Sustainable Attribute Performance for all product stages according to ANSI/NSF 140.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Product Test Reports: For carpet tile, for tests performed by a qualified testing agency.

C. Sample Warranty: For special warranty.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance Data: For carpet tiles to include in maintenance manuals. Include the following:

1. Methods for maintaining carpet tile, including cleaning and stain-removal products and procedures and manufacturer's recommended maintenance schedule.
2. Precautions for cleaning materials and methods that could be detrimental to carpet tile.

1.7 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Carpet Tile: Full-size units equal to 5 percent of amount installed for each type indicated, but not less than 10 sq. yd..

1.8 QUALITY ASSURANCE

A. Mockups: Build mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for fabrication and installation.

1. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Comply with CRI 104.

1.10 FIELD CONDITIONS

- A. Comply with CRI 104 for temperature, humidity, and ventilation limitations.
- B. Environmental Limitations: Do not deliver or install carpet tiles until spaces are enclosed and weathertight, wet work in spaces is complete and dry, and ambient temperature and humidity conditions are maintained at occupancy levels during the remainder of the construction period.
- C. Do not install carpet tiles over concrete slabs until slabs have cured and are sufficiently dry to bond with adhesive and concrete slabs have pH range recommended by carpet tile manufacturer.

1.11 WARRANTY

- A. Special Warranty for Carpet Tiles: Manufacturer agrees to repair or replace components of carpet tile installation that fail in materials or workmanship within specified warranty period.
 1. Warranty does not include deterioration or failure of carpet tile due to unusual traffic, failure of substrate, vandalism, or abuse.
 2. Failures include, but are not limited to, more than 10 percent edge raveling, snags, runs, dimensional stability, excess static discharge, loss of tuft bind strength, loss of face fiber, and delamination.
 3. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 CARPET TILE

- A. Products: Subject to compliance with requirements, provide carpet as selected by the Architect per the allowance.
- B. Applied Soil-Resistance Treatment: Manufacturer's standard material.
- C. Antimicrobial Treatment: Manufacturer's standard material.
- D. Performance Characteristics: As follows:

1. Emissions: Provide carpet tile that complies with testing and product requirements of CRI's "Green Label Plus" program.

2.2 INSTALLATION ACCESSORIES

- A. Trowelable Leveling and Patching Compounds: Latex-modified, hydraulic-cement-based formulation provided or recommended by carpet tile manufacturer.
- B. Adhesives: Water-resistant, mildew-resistant, nonstaining, pressure-sensitive type to suit products and subfloor conditions indicated, that complies with flammability requirements for installed carpet tile and is recommended by carpet tile manufacturer for releasable installation.
 1. Adhesives shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for maximum moisture content, alkalinity range, installation tolerances, and other conditions affecting carpet tile performance. Examine carpet tile for type, color, pattern, and potential defects.
- B. Concrete Subfloors: Verify that concrete slabs comply with ASTM F 710 and the following:
 1. Slab substrates are dry and free of curing compounds, sealers, hardeners, and other materials that may interfere with adhesive bond. Determine adhesion and dryness characteristics by performing bond and moisture tests recommended by carpet tile manufacturer.
 2. Subfloor finishes comply with requirements specified in Section 033000 "Cast-in-Place Concrete" for slabs receiving carpet tile.
 3. Subfloors are free of cracks, ridges, depressions, scale, and foreign deposits.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. General: Comply with CRI 104, Section 6.2, "Site Conditions; Floor Preparation," and with carpet tile manufacturer's written installation instructions for preparing substrates indicated to receive carpet tile installation.
- B. Use trowelable leveling and patching compounds, according to manufacturer's written instructions, to fill cracks, holes, depressions, and protrusions in substrates. Fill or

level cracks, holes and depressions 1/8 inch wide or wider and protrusions more than 1/32 inch unless more stringent requirements are required by manufacturer's written instructions.

- C. Remove coatings, including curing compounds, and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, without using solvents. Use mechanical methods recommended in writing by carpet tile manufacturer.
- D. Broom and vacuum clean substrates to be covered immediately before installing carpet tile.

3.3 INSTALLATION

- A. General: Comply with CRI 104, Section 14, "Carpet Modules," and with carpet tile manufacturer's written installation instructions.
- B. Installation Method: Glue down; install every tile with full-spread, releasable, pressure-sensitive adhesive .
- C. Maintain dye lot integrity. Do not mix dye lots in same area.
- D. Cut and fit carpet tile to butt tightly to vertical surfaces, permanent fixtures, and built-in furniture including cabinets, pipes, outlets, edgings, thresholds, and nosings. Bind or seal cut edges as recommended by carpet tile manufacturer.
- E. Extend carpet tile into toe spaces, door reveals, closets, open-bottomed obstructions, removable flanges, alcoves, and similar openings.
- F. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on finish flooring as marked on subfloor. Use nonpermanent, nonstaining marking device.
- G. Install pattern parallel to walls and borders.

3.4 CLEANING AND PROTECTION

- A. Perform the following operations immediately after installing carpet tile:
 - 1. Remove excess adhesive, seam sealer, and other surface blemishes using cleaner recommended by carpet tile manufacturer.
 - 2. Remove yarns that protrude from carpet tile surface.
 - 3. Vacuum carpet tile using commercial machine with face-beater element.
- B. Protect installed carpet tile to comply with CRI 104, Section 16, "Protecting Indoor Installations."

- C. Protect carpet tile against damage from construction operations and placement of equipment and fixtures during the remainder of construction period. Use protection methods indicated or recommended in writing by carpet tile manufacturer.

END OF SECTION 09 6813

SECTION 09 9113 - EXTERIOR PAINTING

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 surface preparation and the application of paint systems on exterior substrates.
- B. Related Requirements:
 - 1. Division 09 Section "Interior Painting" for surface preparation and the application of paint systems on interior substrates.

1.3 DEFINITIONS

- A. Gloss Level 1: Not more than 5 units at 60 degrees and 10 units at 85 degrees, according to ASTM D 523.
- B. Gloss Level 3: 10 to 25 units at 60 degrees and 10 to 35 units at 85 degrees, according to ASTM D 523.
- C. Gloss Level 4: 20 to 35 units at 60 degrees and not less than 35 units at 85 degrees, according to ASTM D 523.
- D. Gloss Level 5: 35 to 70 units at 60 degrees, according to ASTM D 523.
- E. Gloss Level 6: 70 to 85 units at 60 degrees, according to ASTM D 523.
- F. Gloss Level 7: More than 85 units at 60 degrees, according to ASTM D 523.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product. Include preparation requirements and application instructions.
- B. Samples for Initial Selection: For each type of topcoat product.
- C. Samples for Verification: For each type of paint system and each color and gloss of topcoat.

1. Submit Samples on rigid backing, 8 inches square.
2. Step coats on Samples to show each coat required for system.
3. Label each coat of each Sample.
4. Label each Sample for location and application area.

D. Product List: For each product indicated, include the following:

1. Cross-reference to paint system and locations of application areas. Use same designations indicated on Drawings and in schedules.
2. Printout of current "MPI Approved Products List" for each product category specified, with the proposed product highlighted.
3. VOC content.

1.5 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Paint: 5 percent, but not less than 1 gal. of each material and color applied.

1.6 QUALITY ASSURANCE

A. Mockups: Apply mockups of each paint system indicated and each color and finish selected to verify preliminary selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.

1. Architect will select one surface to represent surfaces and conditions for application of each paint system specified in Part 3.
2. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F.

1. Maintain containers in clean condition, free of foreign materials and residue.
2. Remove rags and waste from storage areas daily.

1.8 FIELD CONDITIONS

A. Apply paints only when temperature of surfaces to be painted and ambient air temperatures are between 50 and 95 deg F.

B. Do not apply paints in snow, rain, fog, or mist; when relative humidity exceeds 85 percent; at temperatures less than 5 deg F above the dew point; or to damp or wet

surfaces.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Basis of Design: Subject to compliance with requirements, provide premium line products from THE SHERWIN WILLIAMS COMPANY or one of the following:
 - 1. Benjamin Moore & Co.
 - 2. ICI Paints.
 - 3. PPG Architectural Finishes, Inc.
 - 4. Rose Talbert.

2.2 PAINT, GENERAL

- A. MPI Standards: Provide products that comply with MPI standards indicated and that are listed in its "MPI Approved Products List."
- B. Material Compatibility:
 - 1. Provide materials for use within each paint system that are compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
 - 2. For each coat in a paint system, provide products recommended in writing by manufacturers of topcoat for use in paint system and on substrate indicated.
- C. VOC Content: Provide materials that comply with VOC limits of authorities having jurisdiction.
- D. Colors: As selected by Architect from manufacturer's full range.

2.3 PRIMERS/SEALERS

- A. Provide primers and sealers produced by the same manufacturer as the finish coats.
- B. Primer, Alkali Resistant, Water Based: MPI #3.

2.4 SOURCE QUALITY CONTROL

- A. Testing of Paint Materials: Owner reserves the right to invoke the following procedure:
 - 1. Owner will engage the services of a qualified testing agency to sample paint materials. Contractor will be notified in advance and may be present when samples are taken. If paint materials have already been delivered to Project site,

- samples may be taken at Project site. Samples will be identified, sealed, and certified by testing agency.
2. Testing agency will perform tests for compliance with product requirements.
 3. Owner may direct Contractor to stop applying paints if test results show materials being used do not comply with product requirements. Contractor shall remove noncomplying paint materials from Project site, pay for testing, and repaint surfaces painted with rejected materials. Contractor will be required to remove rejected materials from previously painted surfaces if, on repainting with complying materials, the two paints are incompatible.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.
- B. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:
 1. As recommended by material manufacturer
- C. Verify suitability of substrates, including surface conditions and compatibility with existing finishes and primers.
- D. Proceed with coating application only after unsatisfactory conditions have been corrected.
 1. Application of coating indicates acceptance of surfaces and conditions.

3.2 PREPARATION

- A. Comply with manufacturer's written instructions and recommendations in "MPI Manual" applicable to substrates and paint systems indicated.
- B. Remove hardware, covers, plates, and similar items already in place that are removable and are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.
 1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection.
- C. Clean substrates of substances that could impair bond of paints, including dust, dirt, oil, grease, and incompatible paints and encapsulants.
 1. Remove incompatible primers and reprime substrate with compatible primers or

apply tie coat as required to produce paint systems indicated.

- D. Steel Substrates: Remove rust, loose mill scale, and shop primer if any. Clean using methods recommended in writing by paint manufacturer.
- E. Galvanized-Metal Substrates: Remove grease and oil residue from galvanized sheet metal by mechanical methods to produce clean, lightly etched surfaces that promote adhesion of subsequently applied paints.

3.3 APPLICATION

- A. Apply paints according to manufacturer's written instructions and recommendations in "MPI Manual."
 - 1. Use applicators and techniques suited for paint and substrate indicated.
 - 2. Paint surfaces behind movable items same as similar exposed surfaces. Before final installation, paint surfaces behind permanently fixed items with prime coat only.
 - 3. Paint both sides and edges of exterior doors and entire exposed surface of exterior door frames.
 - 4. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.
 - 5. Primers specified in painting schedules may be omitted on items that are factory primed or factory finished if acceptable to topcoat manufacturers.
- B. Tint undercoats same color as topcoat, but tint each undercoat a lighter shade to facilitate identification of each coat if multiple coats of same material are to be applied. Provide sufficient difference in shade of undercoats to distinguish each separate coat.
- C. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance.
- D. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.
- E. Painting Fire Suppression, Plumbing, HVAC, Electrical, Communication, and Electronic Safety and Security Work:

3.4 CLEANING AND PROTECTION

- A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.
- B. After completing paint application, clean spattered surfaces. Remove spattered paints by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.

- C. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.
- D. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

3.5 EXTERIOR PAINTING SCHEDULE

- A. CELLULAR PVC MILLWORK AND TRIM:
 - 1. None
- B. EXTERIOR GYPSUM BOARD:
 - 1. Latex System/Satin Finish:
 - a. 1st Coat: S-W PrepRite ProBlock Latex Primer/Sealer.
 - b. 2nd Coat: S-W A-100 Exterior Latex Satin, A82 Series (4 mils).
 - c. 3rd Coat: S-W A-100 Exterior Latex Satin, A82 Series (4 mils).
- C. METAL:
 - 1. Water-Based Light Industrial Coating System:
 - a. 1st Coat: ProCryl Universal Primer B66-310 Series (5 - 10 mils).
 - b. 2nd Coat: S-W Pro Industrial Acrylic Semi-Gloss Coating, B66-650 Series (4 mils).
 - c. 3rd Coat: S-w Pro Industrial Acrylic Semi-Gloss Coating, B66-650 Series (4 mils).
- D. EXISTING EXTERIOR STOREFRONT:
 - 1. Electrostatically spray Applied Polyurethane Enamel System:
 - a. 1st Coat: Prolane S Plus
 - b. 2nd Coat: Prolane S Plus
- E. FIBER CEMENT SIDING, PANELS AND TRIM
 - 1. Latex System/Semi-Gloss Finish:
 - a. 1st Coat: S-W PrepRite ProBlock Latex Primer/Sealer.
 - b. 2nd Coat: S-W Solo Acrylic Semi-Gloss, A76 Series (4 mils).
 - c. 3rd Coat: S-W Solo Acrylic Semi-Gloss, A76 Series (4 mils).

END OF SECTION 09 9113

SECTION 09 9123 - INTERIOR PAINTING

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 surface preparation and the application of paint systems on the following interior substrates:
 - 1. Concrete.
 - 2. Gypsum wallboard
 - 3. Steel.
 - 4. Wood trim with premium transparent finish
 - 5. Wood trim with opaque finish
- B. Related Requirements:
 - 1. Division 05 Sections for shop priming of metal substrates with primers specified in this Section.
 - 2. Division 09 Section "Exterior Painting" for surface preparation and the application of paint systems on exterior substrates.

1.3 DEFINITIONS

- A. Gloss Level 1: Not more than 5 units at 60 degrees and 10 units at 85 degrees, according to ASTM D 523.
- B. Gloss Level 2: Not more than 10 units at 60 degrees and 10 to 35 units at 85 degrees, according to ASTM D 523.
- C. Gloss Level 3: 10 to 25 units at 60 degrees and 10 to 35 units at 85 degrees, according to ASTM D 523.
- D. Gloss Level 4: 20 to 35 units at 60 degrees and not less than 35 units at 85 degrees, according to ASTM D 523.
- E. Gloss Level 5: 35 to 70 units at 60 degrees, according to ASTM D 523.
- F. Gloss Level 6: 70 to 85 units at 60 degrees, according to ASTM D 523.
- G. Gloss Level 7: More than 85 units at 60 degrees, according to ASTM D 523.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product. Include preparation requirements and application instructions.
- B. Samples for Initial Selection: For each type of topcoat product.
- C. Samples for Verification: For each type of paint system and in each color and gloss of topcoat.
 - 1. Submit Samples on rigid backing, 8 inches square.
 - 2. Step coats on Samples to show each coat required for system.
 - 3. Label each coat of each Sample.
 - 4. Label each Sample for location and application area.
- D. Product List: For each product indicated, include the following:
 - 1. Cross-reference to paint system and locations of application areas. Use same designations indicated on Drawings and in schedules.
 - 2. Printout of current "MPI Approved Products List" for each product category specified in Part 2, with the proposed product highlighted.
 - 3. VOC content.
- E. Manufacturer's letter approving flooring applicator.

1.5 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Paint: 5 percent, but not less than 1 gal. of each material and color applied.

1.6 QUALITY ASSURANCE

- A. Mockups: Apply mockups of each paint system indicated and each color and finish selected to verify preliminary selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
 - 1. Architect will select one surface to represent surfaces and conditions for application of each paint system specified in Part 3.
 - 2. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.
- B. Floor coating applicator to be approved by the manufacturer.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F.
 - 1. Maintain containers in clean condition, free of foreign materials and residue.
 - 2. Remove rags and waste from storage areas daily.

1.8 FIELD CONDITIONS

- A. Apply paints only when temperature of surfaces to be painted and ambient air temperatures are between 50 and 95 deg F.
- B. Do not apply paints when relative humidity exceeds 85 percent; at temperatures less than 5 deg F above the dew point; or to damp or wet surfaces.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Basis of Design Manufacturer: Subject to compliance with requirements, provide premium line products by THE SHERWIN WILLIAMS COMPANY or one of the following ::
 - 1. Benjamin Moore & Co.
 - 2. ICI Paints.
 - 3. PPG Architectural Finishes, Inc.
 - 4. Rose Talbert.

2.2 PAINT, GENERAL

- A. Material Compatibility:
 - 1. Provide materials for use within each paint system that are compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
 - 2. For each coat in a paint system, provide products recommended in writing by manufacturers of topcoat for use in paint system and on substrate indicated.
- B. VOC Content: Products shall comply with VOC limits of authorities having jurisdiction and, for interior paints and coatings applied at Project site, the following VOC limits, exclusive of colorants added to a tint base, when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 - 1. Flat Paints and Coatings: 50 g/L.
 - 2. Nonflat Paints and Coatings: 150 g/L.
 - 3. Dry-Fog Coatings: 400 g/L.

4. Primers, Sealers, and Undercoaters: 200 g/L.
 5. Anticorrosive and Antirust Paints Applied to Ferrous Metals: 250 g/L.
 6. Zinc-Rich Industrial Maintenance Primers: 340 g/L.
 7. Pretreatment Wash Primers: 420 g/L.
 8. Floor Coatings: 100 g/L.
 9. Shellacs, Clear: 730 g/L.
 10. Shellacs, Pigmented: 550 g/L.
- C. Low-Emitting Materials: Interior paints and coatings shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
- D. Colors: As selected by Architect from manufacturer's full range.

2.3 SOURCE QUALITY CONTROL

- A. Testing of Paint Materials: Owner reserves the right to invoke the following procedure:
1. Owner will engage the services of a qualified testing agency to sample paint materials. Contractor will be notified in advance and may be present when samples are taken. If paint materials have already been delivered to Project site, samples may be taken at Project site. Samples will be identified, sealed, and certified by testing agency.
 2. Testing agency will perform tests for compliance with product requirements.
 3. Owner may direct Contractor to stop applying coatings if test results show materials being used do not comply with product requirements. Contractor shall remove noncomplying paint materials from Project site, pay for testing, and repaint surfaces painted with rejected materials. Contractor will be required to remove rejected materials from previously painted surfaces if, on repainting with complying materials, the two paints are incompatible.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.
- B. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:
1. Concrete: 12 percent.
- C. Verify suitability of substrates, including surface conditions and compatibility with

existing finishes and primers.

- D. Proceed with coating application only after unsatisfactory conditions have been corrected.
 - 1. Application of coating indicates acceptance of surfaces and conditions.

3.2 PREPARATION

- A. Comply with manufacturer's written instructions and recommendations in "MPI Manual" applicable to substrates indicated.
- B. Remove hardware, covers, plates, and similar items already in place that are removable and are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.
 - 1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection if any.
- C. Clean substrates of substances that could impair bond of paints, including dust, dirt, oil, grease, and incompatible paints and encapsulants.
 - 1. Remove incompatible primers and reprime substrate with compatible primers or apply tie coat as required to produce paint systems indicated.
- D. Concrete Substrates: Remove release agents, curing compounds, efflorescence, and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces to be painted exceeds that permitted in manufacturer's written instructions.

3.3 APPLICATION

- A. Apply paints according to manufacturer's written instructions and to recommendations in "MPI Manual."
 - 1. Use applicators and techniques suited for paint and substrate indicated.
 - 2. Paint surfaces behind movable equipment and furniture same as similar exposed surfaces. Before final installation, paint surfaces behind permanently fixed equipment or furniture with prime coat only.
 - 3. Paint front and backsides of access panels, removable or hinged covers, and similar hinged items to match exposed surfaces.
 - 4. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.
 - 5. Primers specified in painting schedules may be omitted on items that are factory primed or factory finished if acceptable to topcoat manufacturers.
- B. Tint each undercoat a lighter shade to facilitate identification of each coat if multiple coats of same material are to be applied. Tint undercoats to match color of topcoat,

but provide sufficient difference in shade of undercoats to distinguish each separate coat.

- C. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance.
- D. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.
- E. Painting Fire Suppression, Plumbing, HVAC, Electrical, Communication, and Electronic Safety and Security Work:
 - 1. Paint portions of internal surfaces of metal ducts, without liner, behind air inlets and outlets that are visible from occupied spaces.

3.4 FIELD QUALITY CONTROL

- A. Dry Film Thickness Testing: Owner may engage the services of a qualified testing and inspecting agency to inspect and test paint for dry film thickness.
 - 1. Contractor shall touch up and restore painted surfaces damaged by testing.
 - 2. If test results show that dry film thickness of applied paint does not comply with paint manufacturer's written recommendations, Contractor shall pay for testing and apply additional coats as needed to provide dry film thickness that complies with paint manufacturer's written recommendations.

3.5 CLEANING AND PROTECTION

- A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.
- B. After completing paint application, clean spattered surfaces. Remove spattered paints by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.
- C. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.
- D. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

3.6 INTERIOR PAINTING SCHEDULE

- A. CONCRETE - Cast-In-Place Floor slab
 - 1. Pigmented Concrete Sealer
 - a. 2 coat application 2 - 4 mils wft each coat

- b. Aquamor WB 3460
- B. METAL -
 - 1. Alkyd System
 - a. Gloss Finish (Water Base)
 - 1) 1st Coat: S-W Pro Industrial Pro-Cryl Universal Primer, B66-310 Series.
 - 2) 2nd Coat: S-W ProMar 200 Waterbased Acrylic/Alkyd Gloss, B35-8200 Series
 - 3) 3rd Coat: S-W ProMar 200 Waterbased Acrylic/Alkyd Gloss, B35-8200 Series.
- C. GYPSUM DRYWALL: Epoxy paint (primer and 2 finish coats)
 - 1)Primer: ProMar 200 Zero VOC Latex Primer, B28W2600 1st coat: Pro Industrial
 - 2) Water Based Catalyzed Epoxy Eg-Shel, B73-300 Series 2nd coat: Pro Industrial
 - 3)Water Based Catalyzed Epoxy Eg-Shel, B73-300 Series
- D. GYPSUM DRYWALL: Acrylic paint (primer and 2 finish coats).
 - 1. Ceilings Flat Sheen:
 - a. 1 st Coat: S-W Harmony Low Odor Interior Latex Primer, B11W900 (4 mils wet, 1.3 mils dry per coat)
 - b. 2nd Coat: S-W Harmony Low Odor Interior Latex Flat, B5 Series
 - 2. Walls Eggshell Sheen:
 - a. 1st Coat: S-W Harmony Low Odor Interior Latex Primer, B11W900 (4 mils wet, 1.3 mils dry per coat)
 - b. 2nd Coat: S-W Harmony Low Odor Interior Latex Eg-Shel, B9 Series
 - c. 3rd Coat: S-W Harmony Low Odor Interior Latex Eg-Shel, B9 Series (4 mils wet, 1.6 mils dry per coat)
- E. INTERIOR WOOD DOORS, FRAMES, TRIM, and BASE :
 - 1. Transparent Finish: Comply with requirements indicated below for grade, finish system, staining, and sheen, with sheen measured on 60-deg ree gloss meter per ASTM D 523:
 - a. Grade: Premium.
 - b. AWI Finish System: TR-6, catalyzed polyurethane.
 - c. Staining: Match approved sample for color.

- d. Wash Coat for Stained Finish: Apply a vinyl wash coat to woodwork made from closed-grain wood before staining and finishing.
 - e. Open-Grain Woods: After staining (if any), apply paste wood filler to open-grain woods and wipe off excess. Tint filler to match stained wood.
 - f. Sheen: Satin, 30-50 gloss units
2. Opaque Finish: Acrylic/Alkyd System
Gloss finish (Water Base)
- a. 1st coat: S-W Premium Wall & Wood Primer B28W8111 (4 mils wet)
 - b. 2nd coat: S-W ProMar 200 Waterbased Acrylic/Alkyd Gloss (4 mils wet)
 - c. 3rd coat: S-W ProMar 200 Waterbased Acrylic/Alkyd Gloss (4 mils wet)

END OF SECTION 09 9123

SECTION 10 2113 - TOILET COMPARTMENTS

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. Phenolic-core toilet compartments configured as toilet enclosures and urinal screens.

- B. Related Sections:

- 1. Section 10 2800 "Toilet, Bath, and Laundry Accessories" for toilet tissue dispensers, grab bars, purse shelves, and similar accessories.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
- B. Shop Drawings: For toilet compartments. Include plans, elevations, sections, details, and attachments to other work.
 - 1. Show locations of cutouts for compartment-mounted toilet accessories.
 - 2. Show locations of reinforcements for compartment-mounted grab bars.
 - 3. Show locations of centerlines of toilet fixtures.
 - 4. Show overhead support or bracing locations.
- C. Samples for Verification: For the following products, in manufacturer's standard sizes unless otherwise indicated:
 - 1. Each type of material, color, and finish required for units, prepared on 6-inch-square Samples of same thickness and material indicated for Work.
 - 2. Each type of hardware and accessory.

1.4 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For toilet compartments to include in maintenance manuals.

1.5 QUALITY ASSURANCE

- A. Comply with requirements in GSA's CID-A-A-60003, "Partitions, Toilets, Complete."
- B. Surface-Burning Characteristics: As determined by testing identical products according to ASTM E 84, or another standard acceptable to authorities having jurisdiction, by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - 1. Flame-Spread Index: 25 or less.
 - 2. Smoke-Developed Index: 450 or less.
- C. Regulatory Requirements: Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disabilities Act (ADA) and Architectural Barriers Act (ABA) Accessibility Guidelines for Buildings and Facilities" and ICC/ANSI A117.1 for toilet compartments designated as accessible.

1.6 PROJECT CONDITIONS

- A. Field Measurements: Verify actual locations of toilet fixtures, walls, columns, ceilings, and other construction contiguous with toilet compartments by field measurements before fabrication.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Aluminum Castings: ASTM B 26/B 26M.
- B. Aluminum Extrusions: ASTM B 221.
- C. Brass Castings: ASTM B 584.
- D. Brass Extrusions: ASTM B 455.
- E. Steel Sheet: Commercial steel sheet for exposed applications; mill phosphatized and selected for smoothness.
 - 1. Electrolytically Zinc Coated: ASTM A 879/A 879M, 01Z.
 - 2. Hot-Dip Galvanized: ASTM A 653/A 653M, either hot-dip galvanized or galvannealed.
- F. Stainless-Steel Sheet: ASTM A 666, Type 304, stretcher-leveled standard of flatness.
- G. Stainless-Steel Castings: ASTM A 743/A 743M.
- H. Zamac: ASTM B 86, commercial zinc-alloy die castings.

- I. Particleboard: ANSI A208.1, Grade M-2 with 45-lb density

2.2 PHENOLIC-CORE UNITS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Ampco Products.
 - 2. Bradley Corporation.
 - 3. Bobrick.
 - 4. Partition Systems Incorporated of South Carolina.
- B. Toilet-Enclosure Style: Overhead braced Floor anchored .
- C. Urinal-Screen Style: Wall hung.
- D. Door, Panel, Screen, and Pilaster Construction: Solid phenolic-core panel material with melamine facing on both sides fused to substrate during panel manufacture (not separately laminated), and with eased and polished edges and no-sightline system. Provide minimum 3/4-inch- thick doors and pilasters and minimum 1/2-inch- thick panels.
- E. Pilaster Shoes and Sleeves (Caps): Fabricated from stainless-steel sheet, not less than 0.031-inch nominal thickness and 3 inches high, finished to match hardware.
- F. Brackets (Fittings):
 - 1. Full-Height (Continuous) Type: Manufacturer's standard design; stainless steel.
- G. Phenolic-Panel Finish:
 - 1. Facing Sheet Finish: One color and pattern in each room.
 - 2. Color and Pattern: As selected by Architect from manufacturer's full range, with manufacturer's standard through-color core matching face sheet.

2.3 ACCESSORIES

- A. Hardware and Accessories: Manufacturer's standard design, heavy-duty operating hardware and accessories.
 - 1. Material: Clear-anodized aluminum.
 - 2. Hinges: Manufacturer's standard continuous, spring-loaded type.
 - 3. Latch and Keeper: Manufacturer's standard surface-mounted latch unit designed for emergency access and with combination rubber-faced door strike and keeper. Provide units that comply with regulatory requirements for accessibility at compartments designated as accessible.

4. Coat Hook: Manufacturer's standard combination hook and rubber-tipped bumper, sized to prevent in-swinging door from hitting compartment-mounted accessories.
 5. Door Bumper: Manufacturer's standard rubber-tipped bumper at out-swinging doors.
 6. Door Pull: Manufacturer's standard unit at out-swinging doors that complies with regulatory requirements for accessibility. Provide units on both sides of doors at compartments designated as accessible.
- B. Overhead Bracing: Manufacturer's standard continuous, extruded-aluminum head rail with antigrip profile and in manufacturer's standard finish.
- C. Anchorages and Fasteners: Manufacturer's standard exposed fasteners of stainless steel or chrome-plated steel or brass, finished to match the items they are securing, with theft-resistant-type heads. Provide sex-type bolts for through-bolt applications. For concealed anchors, use stainless steel, hot-dip galvanized steel, or other rust-resistant, protective-coated steel.

2.4 FABRICATION

- A. Overhead-Braced Units: Provide manufacturer's standard corrosion-resistant supports, leveling mechanism, and anchors at pilasters to suit floor conditions. Provide shoes at pilasters to conceal supports and leveling mechanism.
- B. Floor-Anchored Units: Provide manufacturer's standard corrosion-resistant anchoring assemblies with leveling adjustment nuts at pilasters for structural connection to floor. Provide shoes at pilasters to conceal anchorage.
- C. Door Size and Swings: Unless otherwise indicated, provide 24-inch- wide, in-swinging doors for standard toilet compartments and 36-inch- wide, out-swinging doors with a minimum 32-inch- wide, clear opening for compartments designated as accessible.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. General: Comply with manufacturer's written installation instructions. Install units rigid, straight, level, and plumb. Secure units in position with manufacturer's recommended anchoring devices.
1. Maximum Clearances:
 - a. Pilasters and Panels: 1/2 inch.
 - b. Panels and Walls: 1 inch.
- B. Overhead-Braced Units: Secure pilasters to floor and level, plumb, and tighten. Set

pilasters with anchors penetrating not less than 1-3/4 inches into structural floor unless otherwise indicated in manufacturer's written instructions. Secure continuous head rail to each pilaster with no fewer than two fasteners. Hang doors to align tops of doors with tops of panels, and adjust so tops of doors are parallel with overhead brace when doors are in closed position.

- C. Floor-Anchored Units: Set pilasters with anchors penetrating not less than 2 inches into structural floor unless otherwise indicated in manufacturer's written instructions. Level, plumb, and tighten pilasters. Hang doors and adjust so tops of doors are level with tops of pilasters when doors are in closed position.
- D. Urinal Screens: Attach with anchoring devices to suit supporting structure. Set units level and plumb, rigid, and secured to resist lateral impact.

3.2 ADJUSTING

- A. Hardware Adjustment: Adjust and lubricate hardware according to hardware manufacturer's written instructions for proper operation. Set hinges on in-swinging doors to hold doors open approximately 30 degrees from closed position when unlatched. Set hinges on out-swinging doors to return doors to fully closed position.

END OF SECTION 10 2113

SECTION 10 2116 - SHOWER AND BATH ENCLOSURES

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Shower and Bath Enclosures of the Following Types:
 - 1. Semi-Frameless Stall Showers with Continuous Hinge Swing Door

1.2 RELATED SECTIONS

- A. Section 06 1000 - Rough Carpentry; blocking.
- B. Section 09 2116 - Gypsum Board Shaft Wall Assemblies.
- C. Section 09 3000 - Tiling.
- D. Section 22 4000 - Plumbing Fixtures; coordination with plumbing fixtures, shower receptor base.

1.3 REFERENCES

- A. American National Standards Institute (ANSI): ANSI Z97.1 - Safety Glazing Materials Used in Buildings - Safety Performance Specifications and Methods of Test.
- B. Consumer Product and Safety Commission (CPSC): 16CFR1201 II - Safety Standard for Architectural Glazing Materials.
- C. American Society of Testing and Materials (ASTM): ASTM C 1048 - Standard Specification for Heat-Treated Flat Glass, Kind HS, Kind FT Coated and Uncoated Glass.
- D. United States Federal Specifications(USFS): DD-G-1403B - Federal Specification, Glass, Float, Sheet, Figured, Coated, (Heat Strengthened and Tempered).
- E. ADA and ABA Accessibility Guidelines for Buildings and Facilities.

1.4 SUBMITTALS

- A. Submit under provisions of Section 01 3000.
- B. Product data: Manufacturer's data sheets on each product to be used, including
 - 1. Preparation instructions and recommendations.
 - 2. Storage and handling requirements and recommendations.
 - 3. Installation methods.
- C. Shop drawings showing dimensions, method of attachment, and required supports.
- D. Selection Samples: For each finish product specified, two complete sets of color chips representing manufacturer's full range of available colors and patterns.
- E. Verification Samples: For each finish product specified, two samples, minimum size 6 inches (150 mm) square, representing actual product, color, and patterns.

1.5 QUALITY ASSURANCE

- A. Source quality control factory test for metal hardness, finish and dimensional tolerance.

- B. Shower and bath enclosures shall be provided and installed in compliance with ANSI Z.97.1, CPSC 16CFR1201 II, ASTM C1048, and USFS DD-G-1403B.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Store products in manufacturer's unopened packaging until ready for installation.
- B. Deliver units to job site door assembled and ready for installation to the greatest extent practical.
- C. Store off ground, under cover, protected from weather and construction activities.
- D. Do not lay glass flat either in transport or stage.

1.7 PROJECT CONDITIONS

- A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.

1.8 WARRANTY

- A. Manufacturer's Warranty: Provide manufacturer's standard warranty for shower and bath enclosures and warranty for any optional glass surface protection system selected.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Basis-of-Design Carnal Series by Cardinal Shower Enclosures 4795 Shepherdsville Rd.; Louisville, KY 40218; Toll Free Tel: 800-826-2577; Tel: 502-969-4059; Fax: 800-313-4195; Email: [request info \(livermore@cardinalshower.com\)](mailto:request_info@livermore@cardinalshower.com); Web: www.cardinalshower.com or equal by one of the following;
- B. Agalite Shower and Bath Enclosures.
- C. Basco Shower Enclosures.
- D. Requests for substitutions considered in accordance with provisions of Div. 01.

2.2 SHOWER AND BATH ENCLOSURES

- A. Semi-Frameless Stall Showers with Continuous Hinge Swing Doors:
 - 1. Height: As indicated on the Drawings.
 - 2. Configuration: Semi-Frameless Enclosure with Single door
 - 3. Aluminum extrusion finish: Brushed Nickel.
 - 4. Header Style: No header on glass door.
 - 5. Bottom Style: No drip channel, no bottom sweep.
 - 6. Hardware: Back-to-back C pull
 - 7. Glass Type: Satin, 1/4 inch (6.35 mm) thick, tempered.
 - 8. Surface Protection System for Glass: Manufacture's 10-year standard surface protection coating.
 - 9. No sight-lines shall exist between bottom and top of door at either pull-side or hinge-side.

2.3 FABRICATION

- A. Shop assembly of doors and sliding panel shall be completed prior to delivery to job site.
- B. Fabrication of metal for out-of-plumb or out-of-level conditions exceeding normal adjustments shall be done prior to installation.
 - 1. Handles shall be secured by means of pressure fitting.

PART 3 EXECUTION

3.1 COORDINATION

- A. Coordinate requirements for blocking to ensure adequate means for support and installation of shower and bath enclosures.

3.2 EXAMINATION

- A. Do not begin installation until substrates have been properly prepared.
- B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.3 PREPARATION

- A. Clean surfaces thoroughly prior to installation. Prior to installation of unit, installer shall be sure that surface is free from foreign matter that could compromise the watertight bond of unit to surface including but not limited to rust, dirt, grease, paint, mastic, taping, compound, and similar items.
- B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.4 INSTALLATION

- A. Comply with manufacturer's installation guidelines and instructions and approved shop drawings.
- B. Install shower and bath enclosures such that contact between glass and metal during normal operation does not occur.

3.5 TESTING AND CLEANING

- A. Inspect installation to verify secure and proper mounting.
- B. Test and adjust operation of all doors until smooth operation is achieved.
 - 1. Clean surfaces and wash with solution as recommended by manufacturer's written instructions.
 - 2. Test to ensure that contact between glass and metal does not occur during normal operation.
- C. Protect shower and bath from damage from subsequent construction operations. If damage occurs, remove and replace damaged units.

3.6 PROTECTION

- A. Touch-up, repair or replace damaged products before Substantial Completion.
- B. Replace damaged products before Substantial Completion.

END OF SECTION 10 2116

SECTION 10 2800 - TOILET, BATH, AND LAUNDRY ACCESSORIES

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. Public-use washroom accessories.
 - 2. Custodial accessories.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated. Include the following:
 - 1. Construction details and dimensions.
 - 2. Anchoring and mounting requirements, including requirements for cutouts in other work and substrate preparation.
 - 3. Material and finish descriptions.
 - 4. Features that will be included for Project.
 - 5. Manufacturer's warranty.
- B. Product Schedule: Indicating types, quantities, sizes, and installation locations by room of each accessory required.
 - 1. Identify locations using room designations indicated.
 - 2. Identify products using designations indicated.

1.4 INFORMATIONAL SUBMITTALS

- A. Warranty: Sample of special warranty.

1.5 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For toilet and bath accessories to include in maintenance manuals.

1.6 QUALITY ASSURANCE

- A. Source Limitations: For products listed together in the same Part 2 articles, obtain products from single source from single manufacturer.

1.7 COORDINATION

- A. Coordinate accessory locations with other work to prevent interference with clearances required for access by people with disabilities, and for proper installation, adjustment, operation, cleaning, and servicing of accessories.
- B. Deliver inserts and anchoring devices set into concrete or masonry as required to prevent delaying the Work.

1.8 WARRANTY

- A. Special Mirror Warranty: Manufacturer's standard form in which manufacturer agrees to replace mirrors that develop visible silver spoilage defects and that fail in materials or workmanship within specified warranty period.
 - 1. Warranty Period: 15 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Stainless Steel: ASTM A 666, Type 304, 0.031-inch minimum nominal thickness unless otherwise indicated.
- B. Brass: ASTM B 19, flat products; ASTM B 16/B 16M, rods, shapes, forgings, and flat products with finished edges; or ASTM B 30, castings.
- C. Steel Sheet: ASTM A 1008/A 1008M, Designation CS (cold rolled, commercial steel), 0.036-inch minimum nominal thickness.
- D. Galvanized-Steel Sheet: ASTM A 653/A 653M, with G60 hot-dip zinc coating.
- E. Galvanized-Steel Mounting Devices: ASTM A 153/A 153M, hot-dip galvanized after fabrication.
- F. Fasteners: Screws, bolts, and other devices of same material as accessory unit and tamper-and-theft resistant where exposed, and of galvanized steel where concealed.
- G. Chrome Plating: ASTM B 456, Service Condition Number SC 2 (moderate service).
- H. ABS Plastic: Acrylonitrile-butadiene-styrene resin formulation.

2.2 PUBLIC-USE WASHROOM ACCESSORIES

- A. Basis-of-Design Product: Bobrick Washroom Equipment, Inc.
- B. See Toilet Accessory Schedule at Drawings for product list and model numbers.
- C. Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
 - 1. American Specialties, Inc.
 - 2. Bradley Corporation.

2.3 FABRICATION

- A. General: Fabricate units with tight seams and joints, and exposed edges rolled. Hang doors and access panels with full-length, continuous hinges. Equip units for concealed anchorage and with corrosion-resistant backing plates.
- B. Keys: Provide universal keys for internal access to accessories for servicing and resupplying. Provide minimum of three keys to Owner's representative.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install accessories according to manufacturers' written instructions, using fasteners appropriate to substrate indicated and recommended by unit manufacturer. Install units level, plumb, and firmly anchored in locations and at heights indicated.
- B. Grab Bars: Install to withstand a downward load of at least 250 lbf, when tested according to ASTM F 446.

3.2 ADJUSTING AND CLEANING

- A. Adjust accessories for unencumbered, smooth operation. Replace damaged or defective items.
- B. Remove temporary labels and protective coatings.
- C. Clean and polish exposed surfaces according to manufacturer's written recommendations.

END OF SECTION 10 2800

SECTION 10 4413 - FIRE EXTINGUISHER CABINETS

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. Fire protection cabinets for the following:
 - a. Portable fire extinguishers.
- B. Related Sections:
 - 1. Section 104416 "Fire Extinguishers."

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for fire protection cabinets.
 - 1. Fire Protection Cabinets: Include roughing-in dimensions, details showing mounting methods, relationships of box and trim to surrounding construction, door hardware, cabinet type, trim style, and panel style.

1.4 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For fire protection cabinets to include in maintenance manuals.

1.5 COORDINATION

- A. Coordinate size of fire protection cabinets to ensure that type and capacity of fire extinguishers indicated are accommodated.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Stainless-Steel Sheet: ASTM A 666, Type 304.

2.2 FIRE PROTECTION CABINET - FEC

- A. Cabinet Type: Suitable for fire extinguisher.
1. Products: Subject to compliance with requirements, provide one of the following:
 - a. J. L. Industries, Inc., a division of Activar Construction Products Group; JL Ambassador Series.
 - b. Equal by Larsen's Manufacturing Company
 - c. Equal by Potter Roemer LLC
- B. Cabinet Construction: Nonrated.
- C. Cabinet Material: Baked enamel steel sheet.
- D. Recessed Cabinet: Cabinet box recessed in walls of sufficient depth to suit style of trim indicated.
1. Exposed Flat Trim: One-piece combination trim and perimeter door frame overlapping surrounding wall surface with exposed trim face and wall return at outer edge (backbend).
- E. Cabinet Trim Material: Same material and finish as door.
- F. Door Material: Baked enamel-steel sheet.
- G. Door Style: Flush opaque panel, frameless, with no exposed hinges.
- H. Door Hardware: Manufacturer's standard door-operating hardware of proper type for cabinet type, trim style, and door material and style indicated.
1. Provide manufacturer's standard.
 2. Provide manufacturer's standard hinge permitting door to open 180 degrees.
- I. Accessories:
1. Mounting Bracket: Manufacturer's standard steel, designed to secure fire extinguisher to fire protection cabinet, of sizes required for types and capacities of fire extinguishers indicated, with plated or baked-enamel finish.
 2. Identification: Lettering complying with authorities having jurisdiction for letter style, size, spacing, and location. Locate as directed by Architect.

- a. Identify fire extinguisher in fire protection cabinet with the words "FIRE EXTINGUISHER."
 - 1) Location: Applied to cabinet door.
 - 2) Application Process: Pressure-sensitive vinyl letters.
 - 3) Lettering Color: Black.
 - 4) Orientation: Vertical.

J. Finishes:

1. Manufacturer's standard baked-enamel paint for the following:
 - a. Interior of cabinet and door.

2.3 FABRICATION

- A. Fire Protection Cabinets: Provide manufacturer's standard box (tub) with trim, frame, door, and hardware to suit cabinet type, trim style, and door style indicated.
 1. Weld joints and grind smooth.
 2. Provide factory-drilled mounting holes.
- B. Cabinet Doors: Fabricate doors according to manufacturer's standards, from materials indicated and coordinated with cabinet types and trim styles selected.
 1. Miter and weld perimeter door frames.

2.4 GENERAL FINISH REQUIREMENTS

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Protect mechanical finishes on exposed surfaces of fire protection cabinets from damage by applying a strippable, temporary protective covering before shipping.
- C. Finish fire protection cabinets after assembly.
- D. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.5 STAINLESS-STEEL FINISHES

- A. Surface Preparation: Remove tool and die marks and stretch lines, or blend into finish.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine walls and partitions for suitable framing depth and blocking where cabinets will be installed.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Prepare recesses for recessed fire protection cabinets as required by type and size of cabinet and trim style.

3.3 INSTALLATION

- A. General: Install fire protection cabinets in locations and at mounting heights indicated or, if not indicated, at heights indicated below:
 - 1. Fire Protection Cabinets: 34 inches above finished floor to bottom of cabinet frame.
- B. Fire Protection Cabinets: Fasten cabinets to structure, square and plumb.
 - 1. Fasten mounting brackets to inside surface of fire protection cabinets, square and plumb. Identification: Apply vinyl lettering at locations indicated.

3.4 ADJUSTING AND CLEANING

- A. Remove temporary protective coverings and strippable films, if any, as fire protection cabinets are installed unless otherwise indicated in manufacturer's written installation instructions.
- B. Adjust fire protection cabinet doors to operate easily without binding. Verify that integral locking devices operate properly.
- C. On completion of fire protection cabinet installation, clean interior and exterior surfaces as recommended by manufacturer.
- D. Touch up marred finishes, or replace fire protection cabinets that cannot be restored to factory-finished appearance. Use only materials and procedures recommended or furnished by fire protection cabinet and mounting bracket manufacturers.
- E. Replace fire protection cabinets that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 10 4413

SECTION 10 4416 - FIRE EXTINGUISHERS

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 portable, hand-carried fire extinguishers. Provide one hand-carried fire extinguisher as specified in this section in each fire extinguisher cabinet location shown in the drawings.
- B. Related Sections:
 - 1. Section 104413 "Fire Extinguisher Cabinets."

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated. Include rating and classification, material descriptions, dimensions of individual components and profiles, and finishes for fire extinguisher.

1.4 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For fire extinguishers to include in maintenance manuals.

1.5 QUALITY ASSURANCE

- A. NFPA Compliance: Fabricate and label fire extinguishers to comply with NFPA 10, "Portable Fire Extinguishers."
- B. Fire Extinguishers: Listed and labeled for type, rating, and classification by an independent testing agency acceptable to authorities having jurisdiction.
 - 1. Provide fire extinguishers approved, listed, and labeled by FMG.

1.6 COORDINATION

- A. Coordinate type and capacity of fire extinguishers with fire protection cabinets to

ensure fit and function.

PART 2 - PRODUCTS

2.1 PORTABLE, HAND-CARRIED FIRE EXTINGUISHERS

- A. Fire Extinguishers: Type, size, and capacity for each indicated.
 - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 2. Basis-of-Design Product: Subject to compliance with requirements, provide Potter Roemer 3000 Series ABC (10 pound), or comparable product by one of the following:
 - a. J. L. Industries, Inc.; a division of Activar Construction Products Group.
 - b. Larsen's Manufacturing Company.
 - c. Potter Roemer LLC.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine fire extinguishers for proper charging and tagging.
 - 1. Remove and replace damaged, defective, or undercharged fire extinguishers.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. General: Install fire extinguishers in locations indicated and in compliance with requirements of authorities having jurisdiction.

END OF SECTION 10 4416

SECTION 10 5300 – ALUMINUM CANOPIES

PART 1 - GENERAL

1.1 SUMMARY

- A. Extruded aluminum overhead cantilever-style canopies.
- B. Related Items and Considerations
 - 1. Flashing of various designs may be required.
 - 2. Determine wall construction, make-up and thickness.

1.2 QUALITY ASSURANCE

- A. Products meeting these specifications established standard of quality required.

1.3 SUBMITTALS

- A. Confirm dimensions prior to preparation of shop drawings.
- B. Submit manufacturer's standard literature and color charts for finish color selection for canopies.
- C. Submit shop drawings showing structural component locations/positions, material dimensions and details of construction and assembly including structural calculations stamped and signed by an engineer licensed in South Carolina.

1.4 DELIVER, STORAGE, HANDLING

- A. Deliver and store all canopy components in protected areas.

PART 2 - PRODUCTS

2.1 MANUFACTURER

- A. Basis of Design: Cantilever Blade Flat Soffit Lumishade by Mapes Industries, Inc., Lincoln, Nebraska, Phone 1-800-228-2391, Fax 1-800-737-6756 www.mapes.com
- B. Peachtree Protective Covers, Hiram, GA 30141, Phone 1-800-341-3325, Fax 770-439-2122 www.peachtreecovers.com
- C. Or approved equal prior to the bid.

2.2 MATERIALS

- A. Fascia shall be extruded aluminum, alloy 6063-T6, in profile as shown on drawings and thickness of manufacturer's standard.

- B. Decking shall be manufacturer's standard interlocking flat soffit formed of minimum 0.078" extruded aluminum.
- C. Attachment hardware shall match finish of decking and custom profile fascia.
- D. Fascia shall be custom extruded style (minimum .125 thick aluminum) in profile shown in drawings.
- E. Steel cantilever hanger tubes shall be provided by the canopy manufacturer.

2.3 FINISHES

- A. Aluminum; fluoropolymer finish all exposed aluminum elements, manufacturer's full range of colors may be selected without additional cost to the owner.
- B. Steel hanger tubes shall be powder coated to match the color of the aluminum elements.

2.4 FABRICATION

- A. All connections shall be mechanically assembled utilizing 3/16" fasteners with a minimum shear stress of 350 lb. Pre-welded or factory-welded connections are not acceptable.
- B. Decking shall be designed with interlocking extruded aluminum members with mechanical fasteners field applied to provide structural integrity for the completed assembly.
- C. Concealed drainage. Water shall drain from covered surfaces into integral fascia gutter and directed to the front for front drainage.

PART 3 - EXECUTION

3.1 INSPECTION

- A. Confirm that surrounding area is ready for the canopy installation.
- B. Installer shall confirm dimensions and elevations to be as shown on drawings provided by manufacturer.
- C. Erection shall be performed by an approved installer and scheduled after all concrete, masonry and roofing in the area is completed.
- D. Erection shall result in proper alignment with surrounding construction per the drawings.

3.2 INSTALLATION

- A. Installation shall be in strict accordance with manufacturer's shop drawings. Particular attention should be given to protecting the finish during handling and erection.
- B. After installation, entire system shall be left in a clean condition with any manufacturer's stickers or labels removed and surfaces cleaned to not show any residue.

END OF SECTION

SECTION 11 1320 - PROJECTION SCREENS AND PROJECTOR LIFTS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes front-projection screens and ceiling mounted projector lifts
- B. See Division 16 Sections for electrical service and connections including metal device boxes for switches and conduit, where required, for low-voltage control wiring.

1.2 SUBMITTALS

- A. Product Data: For each type of screen indicated.
- B. Shop Drawings: Show layouts and types of projection screens and lifts. Include the following:
 - 1. Location of screen centerline relative to ends of screen case.
 - 2. Location of wiring connections.
 - 3. Location of seams in viewing surfaces.
 - 4. Connections to supporting structure for pendant- and recess-mounted screens.
 - 5. Anchorage details.
 - 6. Wiring Diagrams: For electrically operated units.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
 - 1. Products: Subject to compliance with requirements, provide one of the products specified.

2.2 FRONT-PROJECTION ELECTRIC SCREENS

- A. Electrically Operated Screens, General: Manufacturer's standard units consisting of case, screen, motor, controls, mounting accessories, and other components necessary for a complete installation.
 - 1. Low-Voltage Control: System consisting of a control unit with 24-V power supply, remote 3-button or 3-position switches, and interconnecting wiring.
 - a. Provide infrared remote control consisting of battery-powered transmitter and receiver for use with low-voltage control system.
 - 2. End-Mounted Motor: Instant-reversing, gear-drive motor with permanently lubricated ball bearings, automatic thermal-overload protection, preset limit switches, and positive-stop action to prevent coasting.
- B. Recessed, Electrically Operated Screens with Automatic Ceiling Closure: Motor in roller units designed and fabricated for recessed installation in ceiling; with bottom of case composed of two panels: one panel designed to open and close automatically, the other removable or openable for access to interior of case.

1. Products:
 - a. Da-Lite Screen Co., Inc.; Tensioned Advantage Electrol, Da-Matt White (Basis of Design)
 - b. Draper Inc
 - c. Stewart Filmscreen Corporation

- C. Screen Material and Viewing Surface:
 1. Matte-White Viewing Surface: Peak gain of 0.9 to 1.0, and gain of not less than 0.8 at an angle of 50 degrees from the axis of the screen surface.
 2. Seamless Construction: Provide screens, in sizes indicated, without seams.
 3. Edge Treatment:
 - a. Black masking borders and at extra drop lengths.
 - b. Each side of the fabric to have tab guide cable system to maintain even lateral tension and hold surface flat with custom slat bar with added weight to maintain vertical tension on the screen surface. The ends of the aluminum slat to be protected by heavy duty plastic plugs.
 4. Size of Viewing Surface in Video Format as follows:
 - a. At Conference Room #106 Da-Lite "84349" Viewing Area: 87"x116" with 30" extra drop length (black) at top.

2.3 PROJECTOR LIFTS

- A. Recessed, concealed ceiling mounted projector lifts
 1. Products:
 - a. Display Devices (www.displaydevices.com), LCD 100 series
 - b. Draper Inc

- B. Lowering Distance: 10 feet for service.

- C. Provide programmable wired hand-held remote and wall plate remote.

- D. Provide Non-Plenum Rated Housing With Lipless Closure Frame. Support framework and closure frame for drop tile ceilings with non-plenum requirements. Provides minimal seam around projector opening. Includes ceiling closure, spring-loaded and fully adjustable.

- E. Locking Wall Plate Remote wired control panel with security key lock. 2-gang, white

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install front-projection screens with screen cases in position and in relation to adjoining construction indicated. Securely anchor to supporting substrate in a manner that produces a smoothly operating screen with vertical edges plumb and viewing surface flat when screen is lowered.
 1. Install low-voltage controls according to NFPA 70 and manufacturer's written instructions.

- a. Wiring Method: Install wiring in raceway except in accessible ceiling spaces and in gypsum board partitions where unenclosed wiring method may be used. Use UL-listed plenum cable in environmental air spaces, including plenum ceilings. Conceal raceway and cables except in unfinished spaces.
 2. Test electrically operated units to verify that screen controls, limit switches, closure, and other operating components are in optimum functioning condition.
- B. Install projector lifts so that in closed position, the panel is flush with adjacent ceiling. Coordinate with Owner and Projector Screen for other preset heights. Make full connections.

END OF SECTION 11 1320

Section 12 4920 – 2” Horizontal Faux Wood Blinds

PART 1 – GENERAL

1.01 SCOPE

- A. SUPPLIER: Furnish and install 2” Horizontal Non FR Faux Wood Blinds (Premium Quality)
- B. RELATED WORK SPECIFIED ELSEWHERE:
 - 1. Section 06100: Rough Carpentry
 - 2. Section 08552: Aluminum Clad Wood Double Hung and Fixed Windows

1.02 REFERENCES

- A. FLAME-RESISTANT HEADRAIL AND COMPONENTS CONTAINED WITHIN SHALL PASS OR EXCEED ONE OR MORE OF THE FOLLOWING TESTS:
 - National Fire Protection Association (NFPA) 701 (small scale for horizontal applications)
 - Department of Transportation Motor Vehicle Safety Standard 302 Flammability of Interior Materials
 - California Administrative Code Title 19
 - Federal Standard 191 Method 5903 (used by Port Authority of New York and New Jersey for drapery, curtain, and upholstery material)
 - Boston Fire Department Test BFD IX-1
 - New York State Uniform Fire Prevention and Building Code

1.03 SUBMITTALS

- A. PRODUCT DATA: Manufacturer’s descriptive literature shall be submitted indicating materials, finishes, construction and installation instructions and verifying that product meets requirements specified. Manufacturer’s recommendations for maintenance and cleaning shall be included.
- B. DRAWINGS AND DIAGRAMS: Wiring diagrams of any motorized components or units, working and assembly drawings shall be supplied as requested.
- C. SAMPLE: Responsible contracting officer or agent shall supply one sample shade of each type specified in this contract for approval. Supplied units shall be furnished complete with all required components, mounting and associated hardware, instructions and warranty.

1.04 QUALITY ASSURANCE:

- A. Supplier: Manufacturer, subsidiary or licensed agent shall be approved to supply the products specified, and to honor any claims against product presented in accordance with warranty.
- B. INSTALLER: Installer or agent shall be qualified to install specified products by prior experience, demonstrated performance and acceptance of requirements of manufacturer, subsidiary, or licensed agent. Installer shall be responsible for an acceptable installation.
- C. UNIFORMITY: Provide 2” Horizontal Faux Wood Blind of only one manufacturer for entire project.

1.05 DELIVERY, STORAGE AND HANDLING:

- A. Product shall be delivered to site in manufacturer’s original packaging.
- B. Product shall be handled and stored to prevent damage to materials, finishes and operating mechanisms.

1.06 JOB CONDITIONS:

- A. Prior to shade installation, building shall be enclosed.
- B. Interior temperature shall be maintained between 60° F. and 90° F. during and after installation; relative humidity shall not exceed 80%. Wet work shall be complete and dry.

1.07 WARRANTY:

- A. Lifetime Limited Warranty. Specific product warranties available from manufacturer or its authorized agent.

PART 2 – PRODUCTS

2.01 ACCEPTABLE MANUFACTURER

- A. **Hunter Douglas Architectural / 13915 Danielson St., Ste.100/ Poway, CA 92064/ Phone: 800-727-8953 Fax: 800-205-9819/ Website: <http://www.HDarchitectural.com/>**, or architect approved equivalent.
- B. Product matching these specifications by Kirsch
- C. Product substitutions must be approved by architect minimum.

2.02 2” HORIZONTAL FAUX WOOD BLINDS

- A. PRODUCT: **Hunter Douglas “EverWood® 2” Horizontal Faux Wood Blind”**
- B. MATERIALS:
 - 1. SLATS: 2” wide x 0.125” thick polystyrene based polymer with consistent color throughout eliminating slat end touch-up. Furnish not less than nominal 7.2 slats per foot to ensure tight closure and light control. Finish with manufacturer’s standard colors selected by architect from manufacturer’s available contract colors.
 - 2. SLAT SUPPORT: Braided ladders of 100% polyester yarn color compatible with slats and spacing of ladder no more than 16”. Optional cloth tapes constructed of high strength polyester-cotton blend webbing and spacing of no more than 16”. Tapes spaced to comply with industry standards for size and weight of blind.
 - 3. HEADRAIL: U-shaped profile with rolled edges, measuring 1 1/2” x 2 1/4” x .024” constructed of corrosion resistant steel and providing a sleek low profile design. Internally fit with components required for specified performance and designed for smooth, quiet, trouble-free operation. Headrail finish to be standard baked-on polyester and to coordinate with slats. Ends fitted with zinc-coated steel end lock with adjustable tab for centering blinds.

4. BOTTOM RAIL: 2" wide x 9/16" thick polystyrene trapezoid in shape. Color-coordinated engineered polymer tape buttons secure the ladder and cord. Finish to be manufacturers standard colors or stained finish to match slats.
5. LIFTING MECHANISM: Engineering polymer and galvanized steel housing cordlocks with polymer roller bearing and steel locking dogs, two-ply polyester cord filler in braided polyester jacket lift cords meet or exceed commercial specification 1029.86, and fracture-resistant polymer cord-stop color-coordinated to slat. Located on either side of individual blind unit as per architect's request.
6. TILTING MECHANISM: Permanently lubricated and fully enclosed standard cord tilt holds and tilts slats at any angle. Solid steel, corrosion resistant tilt rod. Optional wand tilt of worm and gear construction incorporated into tilter mechanism.
7. OPTIONAL TILT CONTROL WAND: Rounded 3/8" diameter constructed of quality selected hardwood stained and lacquered or painted to match slats and detachable without tools. Located on either side of individual blind unit as per architect's request.
8. MOUNTING HARDWARE: Manufacturer's standard .030" steel box brackets with baked-on polyester finish to match headrail with additional support brackets for blinds over 48" wide.
9. VALANCE: Crafted polystyrene based polymer with finish to match slats.

2.03 FABRICATION

- A. Blind measurements shall be accurate to within $\pm 1/8"$ or as recommended in writing by manufacturer.

2.04 FINISHES

- A. SLAT finish selection from the following: color to be selected
- B. SLAT SUPPORT braided ladders shall be color coordinated with slat. Optional 1.5" solid cloth tapes available colors: to be selected

PART 3 - EXECUTION

3.01 INSPECTION:

- A. SUBCONTRACTOR shall be responsible for inspection on site, approval of mounting surfaces, installation conditions and field measurement for this work.
- B. OTHER INTERACTING TRADES shall receive drawings of shade systems, dimensions, assembly and installation methods from subcontractor upon request.

3.02 INSTALLATION:

- A. INSTALLATION shall comply with manufacturer's specifications, standards and procedures as detailed on contract drawings.
- B. ADEQUATE CLEARANCE shall be provided to permit unencumbered operation of shade and hardware.
- C. CLEAN finish installation of dirt and finger marks. Leave work area clean and free of debris.

3.03 DEMONSTRATION:

- A. Demonstrate operation method and instruct owner's personnel in the proper operation and maintenance of the blinds.

3.04 SCHEDULE:

- A. EXTERIOR WINDOWS:

END OF SECTION

SECTION 12 4940 - ROLLER SHADES

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes motorized roller shades with shade operators as shown on Contract Drawings.
- B. See Division 16 Sections for electrical service and connections for motorized shade operation.

1.2 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: Include plans, elevations, sections, details, details of installation, operational clearances, wiring diagrams, and relationship to adjoining Work.
 - 1. Verify dimensions by field measurements before fabrication and indicate measurements on Shop Drawings.
- C. Coordination Drawings: Drawn to scale and coordinating penetrations and ceiling-mounted items.
- D. Samples: For each exposed finish and for each color and texture required.
- E. Window Treatment Schedule: Use same room designations indicated on Drawings.
- F. Maintenance data.

1.3 QUALITY ASSURANCE

- A. Installer Qualifications: A qualified installer, approved by manufacturer to install manufacturer's products.
- B. Roller Shades Fire-Test-Response Characteristics: Provide products passing flame-resistance testing according to NFPA 701 by a testing agency acceptable to authorities having jurisdiction.
- C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- D. Corded Window Covering Product Standard: Comply with WCMA A 100.1.

PART 2 - PRODUCTS

2.1 ROLLER SHADES

- A. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
- B. Products: Subject to compliance with requirements, provide one of the following:
 - 1. MechoShade Systems, Inc.; Electro Shade.
 - 2. Lutron Electronics Co. Inc.; Sivoia.
 - 3. Approved equal
- C. Finishes:
 - 1. Shade Band Material: Color, texture, and pattern as selected from manufacturer's full range similar to Lutron, "Sheer-Shade", dual-sided fiberglass.
 - 2. Valance: Color as selected from manufacturer's full range.
 - 3. Metal and Plastic Components Exposed to View: Color matching or coordinating with shade band color, unless otherwise indicated.
- D. Shade Band Material: PVC-coated fiberglass.
 - 1. Material Width: Full width of window.
 - 2. Material Solar Optical Properties: Blackout material.
 - 3. Material Openness Factor: 1.0 – 2.0%.
 - 4. Material UV Blockage: 100 percent.
- E. Rollers: Electrogalvanized or epoxy primed steel or extruded-aluminum tube of diameter and wall thickness required to support and fit internal components of operating system and the weight and width of shade band material without sagging; designed to be easily removable from support brackets.
 - 1. Shade Material Attachment: Manufacturer's standard method for attaching shade material to roller.
 - 2. Direction of Roll: As shown.
- F. Mounting Brackets: Fascia end caps, fabricated from steel finished to match fascia or headbox.
- G. Pocket-Style Headbox: U-shaped, formed-steel sheet or extruded aluminum; long edges returned or rolled; with bottom cover consisting of slot opening of minimum dimension to allow lowering and raising of shade and removable or openable, continuous metal access panel concealing shade roller, brackets, and operating hardware and operators within.
- H. Bottom Bar: Steel or extruded aluminum with plastic or metal capped ends and with concealed weight bar as required for smooth, properly balanced shade operation.
 - 1. Type: Concealed, by pocket of shade material, internal.
- I. Shade Operation: Motorized or manual operator as shown on drawings.
- J. Valance: In style as selected from manufacturers full range.

- K. Mounting: As indicated, permitting easy removal and replacement without damaging roller shade or adjacent surfaces and finishes.

2.2 FABRICATION

- A. Product Description: Roller shade consisting of roller, a means of supporting roller, flexible sheet or band of material carried by roller, a means of attaching material to roller, bottom bar, and operating mechanism that lifts and lowers the shade.
- B. Concealed Components: Noncorrodible or corrosion-resistant-coated materials.
 - 1. Lifting Mechanism: With permanently lubricated moving parts.
- C. Unit Sizes: Obtain units fabricated in sizes to fill window and other openings as follows, measured at 74 deg F (23 deg C):
 - 1. Shade Units Installed between (Inside) Jambs: Edge of shade not more than 1/4 inch (6 mm) from face of jamb. Length equal to head to sill dimension of opening in which each shade is installed.
- D. Installation Brackets: Designed for easy removal and reinstallation of shade, for supporting headbox, roller, and operating hardware and for hardware position and shade mounting method indicated.
- E. Installation Fasteners: Not fewer than two fasteners per bracket, fabricated from metal noncorrosive to shade hardware and adjoining construction; type designed for securing to supporting substrate; and supporting shades and accessories under conditions of normal use.

2.3 MOTORIZED ROLLER SHADE OPERATORS

- A. General:
 - 1. Factory-assembled motorized shade operation systems designed for lifting shades of type, size, weight, construction, use, and operation frequency indicated and of size and capacity and with features, characteristics, and accessories suitable for Project conditions and recommended by shade manufacturer.
 - 2. Include electric motors and factory-prewired motor controls, remote-control stations, remote-control devices, power disconnect switches, enclosures protecting controls and all operating parts, and accessories required for reliable operation without malfunction.
 - 3. Include wiring from motor controls to motors. Coordinate operator wiring requirements and electrical characteristics with the building electrical system.
 - 4. Comply with NFPA 70.
- B. Control Equipment: Comply with NEMA ICS 1, NEMA ICS 2, and NEMA ICS 6 with NFPA 70 Class 2 control circuit, maximum 24-V ac or dc.
- C. Electric Motors: UL-approved or -recognized, asynchronous, totally enclosed, insulated, capacitor-start motors, complying with NEMA MG 1, with thermal-overload protection, brake, permanently lubricated bearings, and limit switches; sized by shade manufacturer to start and operate size and weight of shade considering service factor or considering Project's service conditions without exceeding nameplate ratings.

1. Service Factor: According to NEMA MG 1, unless otherwise indicated.
 2. Motor Characteristics: Single phase, 24 V, 60 Hz.
 3. Motor Mounting: Within manufacturer's standard roller enclosure.
- D. Remote Controls: Electric controls with NEMA ICS 6, Type 1 enclosure.
1. Mounting: Recessed or flush.
 2. GroupControl Stations: Keyed Rocker switch.
 3. Radio Controls: To interface with Owner's Control system.
 4. Microprocessor Controls: Electronic programmable means for setting, changing, and adjusting control features and isolated from voltage spikes and surges.
- E. Limit Switches: Adjustable switches, interlocked with motor controls and set to automatically stop shade at fully raised and fully lowered positions.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install roller shades level, plumb, square, and true according to manufacturer's written instructions. Allow clearances for window operation hardware.
1. Location: As shown.
- B. Connections: Connect motorized operators to building electrical system.
- C. Adjusting: Adjust roller shades to operate smoothly, easily, safely, and free from binding or malfunction throughout entire operational range.
- D. Cleaning: Clean roller shade surfaces after installation, according to manufacturer's written instructions.

3.2 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain systems. Refer to Division 1 Section "Closeout Procedures" and "Demonstration and Training."

END OF SECTION 12494

SECTION 220500 - PLUMBING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. The drawings and general provisions of the Contract, including General and Supplementary Conditions, General Requirements and all other Specification Sections apply to the work specified in this section. In the event of conflict between specific requirements of the various documents, the more restrictive, the more extensive (i.e.: more expensive) requirement shall govern.

1.2 SCOPE

- A. This section includes the storm, soil, waste, drain, vent and domestic water systems from their source of supply or point of disposal to and including their connection to equipment and fixtures.
- B. Contractor shall coordinate required water, foundation drainage, storm, and sanitary services with the general contractor. Contractor shall perform all work within the building and to a point five (5) feet from the building wall and shall be coordinated with civil work.
- C. The requirements of Division 23, Sections "Mechanical and Electrical General Provisions" shall apply to all work specified under this section. Sterilization shall comply with Section 610 of the 2015 International Plumbing Code.
- D. Roof and overflow drains shall be furnished by plumbing contractor, installed by roofing contractor. Vents through roof shall be installed by plumbing contractor. Roofing contractor(s) shall be responsible for flashing all roof penetrations thru roof systems to maintain warranties.

1.3 CODES

- A. All plumbing work shall comply with the 2015 International Plumbing Code and the regulations of the South Carolina Department of Health and Environmental Control (DHEC), and the State of South Carolina. Obtain all approvals before starting plumbing work. Request all inspections during the course of work.
- B. Installation shall meet the regulations contained in the Safe Drinking Water Act (SDWA) concerning lead and copper concentrations.
- C. All residential type faucets, electric water coolers and drinking fountains shall meet the requirements of NSF Standard 61, Section 9.

1.4 QUALITY ASSURANCE

- A. All building domestic and service water heating systems shall meet the mandatory provisions

for performance as documented in ASHRAE 90.1-2007 Section 7.4. The minimum performance requirements listed in ASHRAE 90.1-2007 Table 7.8 must be met.

1.5 SERVICES

- A. Contractor shall arrange for and coordinate water, foundation drainage, storm, and sanitary services. Contractor shall perform all work within the building and to a point five (5) feet from the building wall and shall be coordinated with civil work. The building water main, foundation drainage, sanitary and storm sewers shall connect to site water mains and sewers provided under another Division.
- B. Contractor shall arrange and pay for all permits required for service connections.
- C. Before any sewer work is done inside the property line, the Contractor shall uncover each street sewer at the point of connection and shall determine the actual sewer elevation. If actual elevation is such that the drainage systems cannot be installed as shown, notify the Architect before proceeding with any work.

1.6 EQUIPMENT CONNECTIONS

- A. Provide all plumbing connections required by equipment which is provided on this project. Certain items of equipment shall be provided under this section and certain items will be furnished and set under other sections of the specifications. In all cases, provide valved water supplies, waste and vent lines, and, unless noted otherwise, make final connections after equipment is in place.

PART 2 - PRODUCTS

2.1 PIPE, VALVES AND FITTINGS

- A. Provide materials as hereinbefore specified in Division 23, Section "Basic Materials and Methods". All floor, wall and ceiling penetrations for piping shall be sealed with appropriate sealant.
- B. Unions or flanges shall be provided at all connections to each piece of plumbing equipment and on both sides of valves and other in-line devices that require removal for maintenance. Bronze adaptors shall be used at all copper to flanged or IPS connections.

2.2 CLEANOUTS

- A. Cleanouts shall be placed in piping throughout the building, where noted and where required by code and at not greater than seventy five (75) foot intervals. Cleanouts on piping below floors, at ends of runs and changes of direction of piping shall consist of Y branches, the full size of pipes to which they are connected with cleanout plugs and covers as listed below or as detailed. Extend cleanouts on concealed piping to finished walls, floors and grade. Cleanouts shall be Josam, Zurn or J.R. Smith equal to Josam numbers indicated below.

- B. In concrete floors on grade (generally) - Series 55000-1-SQ cleanout with scoriated square satin nikaloy top, bronze cleanout plug with gasket seal, and adjustable frame.
- C. At base of vertical piping and in walls - Series 58910-Z cleanout tee with countersunk bronze threaded plug. Where risers are concealed, provide Series 58760 cleanout tee with plug and nickel satin access cover and frame.
- D. Cleanouts on exposed and above ceiling horizontal piping shall be Series 58900 with bronze threaded plug.
- E. Cleanouts in exterior underground piping shall be countersunk set in four (4) inch extra heavy cast iron pipe extension to grade. Provide Josam Series 58360 set in twelve (12) inches by twelve (12) inches by eight (8) inches concrete finished flush with grade.
- F. Cleanouts in waterproofed equipment rooms - Series 58460A with bronze plug.
- G. Provide cleanouts in each exposed P-trap not integral with the fixture.
- H. Clean-outs shall be the same nominal size of the pipe for sizes 4" and smaller and 4" nominal size for larger pipe.

2.3 DRAINS

- A. Drains installed where water-proofing membranes exist shall have a flashing clamp device.
 - 1. Provide drains where indicated. Drains shall be J. R. Smith, Josam or Zurn equal to J. R. Smith equipment as follows:

Floor Drains (FDR)	J. R. Smith 2005
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 - 2. Floor drains installed where people walk shall have a grate to prevent people from falling into the sink.
 - 3. Drains receiving indirect waste shall be provided with ½ grates as required to receive discharge without splashing.

2.4 ELECTRIC DOMESTIC WATER HEATER (STORAGE TYPE)

- A. The heater(s) shall be commercial electric water heater manufactured by State Industries, AO Smith, or Patterson-Kelley equal to State Industries Patriot PCE Series. Unit shall be capable of providing the capacities as scheduled on the drawings, listed by Underwriters' Laboratories and approved to the NSF Standard 5 by UL. Heater shall meet or exceed the requirements of ASHRAE 90.1b -1992 and ASHRAE/IESNA 90.1-2007.
- B. Heater(s) shall have 150 psi working pressure and be equipped with extruded high-density anode rod.
- C. All internal surfaces of the heater(s) exposed to water shall be glass-lined with an alkaline borosilicate composition that has been fused-to-steel by firing at a temperature range of 1600°F. The outer jacket shall be of baked enamel finish and shall be provided with full size control

compartment for performance of service and maintenance through hinged front panel and shall enclose the tank with foam insulation. The drain valve shall be located in the front for ease of servicing.

- D. Electric heating elements shall be medium watt density with zinc-plated copper sheath or Incoloy sheath. Each element shall be controlled by an individually mounted thermostat and high temperature cut-off switch. All internal circuits shall be fused. Electrical junction box with heavy duty terminal block shall be provided.
- E. Heater tank shall have a three year limited warranty as outlined in the written warranty. CSA Certified and ASME rated temperature and pressure relief valve shall be factory-installed. Fully illustrated instruction manual shall be included.
- F. Suspended water heaters shall be supported by an engineered suspended platform equal to Hubbard Enterprises Holdrite Model 50-SWHP. Platform shall be of constructed of galvanized steel, factory assembled, water-tight, with CPVC drain fitting (transition to copper for extension to drain) and seismic cross braces. Platform shall be capable of supporting up to 600 lb with 3/8" threaded hanger rod.

2.5 DOMESTIC WATER THERMAL EXPANSION TANKS

- A. Pressurized diaphragm or bladder type expansion tank shall be provided for the domestic water system, where indicated on the drawings. Pressurized diaphragm type expansion tanks as manufactured by Amtrol or Taco equal to Amtrol Therm-X-Trol Series shall be provided. Capacities shall be as indicated. Each tank and system shall be air precharged to the initial fill pressure of its respective system, suitable for a maximum working pressure of 125 pounds per square inch gauge (psig). All internal parts must comply with FDA regulations and approvals. The tank shall be supported by steel legs or a base (integral ring mount) for a vertical installation. Each tank shall have a steel shell and an internal butyl/EPDM diaphragm or butyl bladder with code approvals NSF/ANSI 61 used to isolate the air charge from fluid.. Provide air charger tank connection.

2.6 HOT WATER CIRCULATOR

- A. Refer to Pumps specification in Division 23, Section "Heating and Air-Conditioning Equipment".
- B. Pump for domestic water systems and indicated as Type "B" or Type "C" in the Pump specification shall be Bell and Gossett, Taco, or Thrush in-line circulator of capacity indicated on drawings. Pump shall be suitable for continuous operation with 200 degrees Fahrenheit water and shall be all bronze construction.
- C. Pump shall also meet all requirements as hereinafter specified in Division 23, Section "Heating and Air-Conditioning Equipment".

2.7 PLUMBING FIXTURES

- A. Provide all plumbing fixtures indicated on the drawings and as specified herein. All exposed

metal parts of all fixtures, including all trim and fittings, shall be brass, chromium plated. Each hot and cold water connection to each fixture shall be provided with a stop valve and all nipples shall be chrome plated red brass. Provide backflow devices on all faucets and fittings requiring same. Devices may be inline type when not provided integral with the faucet. All faucet handles, where possible, shall have color coded "indexes" identifying the service used. All "serrated" or slip hose connection spout outlets shall have Allen wrench operated volume controls to control "splashing" of water as it hits sink bottoms. Water supplies for handicapped lavatories and sinks shall be insulated. Waste line for handicapped lavatories and sinks shall be offset and insulated. Refer to Division 23, Section "Mechanical Insulation" for insulation type and thickness.

- B. Water supplies for handicapped water closets shall be roughed-in for flush valve handles to be operated from the accessible side of the water closet. The Contractor shall coordinate and provide flush handles on the accessible side of all handicapped water closets. Provide offset flush connection as required to coordinate with wall mounted grab bars" to all ADA water closets with flush valves.
- C. The Contractor shall provide metal supports necessary to adequately and substantially hang and set all fixtures subject to the approval of the Architect. No wood grounds, wood plugs, or expansion bolts shall be permitted for fixture support. Provide carriers where specified below and as required to hang fixtures.
- D. Insulate all exposed piping under lavatories and sinks with a white, fitted/molded antimicrobial undersink pipe cover equal to Truebro Lav Guard 2. Cover shall have internal, E-Z Tear-To-Fit trim feature for square, clean trimming (internal ribs) and built-in, concealed E-Z Grip fasteners (no cable-tie fasteners allowed).
- E. Water-Conserving Fixtures: Plumbing fixtures and fittings shall use in aggregate at least 30% less water than the water use baseline calculated for the building after meeting the Energy Policy Act of 1992 fixture performance requirements. Flow and flush rates shall not exceed the following:
 - 1. Toilets: no more than 1.3 gallons per flush and have documented bowl evacuation capability per MaP testing of at least 400 grams.
 - 2. Urinals: no more than 0.13 gallons per flush or use.
 - 3. Lavatory Faucets: 0.35 gpm with automatic faucet controls.
 - 4. Showerheads: no more than 1.5 gpm.
- F. Acceptable Manufacturers
 - 1. Fixture shall be Sloan, American Standard, Crane or Kohler, equal to American Standard or other manufacturer of the types listed below.
 - 2. Flush valves shall be Zurn, Sloan, Delany or Cambridge Brass, equal to Sloan of the types listed below.
 - 3. Faucets shall be Sloan, Kohler, Chicago Faucet, T & S Brass, Crane, Eljer or American Standard equal to Sloan of the types listed below.
 - 4. Drinking fountains shall be Elkay, Oasis or Halsey Taylor equal to Elkay of the types listed below.
 - 5. Toilet seats shall be Bemis (Church), Beneke, Sperzel equal to Church of the types listed below.

G. Fixtures:

1. P-1 Water Closet:

Fixture: American Standard 3351.511; low consumption, high efficiency toilet

Flush Valve: American Standard 6065.111; (top spud) exposed, sensor activated, battery powered, low consumption water closet flushometer with courtesy flush override button.

Seat: Church No. 9500CT, open front

Carrier: Josam Series 12000

Remarks: Wall mounted, elongated bowl, vitreous china, 1-1/2" inlet, 15" rim height.

2. P-1a Water Closet:

Fixture: American Standard 3351.511; low consumption, high efficiency toilet

Flush Valve: American Standard 6065.111; (top spud) exposed, sensor activated, battery powered, low consumption water closet flushometer with courtesy flush override button.

Seat: Church No. 9500CT, open front

Carrier: Josam Series 12000

Remarks: Wall mounted, elongated bowl, vitreous china, 1-1/2" inlet. Installation shall meet the American with Disabilities Act guidelines and ANSI A117.1 Accessible and Usable Buildings and Facilities (17" rim height).

3. P-2 Urinal:

Fixture: American Standard 6590.525; low consumption, ultra high efficiency urinal at 0.125 gallons per flush

Flush Valve: American Standard 6063.013 (top spud) exposed, sensor activated, battery powered, low consumption urinal flushometer with courtesy flush override button

Carrier: Josam Series 17810

Remarks: Vitreous China 3/4" Inlet

4. P-3 Lavatory:

Fixture: MR Direct – Model 909; copper undermount sink 16 3/4"x13 3/4"x5 1/2", hammered finish, center drain, scratch resistant. Copper sink drain.

Faucet: American Standard 6055.165; 0.5 GPM sensor activated, battery powered, pressure compensating, vandal-resistant, non-aerated spray.

Strainer: McGuire 155-WC cast brass chrome plated offset wheelchair with polished chrome cast brass elbow, 17 gauge 1-1/4 inch seamless brass offset tailpiece, heavy rubber basin washer and fiber friction washer. Offset lavatory strainer shall be in compliance with CSA or other recognized testing authority and bear both manufacturer and testing mark.

Trap: McGuire 8872 cast brass chrome plated 1-1/4" x 1-1/4" P-trap with cleanout with 17 gauge tubular wall bend, cast brass slip nuts. Trap shall be in compliance with CSA and bear both manufacturer and testing mark.

Supplies and Stops: Chicago Faucet No. 1006 with 1-100xtjknf cartridge , 1/4 turn, ball valve type angle stop fitting.

Remarks: Contractor shall verify and coordinate rough-in locations.

5. P-4 Kitchen Sink:

Fixture: American Standard 14SB.251900.073; undermount, 18 gauge stainless steel, single bowl sink, 24 3/4"x18 3/4"x9"

Faucet: American Standard 6409.180; top mount faucet with 8" gooseneck spout and laminar flow in spout base field-convertible rigid / swivel gooseneck spout. Vandal-resistant metal wrist blade handles with red/blue indexes. 1.5 gpm pressure compensating laminar flow device in the base of the spout. Plain spout end.

Strainer: McGuire 155-WC cast brass chrome plated offset wheelchair strainer with polished chrome cast brass elbow, 17 gauge 1-1/4 inch seamless brass offset tailpiece, heavy rubber basin washer and fiber friction washer. Offset lavatory strainer shall be in compliance with CSA or other recognized testing authority and bear both manufacturer and testing mark

Trap: McGuire 8872 cast brass chrome plated 1-1/4" x 1-1/4" P-trap with cleanout with 17 gauge tubular wall bend, cast brass slip nuts. Trap shall be in compliance with CSA and bear both manufacturer and testing mark.

Supplies and Stops: Chicago Faucet No. 1006 with 1-100xtjknf cartridge , 1/4 turn, ball valve type angle stop fitting.

Remarks: Contractor shall verify and coordinate rough-in locations.

6. P-5 Janitor Sink:
- Fixture: American Standard Florwell Service Sink 7745.811; enameled cast iron, 3" outlet, corner model, 28"x28"x13"
- Faucet: American Standard 8351.076; exposed yoke wall-mount utility faucet 3" cast brass spout with vacuum breaker. Ceramic disc valves. Integral supply stops. Offset shanks with integral check valves. Vandal-resistant metal lever handles. Bucket hook. 3/4" Threaded hose end. 1/2" NPT female inlets. Adjustable centers to-centers: 6" - 10"
- Strainer: Included with the fixture
7. P-6 Electric Water Cooler:
- Fixture: Elkay LMABFTL8WS; Self-contained, wall hung refrigerated water cooler with bottle filling station. Shall deliver 8 GPH of 50°F drinking water at 90°F ambient and 80°F inlet water. Lower units shall have mechanically-activated pushbar operation. Bottle filling unit shall include an electronic sensor for touchless activation with auto 20-second shut-off timer. Shall include displaying count of plastic bottles saved from waste. Bottle filler shall provide 1.1-1.5 gpm flow rate with laminar flow to minimize splashing. Shall include a 3000-gallon capacity filter, certified to NSF/ANSI 42 and 53, with visual monitor to indicate when replacement is necessary. Shall include integrated silver ion anti-microbial protection in key areas. Unit shall meet ADA guidelines. Unit shall be lead-free design which is certified to NSF/ANSI 61 and 372 and meets Federal and State low-lead requirements. Unit shall be certified to UL399 and CAN/CSA 22.2 No. 120.
8. P-7 Shower:
- Fixture: Symmons 9605-PLR-2.0; Shower/hand shower system powered by a temptrol pressure balancing valve. Features adjustable stop screw to limit handle turn, 36" slide bar, separate two function diverter, in-line vacuum breaker, 60" flexible metal hose, ADA hand shower, 1mode showerhead with easy to clean rubber nozzles and standard 2.5 gpm flow restrictors. Components made from metal and nonmetallic materials plated in standard polished chrome finish.
- Drain: Kohler K-9135; Tile-in shower drain, Brass and PVC construction, through-the-floor tile-in installation, removable grid plate, reversible collar to accommodate a variety of tile thicknesses
9. P-8 Service Sink:
- Fixture: Elkay B2C24X24X; 12" deep two compartment stainless steel sink, no drainboard, 9" backsplash, 18 gauge, 300 series

	stainless steel top and bowl, galvanized legs & adjustable feet, raised 1 1/2" rolled edge, includes 3 1/2" basket strainer
Faucet:	American Standard 7293.252.F15; wall mount sink faucet; durable brass construction throughout. Amarilis 1/4 turn washerless ceramic disc valve cartridges. One-half inch NPT female inlets with brass coupling nuts. Brass gooseneck swivel spout (360° rotation), 1.5 gpm, maximum flow rate.
Strainer:	McGuire 155-WC cast brass chrome plated offset wheelchair strainer with polished chrome cast brass elbow, 17 gauge 1-1/4 inch seamless brass offset tailpiece, heavy rubber basin washer and fiber friction washer. Offset lavatory strainer shall be in compliance with CSA or other recognized testing authority and bear both manufacturer and testing mark
Trap:	McGuire 8872 cast brass chrome plated 1-1/4" x 1-1/4" P-trap with cleanout with 17 gauge tubular wall bend, cast brass slip nuts. Trap shall be in compliance with CSA and bear both manufacturer and testing mark.
Supplies and Stops:	Chicago Faucet No. 1006 with 1-100xtjknf cartridge , 1/4 turn, ball valve type angle stop fitting.
Remarks:	Contractor shall verify and coordinate rough-in locations.

2.8 SPECIALTIES

A. Hose Bibcocks and Wall Hydrants

1. Hose bibcocks shall be freeze protected with an escutcheon plate on the wall.
2. Hose bibcocks, including wall hydrants and sill cocks shall be equipped with a vacuum breaker as per instructions from the S.C. Department of Health and Environmental Control (DHEC).
3. Interior hose bibcocks shall be Kohler 1-8980, 3/4" brass, with wheel handle, to fit standard garden hose.
4. Exterior hose bibcock shall be Watts No. NFB.
5. Exterior wall hydrants shall be Josam Series 71000-54-74-95, Watts No. NFB or approved equal, non-freeze type with union elbow assembly and cylinder vandal-proof lock.
6. Indoor wall hydrants shall be Josam Series 71020-54-74-92 or approved equal, with union elbow assembly and cylinder vandal-proof lock.

B. Shock Absorbers

1. Provide Josam, Watts or Zurn shock absorbers/arrestors equal to Josam 1480/1481 where indicated and as required by code and sized in accordance with PDI Standard WH 201.
2. Shock absorbers shall be the same size as the line on which they are installed, up to 1" pipe size. Pipe lines larger than 1" shall have one inch shock absorbers installed.
3. Shock absorbers shall be installed at the end of all branch lines and as indicated on the

- drawings.
4. Pipe extensions shall not be used in place of shock absorbers
- C. Josam 60100H-SAP Series epoxy coated fabricated steel grease interceptor, no-hub connections, internal trap, removable diffuser baffle, gasketed non-skid center bolt cover, flow control fitting, PDI seal of approval and wall mounted controller for factory installed grease/oil level detector and alarm probe. Unit shall be sized for 70 lb grease capacity.
- D. Josam 61805 Series lint interceptor with acid-resisting coating, non-skid cover, galvanized steel bucket with stainless steel screens and threaded connections. Unit shall be sized for 64 gpm drainage flow rate. Inlet height of interceptor shall be equal to or below the discharge drain height of the washer/laundry extractor.
- E. Solids Interceptor Trap
1. Solids interceptor trap shall be a normal capacity solids interceptor, on the floor type, equal to Jay R Smith Model No. 8714-56. Interceptor shall have an internal deep seal trap and shall be cleaned by removing cover and lifting sediment bucket vertically out of the body.
 2. Unit shall consist of a steel body with galvanized sub-coat with white duco finish inside and outside, stainless steel perforated bucket and aluminum cover.
 3. Install components in accordance with manufacturer's instructions and approved product data submittals. Set unit plumb, level, and rigid.
- F. Trap Primer:
1. Type A: Provide one (1) flush valve in each toilet room with a Sloan VBF-72-A1 vacuum breaker trap primer. Extend 3/8 inch water line to floor drains located in toilet rooms or any adjacent rooms indicated on the drawings. Trap primer water line shall be connected to the rear of the tailpiece such that it is concealed from view.
 2. Type B: Trap primer system shall be provided where indicated on the plans and shall consist of Precision Plumbing Products Model No. PTS. System shall consist of 3/4" inch NPT female inlet, 1/2" inch compression fitting outlets, circuit Breaker, manual over ride switch/test button, timer, UL listed solenoid valve, anti-siphon atmospheric vacuum breaker. Electric timer shall be arranged for one (1) five second operation every twenty-four (24) hours. The entire system shall be packaged and mounted in a common, locking control panel with 3/4" Type "L" copper tubing manifold with the total number of discharge lines and balancing cocks as indicated on the drawings. Extend 3/8 inch water line to floor drains in all locations except for toilet rooms. System shall utilize 120 volt power source provided under Division 26.
- G. Backwater valve shall be Josam Series 67500 or approved equal swing-check type where indicated on the drawings. Valve shall be constructed of cast-iron with bronze swing check assembly and bolted gasketed cover for access.

2.9 WATER METERS

- A. Indoor water meters located on new/existing building mains, HVAC make-up water lines and as indicated on the plumbing drawings shall be Badger Meter, Inc. Recordall Turbo Series or approved equal bronze meter meeting AWWA C701 Class II standard.

- B. Meter shall have hermetically sealed register with tamperproof seal screw.
- C. Meters shall be suitable for a maximum operating temperature range of thirty-eight (38) degrees Fahrenheit to eighty (80) degrees Fahrenheit and maximum operating pressure of 150 pounds per square inch.
- D. Meter shall be provided with integral plate strainer.
- E. Isolation valves shall be provided on both sides of water meters to allow servicing.

2.10 THERMOSTATIC MIXING VALVE

- A. Provide factory assembled and tested Leonard New Generation High-Low Systems consisting of large Type TM thermostatic water mixing valve, small Type TM valve, DURA-trol solid bi-metal thermostat (directly linked to valve porting to control the intake of hot and cold water and compensate for supply temperature or pressure fluctuations) with seven year limited warranty, color coded dials (hot-cold with directional indicators), locking temperature regulator handles, adjustable limit stops set for 120°F (49°C), integral hot and cold supply checkstops, outlet ball valve shutoffs and color coded dial thermometer, inlet piping manifold Factory preassembled and tested, rough bronze finish, mounted in a stainless steel recessed cabinet with door and lock. System shall provide full time standby service should one mixing valve require maintenance and shall be piped according to Leonard's required piping method.

PART 3 - EXECUTION

3.1 FLOOR DRAINS

- A. Floor drains shall be covered during periods of construction. If drains are not covered and it is suspected that dirt, debris or trash has entered the drainage system, the interior drainage system shall be professionally cleaned to the Architect's satisfaction and at no expense to the Owner.

3.2 INSTALLATION OF PIPING

- A. Interior Drainage Systems:
 1. Soil, waste, vent, and drain piping for sanitary and storm drainage, shall be of the sizes noted, and shall be run as indicated. Pipes must be run in straight lines and have a uniform grade between elevations noted. No branch drain shall have a grade less than that indicated for the main drain to which it is connected. Where elevations are not given, horizontal pipes shall have a uniform grade of 1/4 inch per foot where possible but in no case less than 1/8 inch per foot and shall be installed to the inverts shown. All piping shall be adequately supported as specified in Division 23, Section "Mechanical and Electrical General Provisions". All main vertical soil and waste stacks shall be extended as vents full size to approximately 18 inches above the roof of the building. Two (2) or more vent lines shall be connected together where practicable and extended as one (1) pipe through the roof. Vent pipes in roof spaces shall be run as close as possible to the underside of the roof without forming traps in pipes. Vent pipes may be connected

to other vent pipes or to main vent stacks provided the connections are at least four (4) feet above the floor on which the fixtures are located so that no vent pipe can be used as a waste. Openings in roof for vent pipes shall be flashed and made watertight. Use vent stack flashing sleeves where applicable. Handicapped plumbing fixtures shall be rough-in to suit the specific mounting of the fixture. Waste lines shall be offset for lavatories and sinks to accommodate wheelchair type strainers and traps shall be insulated.

2. Changes in direction shall be made by appropriate use of forty-five (45) degree wyes, 1/2 wyes, or long sweep 1/4, 1/6, 1/8, or 1/16 bends. Sanitary tees or short quarter bends may be used on vertical stacks of drainage lines where change in direction of flow is from horizontal to vertical; except use long turn tee wyes when two (2) fixtures have common drain. Straight tees, elbows, and crosses may be used on vent lines. Make no change in direction of flow greater than ninety (90) degrees. Where different sizes of drainage pipes or pipes and fittings are to be connected, use standard increasers and reducers of proper size. Reduction of size in horizontal drainage piping in direction of flow is prohibited.
3. Drilling and tapping of drains, soil, waste, or vent piping, and use of saddle hubs and bands are prohibited.
4. Connect piping to fixtures or equipment by couplings or unions so that devices may be replaced with no disturbance to piping.

B. Exterior Drainage Systems:

1. See Division 23, Section "Mechanical and Electrical General Provisions" for Excavation and Backfill.
2. Pipe and fittings shall be moved to the trench, carefully lowered and set to line and grade. Pipe shall be laid on the shaped sub-grade. No blocking will be permitted and the bedding shall be such that it forms a continuous bearing with a minimum width of bearing equal to 0.6 the outside diameter of the pipe for the full length of the pipe, except for that portion at the bell hole. No pipe or fitting shall be installed until sufficient trench has been completely excavated to satisfy the Architect that no unforeseen obstructions of any kind are likely to be encountered. Pipe shall be cut by the Contractor when required without any additional compensation. Special care shall be exercised by the Contractor to prevent damage to any pipe. Before placing in the trench, each pipe or fitting shall be carefully cleaned of any foreign substance which may have collected therein and shall be kept clean at all times thereafter. For this purpose, the open ends of all pipes and fittings in the trench shall be closed to the satisfaction of the Architect before leaving the work for the night and for all holidays or other items of interruption to the work.
3. Install horizontal lines to 1/8 inch per foot minimum grade, unless otherwise indicated.

C. Water Piping Systems:

1. Water piping shall be complete from service connection to all fixtures, equipment, outlets, etc. Sizes of pipes shall be shown or as specified.
2. Chromium plated piping shall be threaded and made up carefully, and not more than one (1) full turn of thread shall be exposed beyond any fitting.
3. Ends of pipes or tubing and recesses of fittings to be bronzed or soldered shall be thoroughly cleaned. Joints shall be assembled without binding. Brazing material or solder shall penetrate fully and shall fill the joint completely.
4. All brass and copper pipe and tubing shall be free from cuts, dents or other surface damage at the time of final inspection. Damaged pipe or tubing shall be removed and replaced with new pipe or tubing.

5. Horizontal runs of brass and copper pipe and tubing over fifty (50) feet in length shall be anchored to wall or floor construction. Anchors shall be located near the midpoints of the runs so as to force the expansion equally to the ends or in a direction where expansion can take place without excessive strain. Swing joints, offsets, expansion joints, etc., shall be provided where necessary to accommodate expansion of piping, which will be approximately two (2) inches in 100 feet of brass or copper hot water piping.
 6. Where non-ferrous metal piping and zinc-coated metal piping are jointed, dielectric (insulating) couplings, fittings or unions shall be provided.
 7. Where pipe sizes shown or specified differ from the connection sizes of meters, pumps, fixtures, outlets, etc., reducing fittings shall be installed.
 8. Water supplies for wall hung lavatories shall be roughed in as high as possible and still permit connections to the faucet. Water supplies shall be insulated for handicapped fixtures and rough-in shall be on accessible side of fixture for flush valves and flush handles.
- D. All rough-in plumbing shall be sealed off with test plugs, caps, etc., until fixtures are ready to be installed.

3.3 CLEANOUTS

- A. Where soil, waste, or roof drainage risers connect to a sewer or drain extending from the building above the lowest floor, the fitting at the base of each stack or downspout shall be a sanitary tee or a combination Y and 1/8 bend with cleanout plug in the end of the run of the main.
- B. Each vertical soil, waste, and vent pipe and each downspout and roof drainage pipe which connects to horizontal drain piping below ground shall be fitted with a test tee above the lowest floor or ground. Where accessible, test tee may be installed in the horizontal pipe at the base of the riser.

3.4 TRAPS

- A. Each fixture, floor drain and piece of equipment connected to the sanitary system shall be equipped with a trap.
- B. Provide traps for storm water lines where required by code.
- C. Each trap shall be placed as close to the fixture as possible and no fixture shall be double trapped.
- D. All traps on bell and spigot pipe shall be extra heavy cast iron and all traps on threaded pipe shall be galvanized cast iron recessed drainage type.

END OF SECTION 220500

SECTION 230500 - MECHANICAL AND ELECTRICAL GENERAL PROVISIONS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. The drawings and general provisions of the Contract, including General and Supplementary Conditions, General Requirements and all other Specification Sections apply to the work specified in this section. In the event of conflict between specific requirements of the various documents, the more restrictive, the more extensive (i.e.: more expensive) requirement shall govern.

1.2 SCOPE

- A. This Section describes the general provisions for the fire protection, plumbing, mechanical and electrical work included in Divisions 22, 23 and 26 respectively. This section applies to all sections of Divisions 22, 23 and 26. Refer to Division 26 for additional General Provisions related to electrical work.
- B. Contractor shall obtain and pay for all installation permits, certificates, and inspection fees relative to the work. The preparation of any specific plans or shop drawings necessary to obtain these permits shall also be the responsibility of the contractor.

1.3 COMMISSIONING

- A. All building energy-related systems shall be commissioned in order to verify and ensure that fundamental building elements and systems are installed, constructed, calibrated to operate, and perform according to the Owner's Project Requirements, Basis of Design, and Construction Documents.
- B. Refer to the Divisions 1, 22, and 23 for additional information.

1.4 RESPONSIBILITY

- A. The General Contractor shall be responsible for all work included in the Mechanical, Electrical, Plumbing and Fire Protection Divisions. The delegation of work to Subcontractors shall not relieve him of this responsibility. Subcontractors who perform work under these Sections shall be responsible to the General Contractor. The term "Contractor" is used throughout this Division and shall mean the General Contractor, although the actual performance of the work may be by a Subcontractor.
- B. Within thirty (30) days after award of the contract, the Contractor shall submit to the Architect, for approval a list of all subcontractors' names he proposes to use.
- C. The Contractor shall carefully review all divisions of the project specifications. Where conflicts exist between divisions and/or sections of the specifications the most stringent requirement as

determined by the Architect shall apply.

- D. The contractor shall obtain and pay for all installation permits, certificates, and inspection fees relative to the work. The preparation of any specific plans or shop drawings necessary to obtain these permits shall also be the responsibility of the contractor.

1.5 REFERENCES AND DEFINITIONS

Following are definitions of terms and expressions used in the Mechanical and Electrical Sections:

Provide	- furnish and install
Directed	- directed by the Architect
Indicated	- indicated in Contract Documents
Concealed	- hidden from normal sight; includes items within furred spaces, pipe and duct shafts, above suspended ceilings and within return air plenums.
Exposed	- non concealed - Work within Equipment Rooms shall be considered exposed.
Exterior	- items being or situated outside. Items located within a crawl space shall be considered exterior.
Conditioned	- a heated or cooled space, or both, within a building and, where required, provided with humidification or dehumidification means, so as to be capable of maintaining a space condition falling within the comfort envelope set forth in ASHRAE 55.
Piping	- includes pipes, fittings, valves, hangers, and accessories comprising a system
Ductwork	- includes ducts, fittings, housings, dampers, hangers, air devices, and accessories comprising a system.

1.6 STANDARD SPECIFICATIONS

- A. See Division 1 - General Requirements.
- B. References to catalogs, standards, codes, specifications, and regulations apply to the latest edition in effect at the date of the invitation to bid.

1.7 CODES, REGULATIONS, AND PERMITS:

- A. Give all necessary notices, obtain all permits, and pay all fees and other costs, including those for utility connections or extensions in connection with the work. File all necessary plans, prepare all documents, and obtain all necessary approvals of all governmental departments having jurisdiction. Obtain all required certificates of inspection and deliver same to the Architect before request for acceptance and final payment for the work.
- B. All materials furnished and all work installed shall comply with the latest rules, regulations, and recommendations of the following bodies:

2015 International Building Code with State of South Carolina Supplements
2015 International Existing Building Code with State of South Carolina
Supplements
2015 International Mechanical Code with State of South Carolina Supplements
2015 International Fire Code with State of South Carolina Supplements
2009 International Energy Code with State of South Carolina Supplements
National Electric Code, 2008 Edition
National Fire Protection Association Standards (Latest Editions)
State Fire Marshal Regulations
Fire Prevention Bureaus of Mount Pleasant, the City of Charleston, Charleston
County and the State of South Carolina
ASHRAE Standards and Handbooks (Latest Editions)
Local Health Department
State Health Department
Local Utility Companies
Underwriters Laboratories
Owner's Insurance Underwriter Standards
Environmental Protection Agency

1.8 MATERIALS LIST AND SHOP DRAWINGS

- A. See Division 1, GENERAL REQUIREMENTS for Additional Requirements related to submittals and shop drawings.
- B. Prior to delivery of any material or equipment to the job site; submit for approval, dimensioned drawings or cuts showing construction size, arrangement, operating clearances, performance characteristics, and capacity of material or equipment. Each item of equipment proposed shall be a standard catalog product of the approved manufacturer. Submittals shall be received early in the construction period to allow the Architect ample time for review and checking for compliance with the contract documents. The Architect will be expected to process a maximum of ten (10) submittals in a five (5) day working period. The Contractor shall carefully schedule the submission time of all submittals to insure that approvals will be received to meet the critical path of the construction project.
- C. If the Contractor's submittals, upon review by the Architect, do not conform to the requirements of the contract documents, the contractor shall be required to resubmit with modification, within fifteen (15) working days of receipt of the Architect's notification and comments to the Contractor. The Contractor shall be responsible for the extra expenses for subsequent review of rejected or revised submittals necessitated by the Contractor's failure to provide a complete and accurate submittal meeting the requirements of the contract documents. Such extra fees shall be deducted by the Owner from payments to the Contractor.
- D. Samples, drawings, specifications, catalogs, etc., submitted for approval shall be properly labeled indicating specific item, model number, and service for which material or equipment shall be used. Section and article number of specifications governing, Contractor's name, name of job, and date and also be clearly indicated on all submittals. Submittals that are not properly labeled or identified will be returned marked "Not Reviewed".
- E. Catalogs, pamphlets, or other documents submitted to describe items on which approval is

being requested shall be specific. Identification in catalog, pamphlet, etc., of item submitted shall be clearly made in ink. Data of a general nature will not be accepted.

- F. If material or equipment is installed prior to receipt by the Contractor of pertinent shop drawings marked "No Exceptions Taken" or "Comments Noted", the Contractor shall be liable for its removable replacement at no extra charge to the Owner.
- G. Prepare and submit shop drawings for all specifically fabricated items, modifications to standards items, specially designed systems where detailed design is not shown on the contract drawings, or where the proposed installation differs from that shown on contract drawings.
- H. Submit data and shop drawings as listed below, in addition to provisions of paragraphs above. Identify all shop drawings by the name of the item and system and applicable specification paragraph number.

Shop Drawings:

Section 220500 – Plumbing

- Cleanouts
- Drains
- Electric Domestic Water Heater
- Hot Water Circulator
- Plumbing Fixtures
- Electric Water Coolers
- Drinking Water Chillers
- Trap Primers
- Water Meters
- Tempering Valves
- Shock Absorbers
- Downspout Nozzles
- Wall Hydrants
- Hose Bibbs

Section 230500 – Mechanical and Electrical General Provisions

- Record Drawings
- Installation and Coordination Drawings
- Pipe and Conduit Hangers and Supports
- Access Doors
- Sleeves and Penetrations Drawings
- Operation and Maintenance Manuals
- List of Manufacturers' Material and Equipment
- Welder Certificates

Section 230513 – Motors

- Motors

Section 230530 – Basic Materials and Methods

Hangers and Pipe Shields
Identification Items
Pipe, Fittings, and Joints

Section 230548 – Mechanical Vibration, Sound and Seismic Controls

Vibration Isolation and Seismic Restraint Components

Section 230593 – Testing and Balancing

Test Reports

Section 230700 – Mechanical Systems Insulation

All Insulation Types
Adhesives, Sealers, and Coatings
Fabric Jackets
Fitting and Valve Covers
Metallic Components

Section 233110 – Air Distribution

Air Devices
Dampers:
 Fire
 Fire/Smoke
 Smoke
 Volume
Ductwork
Duct Lining
Fans
Roof Ventilators and Penthouses
Louvers
Duct Heaters

Section 233400 – Centrifugal HVAC Fans

HVAC Fans

Section 237330 – Dedicated Outdoor Air Units

Dedicated Outdoor Air Units

Section 238120 – Heating and Air-Conditioning Equipment

Direct Expansion Units

- i. Contractor, additionally, shall submit for approval any other shop drawings as requested by the Architect. No item listed above shall be delivered to the site, or installed, until approved. After the proposed materials have been approved, no substitution will be permitted except where approved by the Architect.

1.9 EQUIPMENT START-UP AND INITIAL OPERATION

- A. No equipment shall be operated, for testing or trial use, before full compliance with the equipment manufacturers' specifications and instructions for the lubrication, alignment, direction of rotation, balance, and other applicable considerations.
- B. Particular care shall be taken to see that all equipment is completely assembled, properly lubricated, and all grease and oil cases and reservoirs have been filled to the correct level with the recommended lubricants.
- C. It is the Contractor's responsibility to place each item of equipment, installed by him, in operating condition. This responsibility includes all auxiliaries, piping, wiring, etc., the start up of each unit, and a check of its performance.

1.10 WARRANTY

- A. The Contractor shall warranty, by his acceptance of the Contract, that all work installed, by him or his subcontractors, will be free from defects, in workmanship and materials, for a period of one (1) year after the date of certification of completion and acceptance of work. Any defects in workmanship, materials or performance which appear within the guarantee period shall be corrected by the Contractor, without cost to the Owner, within a reasonable time to be specified in notice from the Architect. In default thereof, Owner may have such work done and charge the cost of same to the Contractor.

1.11 SITE VISIT

- A. Prior to preparing the bid, the Contractor and subcontractors shall visit the site and familiarize themselves with all existing conditions, make all necessary investigations as to locations of utilities, and all other matters which can affect the work. No additional compensation will be made to the Contractor as a result of his failure to familiarize himself with the existing conditions under which the work must be performed.

1.12 DRAWINGS

- A. The Contract Drawings are diagrammatic and indicate the general arrangement of systems and work included in the Contract. Any offsets, rises, or transitions not shown on the drawings and required to provide a complete system shall be provided at no additional contract cost. Do not scale the drawings. Consult the Architectural and Structural drawings and details for exact location of structure and equipment; where same are not definitely located, obtain this information from the Architect.

1.13 RECORD DRAWINGS

- A. Contractor shall keep accurate records of all deviations in work, as actually installed, from work indicated.
- B. When work is complete, make two (2) complete "Record" sets of marked-up prints, certify the accuracy of each print by endorsement and signature thereon. Deliver same to the Architect

who will, after approval, deliver these two (2) sets to the Owner.

- C. All underground work shall be accurately located on record drawings by plan dimension and elevation. Such work shall include utilities, storage tanks, plumbing pipes, etc.

1.14 OPERATING AND MAINTENANCE INSTRUCTIONS

- A. Upon completion of all work and all tests, Contractor shall furnish the necessary skilled labor and helpers for operating the systems and equipment for a minimum period of four (4) days of eight (8) hours each, or as otherwise specified. During this period, Contractor shall instruct the Owner's representative fully in the operation, adjustment, and maintenance of all equipment furnished. At least forty-eight (48) hours in advance written notice shall be given to the Owner.
- B. Contractor shall furnish to the Architect four (4) complete bound sets of typewritten or blueprinted instructions for operating and maintaining all systems and equipment included in this Contract. Operating and maintenance manuals shall include all construction test reports, final balancing reports, valve tag schedule, final inspection certificates, and occupancy permits. Also provide two (2) complete bound sets of approved shop drawings for all items of equipment utilized on the project. All instructions shall be submitted in draft for approval prior to final issue. Manufacturers' advertising literature or catalogs will not be acceptable for operating and maintenance instructions.
- C. Instructions shall include a general description of each system and specific instructions describing routine and emergency procedures required of the building personnel for operating and maintaining each system. The instructions shall include the name or label, location, and function of all operating equipment and controls, such as start-stop switches, time clocks, and safety and temperature controllers. Operating modes and the procedures for indexing each mode shall be clearly described. A listing of names, addresses, and phone numbers of the service organizations for each item of equipment and a typewritten maintenance schedule for same shall be included.
- D. The instructor shall be thoroughly familiar with all parts of the installation on which he is to give instruction. The instructor shall be trained in operating theory as well as practical operation and maintenance work. Employ factory trained instructors for automatic temperature control systems and wherever else necessary, as determined by the Architect.
- E. During the warranty period, the Contractor shall service and maintain all equipment, excluding filter replacement, provided under this contract. Prior to the start of guarantee period, the Contractor shall provide the Owner with a schedule of required maintenance operations for each system and items of equipment. Contractor shall submit schedule to the Architect for approval. Thereafter, monthly reports shall be submitted to the Owner describing actual service provided. Forty-eight (48) hours advance notice shall be given to the Owner, prior to work required under this Section.
- F. Contractor shall provide the Owner with all tools required to service and maintain all equipment.

1.15 ELECTRICAL WORK

- A. Under Divisions 22 PLUMBING and 23 MECHANICAL, provide the following items of electrical work which shall conform with the applicable requirements of the Electrical Division:
 - 1. Low voltage temperature control wiring.
 - 2. Interlock wiring for mechanical equipment and devices.
- B. Under Division 26 ELECTRICAL, provide:
 - 1. Power wiring, complete from power source to motor or equipment junction box, including power wiring through motor starters, power factor correction devices, and line reactors. Power factor correction devices shall be provided under Division 23 and installed under Division 26.
 - 2. Motor control centers or motor starter, panelboards.
 - 3. All miscellaneous individual motor starters, unless noted or specified otherwise.
- C. Variable frequency drives will be furnished and set in place under Division 23. Power wiring shall be provided under Division 26

1.16 SINGULAR NUMBER

- A. Where any device or part of equipment is herein referred to in the singular number (such as "valve"), such reference applies to as many such devices as are required to complete the installation as shown on the drawings.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. All materials shall be new, the best of their respective kinds, suitable for the conditions and duties imposed on them at the building, and shall be of reputable manufacturers'. The description, characteristics, and requirements of materials to be used shall be in accordance with qualifying conditions established in the sections following.
- B. See Division 1 - General Requirements. All component parts of each items of equipment or device shall bear the manufacturers' name plate; giving name of manufacturer, description, size, type, serial or model number, electrical characteristics, etc., in order to facilitate the maintenance or replacement. The name plate of a subcontractor or distributor will not be acceptable. Where Underwriters' Laboratories standards apply, material and equipment shall be approved by them and shall bear the UL Label.
- C. In specifying materials, three (3) general procedures are used. The three (3) classifications are as follows:

GROUP 1: When a material or equipment is specified by brand name or other identifying information and three (3) or more brands are named it is considered that any one (1) of the brands so named will perform as desired, and the Contractor shall base his proposal on one (1)

of the named brands. The first brand named or identified basis of design shall be used as a standard. The other brands named shall be equal to the specified brand in all respects. If one (1) of the other brands named is used it shall be the Contractor's responsibility to verify proper clearances and fit of the substituted equipment.

GROUP 2: When the material or equipment is specified with the phrase "...or approved equal..." after a brand name and other identifying information, it is intended that the brand name is used for the purpose of establishing a minimum acceptable standard of quality and performance and Contractor may base his bid proposal on any item which is in all respects equal to that specified and presents essentially the same appearance. It shall be the Contractor's responsibility to ensure proper fit and clearances of all substituted equipment.

GROUP 3: When material is specified as complying with the requirements of published "Standard Specification" of trade associations, American Society of Testing and Materials, government specifications, etc. the Contractor shall base his proposal on any item which can be shown to comply in all respects to the referred "Standard Specification".

1. It is distinctly understood: (1) that the Architect will use his own judgment in determining whether or not any materials, equipment or methods offered in substitution are equal to those specified; (2) that the decision of the Architect on all such questions of equality is final; and (3) that all substitutions will be made at no increase in cost to the Owner.
2. Upon receipt of written approval from Architect, Contractor may proceed with substitution providing Contractor assumes full responsibility for, and makes, at his own expense, any changes or adjustments in construction or connection with other work that may be required by the substitution of such materials, equipment or methods. In the event of any adverse decisions by the Architect no claim of any sort shall be made or allowed against the Owner.

2.2 INSTALLATION AND COORDINATION DRAWINGS

- A. Prepare, submit and use composite installation and coordination drawings to assure proper coordination and installation of work in all buildings. No installation or construction work shall begin until the coordination drawings are completed, submitted, and approved. Drawings shall include, but not be limited to, the following:
 1. Complete Roof, Floor, Interstitial and Crawl Space Plans, including all exterior equipment
 2. Mechanical Rooms in the Building
 3. Mechanical Shafts
 4. Pipe sleeves, equipment pads, etc.
- B. Show relationship and integration of different construction elements that require coordination during fabrication or installation to fit in space provided and function as intended.
- C. Prior to fabricating or installing work, prepare composite coordination drawings at appropriate scale; detail major elements, components, and systems of architectural, structural, mechanical, and electrical such as equipment, components, and materials in relationship with each other, installations, and building components. Include dimensions. Composite coordination drawings shall include new and existing elements, components, and systems.

- D. Indicate locations where space is limited for installation and access and where sequencing and coordination of installations are important to efficient flow of Work.
- E. Indicate scheduling, sequencing, movement, and positioning of large equipment into building during construction.
- F. Assembly Penetrations: Prepare drawings as required to indicate penetrations in floors, walls, and ceilings and their relationship to assembly construction, other penetrations and installations. Identify where additional bracing and offsets are required to comply with Contract Documents.
- G. Prepare drawings as required to coordinate and integrate ceiling installations, air outlets and inlets, light fixtures, communications systems components, sprinklers, other ceiling-mounted devices, components located above suspended ceilings, and suspended ceiling support components.
- H. Show interrelationship of components indicated on separate Shop Drawings.
- I. Indicate required installation sequences to minimize cutting and patching.
- J. In addition, prepare coordination drawings required below and in other Specification sections.
- K. Mechanical Systems: Include, but do not necessarily limit to, the following:
 - 1. Proposed locations of piping, ductwork, equipment, and materials.
 - 2. Proposed locations for access panels and doors.
 - 3. Clearances for installing and maintaining insulation.
 - 4. Clearances for servicing and maintaining equipment, including tube removal, filter removal, and space for equipment disassembly required for periodic maintenance. Show access locations.
 - 5. Equipment connections and support details, including vibration isolation, seismic and sway bracing.
 - 6. Exterior wall, roof and foundation penetrations.
 - 7. Fire-rated wall and floor penetrations.
 - 8. Sizes and location of required concrete pads and bases.
 - 9. Valve stem movement.
- L. Draw plans to a scale not less than 1/4 inch equals one (1) foot. Include plans, sections, and elevations of proposed work, showing all equipment, piping and ductwork in areas involved. Fully dimension all work horizontally and vertically. Show coordination with other work including sprinklers, lighting fixtures, conduits, pullboxes, panelboards, and other electrical work, walls, doors, ceilings, columns, beams, joists and other architectural and structural work.
- M. Identify all equipment and devices on wiring diagrams and schematics. Where field connections are shown to be factory-wired terminals include manufacturer's literature showing internal wiring.
- N. Installation and coordination drawings shall be produced on an AutoCad format. Reproduction of any portion of the mechanical and electrical contract drawings for re-submittal as a shop drawing is strictly prohibited. Shop drawings produced in such a manner will be rejected and returned not reviewed. Installation and coordination drawings shall be to scale reflecting actual equipment sizes purchased for the project.

- O. The "Base" architectural and structural background drawings will be provided on Autocad format by the Construction Manager/General Contractor. These "Base" background documents are to be provided to each Contractor in the coordination process to establish a common platform for each Contractor to use for their design drawings. This same information will be used to communicate their respective coordination with the other Contractors. Coordination will be accomplished by each Contractor superimposing his work on drawings in the following sequence:
1. Construction Manager/General Contractor - Base Drawings indicating structural steel with elevations for bottom of beams & finish floor. The general contractor shall include a layout of ceiling tiles (where applicable).
 2. HVAC Contractor - Ductwork layout drawings & piping with elevations to bottom of ductwork & piping. HVAC contractor shall indicate location of all registers, diffusers and grilles.
 3. Plumbing Contractor - Layout of all piping with elevations.
 4. Sprinkler Contractor - Layout of all piping & heads with elevations.
 5. Electrical Contractor - Conduit layout with junction boxes and location of all electrical fixtures.
- P. If necessary, Contractor coordination meetings shall be held continuously until the coordination drawings are complete and approved by all parties. Any conflicts, etc., discovered in the coordination stages prior to Contractor(s) sign-off which cannot be resolved by the Contractor(s) shall be brought to the Architect's attention for resolution.
- Q. Any conflicts, etc., discovered after the created and submission of the coordination and installation drawings and during the installation of the Work will be the responsibility of the Contractor(s) to resolve with the approval of Architect. Any and all costs for these resolutions shall be solely the responsibility of the Contractor(s).
- R. Work fabricated/installed prior to the completion of the coordination and installation drawings is performed at the Contractors own risk, and compensation of time/costs for corrections will not be awarded. Any work installed that is not in conformance with final approved coordination and installation drawings shall be required to be removed and relocated, and compensation of time/costs for corrections will not be awarded.
- S. Each Contractor is responsible for timely updates to the coordination drawings to indicate as-built conditions for their own work. Updates are required to include all changes regardless of the source or reason for the change, including changes initiated by the Owner, Architects or Engineers.

2.3 PIPING, CONDUITS, AND SUPPORTS, GENERALLY

- A. Piping and conduits, except electrical conduits run in floor construction, shall be run parallel with the lines of the building, unless otherwise shown or noted on the drawings. Electrical conduits shall not be hung on hangers with any other service pipes. The different service pipes, valves, and fittings shall be so installed that after the covering is applied there will not be less than 1/2 inch clear space between the finished covering and other work and between the finished covering and parallel adjacent pipes. Hangers on different service lines, running parallel with each other and nearly together, shall be in line with each other and parallel to the lines of the building. Exact location of sprinklers, electrical outlets, piping, ducts, and conduits

shall be coordinated among the trades so that there will be no interference between lighting fixtures, piping, ducts, and conduits. Where conflicts between the trades result, they shall be resolved by the Contractor to the Architect's satisfaction and at no expense to the Owner.

- B. Hangers shall be spaced to prevent sag and permit proper drainage. Refer to Division 23, Section "Basic Materials and Methods" for hanger spacing. A hanger shall be placed within one (1) foot of each horizontal elbow. See drawings for any additional hanger requirements.
- C. Vertical runs of pipe and conduit less than fifteen (15) feet long shall be supported by hangers placed one (1) foot or less from the elbows on the connecting horizontal runs. Vertical runs of pipe and conduit over fifteen (15) feet long, but not over sixty (60) feet long, and not over six (6) inches in size, shall be supported by heavy steel clamps. Clamps shall be bolted tightly around the pipes and conduits and shall rest securely on the building structure without blocking. Clamps may be welded to the pipes or placed below coupling.
- D. Hangers and support devices shall be by Anvil International, Unistrut, Fee & Mason, Elcene, Kindorf, Mueller or Auto-Grip. Unless otherwise specified, or indicated on the drawings, pipe and conduit hangers and hanger supports shall conform to the following Anvil International figures.
 - 1. Hangers generally shall be Figs. 65, 104, 212, 260 and 295.
 - 2. Hanger Figs. 212 and 295 shall be provided with turnbuckles and eye rods or rods with eye nuts.
 - 3. Turnbuckles shall be Figs. 114 or 230, shall have not less than 1-1/2 inches of adjustment, and shall be provided with locknuts.
 - 4. Brackets Figs. 194, 195, and 199 shall be used for support of pipe hangers on lines larger than four (4) inches run along walls near floors.
 - 5. Riser clamps shall be Figs. 261 or CT-121.
 - 6. Roller hangers Figs. 171, 175, 177 and 181 shall be used for steam and condensate piping two (2) inches and larger and wherever the movement of pipe due to expansion exceeds 3/4 inch per foot of hanger rod lengths.
 - 7. Roller supports shall be adjustable, Anvil International Fig. 274 for installation of hot service piping over two (2) inches in size and installed in racks or on trapeze hangers.
 - 8. Concrete inserts shall be Figs. 281 or 282.
 - 9. On copper pipes, hangers in contact with pipe shall be copper plated.
- E. In lieu of individual hangers, multiple (trapeze) hangers may be used for water pipes having same elevation and slope and for electrical conduits as specified hereinafter:
 - 1. Horizontal members shall consist of 1-1/2 inch by 1-1/2 inch twelve (12) gauge, cold formed, lipped channels designed to accept special, springheld, hardened steel nuts for securing hanger rods and other attachments. Two (2) or more such channels may be welded together forming horizontal members of greater strength than single channels. Members shall be Kindorf, Unistrut, or equal. Horizontal members made of Kindorf, Unistrut, or similar products shall be limited to a maximum length of eight (8) feet. Structural steel members shall be used for horizontal members exceeding eight (8) feet in length.
 - 2. Each multiple hanger shall be designed to support a load equal to the sum of the weights of the pipes, conduits, wire, and water, the weight of the hanger itself, and 200 pounds. The size of the hanger rods shall be such that the stress at the roof of the thread will not be over 10,000 pounds per square inch at the design load. No rod shall be smaller than

- 3/8 inch. The size of the horizontal members shall be such that the maximum stress will not be over 15,000 pounds per square inch at design load.
3. Horizontal runs of piping and conduits along walls, four (4) inches and smaller, exposed or concealed, shall be secured to Kindorf or Unistrut support members as specified hereinbefore. Provide appropriate clamps, brackets and similar attachments to secure piping and conduits to vertical members in accordance with applicable sections of the specification.
 4. Refer to architectural and laboratory design drawings and specifications for additional requirements related to supports using Kindorf or Unistrut type systems.
- F. Hanger attachments shall be suitable for each type of hanger and shall be compatible with the building materials to which it is secured. The types of attachments which shall be used for the various types of building construction encountered shall conform to the following Anvil International figures:
1. Concrete (new) - Inserts Figs. 281 or 282. Power driven fasteners may be used for light loading as hereinafter specified.
 2. Concrete (existing) - Figs. 47, 49 or 52 attachments. Refer to drawings for specific application of individual types.
 3. Steel beams - Figs. 66, 92, and 93 attachments. Refer to drawings for specific application of individual types.
 4. Bar joists - Figs. 60 or 225.
 5. Brick or block walls - Figs. 194, 195, 199, or 202 fastened as follows: For light duty, self-drilling anchors in brick and toggle bolts in block; for heavy duty, through bolts with backing plates.
- G. Per IBC code section 1912 and ACI 318 Appendix D, all concrete anchors within the scope of ACI 318 require approved anchors for crack concrete. Attachment devices shall have certified load test data from an independent test laboratory and shall be capable of carrying a minimum of five times the design load. The concrete anchors for the following supported items need to meet the crack concrete requirements:
1. Any suspended pipe, larger than 2", regardless of material.
 2. All components with an Ip 1.5 (example) Sprinkler piping, gas lines, exhaust / fume hoods containing hazards.
 3. Cable tray.
 4. All components required to function after a seismic event (example) generator, emergency lightings, fire alarm and all associated conduits / panels, etc.
 5. Anywhere required by ASCE 7.
 6. All suspended HVAC and air distribution equipment, including air handling units, supply and exhaust air terminal units, fan coil units and fans.
- H. Welded attachments for securing hangers to piping or to structural steel may be provided in lieu of other attachments specified. Welded attachments shall be designed so that the fiber stress at any point in the weld or attachment will not exceed the fiber stress in the hanger rod.
- I. The different service pipes, valves, and fittings shall be installed so that, after the insulation/jacketing is applied, there shall not be less than 1 in. clear space between the finished jacketing and other work, and between the finished jacketing and parallel adjacent pipes.
- J. Refer to Division 23, Section "Mechanical Vibration, Sound and Seismic Controls", for

vibration hanger requirements.

- K. In no case shall wire or perforated strap be used for pipe or conduit support.
- L. All piping, ductwork, and equipment shall be suspended from the structure above unless otherwise indicated or noted on the drawings. The Contractor shall obtain prior approval from the Architect for floor supports of piping, ductwork, and equipment. Provide structural steel members consisting of angles, channels, and beams as required to hang piping, ductwork, and equipment.
- M. Gripple hangers shall be used to suspend all exposed rectangular, oval, round and spiral ductwork. Gripple hangers shall consist of a pre-formed wire rope sling with either a pre-formed ferruled loop, permanently fixed threaded stud, or permanently fixed end-stop with or without a toggle. This is secured and tensioned with a Gripple.
 - 1. The contractor shall select the correct specification of Gripple hangers for supporting each particular service.
 - 2. Gripple hangers shall be installed in accordance with all the manufacturer's recommendations.

2.4 SLEEVES AND PLATES

- A. All pipe sleeves shall be constructed of one (1) piece Schedule 40 steel pipe, unless otherwise indicated on the drawings.
- B. Where watertight sleeves are indicated, provide Link Seal rubber seals, as manufactured by Thunderline Corporation, between pipes and sleeves.
- C. Escutcheon plates shall be provided for all exposed pipes passing through walls, floors, and ceilings in finished areas. Plates shall be chrome plated brass, split ring type, and sized to match the pipe or insulation where installed. Where plates are provided for pipes passing through sleeves which extend above the floor surface, provide deep recessed plates to conceal the pipe sleeves.
- D. Provide twenty-four (24) gauge galvanized sheet metal sleeves for all exposed ductwork passing through floors, walls, or ceilings and all ductwork passing through fire-rated or smoke partitions. Duct sleeves shall be large enough to pass duct with insulation and shall have 2 (two) inch flanges returned against floor, wall, partition, or ceiling. Where fire dampers are required, provide sleeves as detailed on the drawings and as required by the damper manufacturer.
- E. At all sleeves, where noise can be transmitted and at fire rated separations, seal all openings between pipes and ducts and corresponding sleeve to prevent sound transmission and maintain fire rating of the wall, floor or ceiling. Submit method of sealing sleeves for approval. U.L. assembly rating of fire walls and floors shall be maintained at all times. All sleeves installed in masonry or concrete construction shall be grouted in place.

2.5 FIRE RATED PENETRATION SYSTEMS

- A. Provide UL Listed fire penetration systems in openings in rated floors, walls, and other elements of construction. Provide UL listed fire penetration systems at all new and existing pipe penetrations of new and existing rated construction within the area of work. Coordinate work of this section with all other trades necessary for the proper installation of the fire rated penetration systems.
- B. Submit shop drawings showing each condition requiring penetration seals in dictating proposed UL systems materials, anchorage, methods of installation, and actual adjacent construction. Submit a copy of UL illustration of each proposed system indicating manufacturer approved modifications. Submit copies of manufacturer's specifications, recommendations, inspection requirements, installation instructions, and maintenance data for each type of material required. Include letter indicating that each material complies with the requirements and is recommended for the applications shown.
- C. All fire penetration systems shall reference ASTM E814/UL 1479 - Fire Test of Through - Penetration Fire Stops.
- D. All systems shall be UL tested and listed in the UL Fire Resistance Directory.
- E. Submit copies of written guarantee agreeing to repair or replace joint sealers which fail in joint adhesion, cohesion, abrasion resistance, weather resistance, extrusion resistance, migration resistance, stain resistance, general durability or appear to deteriorate in any other manner not clearly specified by submitted manufacturer's data as an inherent quality of the material for the exposure indicated. The guarantee period shall be one (1) year from date of substantial completion.
- F. 3M products have been specified as the penetration fire stop basis of design. Other manufacturer's systems are acceptable providing they meet the requirements set forth in this specification. The fire rated penetration systems shall be the products of one manufacturer to the maximum extent possible. The products of more than one manufacturer shall not be used as a combined seal.
- G. Provide materials classified by UL to provide fire stopping equal to time rating, both "F" and "T" ratings, of construction being penetrated. Provide asbestos free materials that comply with applicable codes and have been tested under positive pressure in accordance with UL 1479 or ASTM E814. Systems shall be smoke and air tight.
- H. Deliver material undamaged in manufacturer's clearly labeled, unopened containers identified with brand, type, grade, and UL label where applicable. Coordinate delivery with scheduled installation date to allow minimum storage time at site. Store material in clean, dry ventilated location. Protect from soiling, abuse, and moisture. Follow manufacturer's instruction.
- I. Verify existing conditions and substrates before starting work. Correct unsatisfactory conditions before proceeding. Proceed with installation only after penetrations of the substrate and supporting brackets have been installed.
- J. Furnish adequate ventilation if using solvent. Furnish forced air ventilation during installation if required by manufacturer. Keep flammable materials away from sparks or flame. Provide masking and drop cloths to prevent contamination of adjacent surfaces by fire stopping

resistance.

- K. Clean surfaces to be in contact with penetration seal materials, of dirt, grease, oil, loose, materials, rust, or other substances that may affect proper fitting, adhesion of the required fire resistance.
- L. Install penetration seal materials in accordance with printed instructions of the UL Fire Resistance Directory and in accordance with manufacturer's instructions. Seal holes or voids made by penetrations to ensure an effective smoke barrier. Where floor openings without penetrating items are more than four (4) inches in width and subject to traffic or loading, install fire stopping materials capable of supporting same loading as floor. Protect materials from damages on surfaces subject to traffic.
- M. Clean up spills of liquid components. Neatly cut and trim materials as required. Remove equipment, materials, and debris, leaving area in undamaged, clean condition.
- N. Examine penetration sealed areas to ensure proper installation before concealing or enclosing areas. Keep areas of work accessible until inspection by applicable code authorities. Perform under this section patching and repairing of fire stopping caused by cutting or penetration by local inspectors and other trades.

2.6 DRIVES FOR MACHINERY

- A. Equip each motor driven machine with a V-belt drive except those which are specified as direct drive. Where factory designed and assembled belt drives which do not conform to the following are proposed to be furnished, such non-conformity must be noted on the shop drawings submittals and may be cause for rejection of the item.
- B. Provide OSHA approved guards, for all belt drives, constructed in accordance with SMACNA standards. Submit shop drawings for approval.
- C. Select each drive according to the ratings and recommendations of the manufacturer for the service with which used, giving proper allowance for sheave diameter, center distance, and arc of contact less than one hundred eighty degrees. Size the motor driving a centrifugal fan, with forward curved blades, to have a nameplate rating of not less than five (5) percent above the total of actual fan brake horsepower and drive loss at specified capacity, if the wheel is of other than the forward curved blade type. Size motor not less than fifty (50) percent above the total of actual fan brake horsepower and drive loss at specified capacity, if the wheel is of the forward curved blade type.
- D. Belts shall be constructed of endless reinforced cords of long staple cotton, nylon, rayon, or other suitable textile fibers imbedded in rubber. Use belt with correct cross section to fit properly the sheave grooves. Carefully match belts for each drive.
- E. Sheaves for motors under fifteen (15) HP shall be adjustable pitch type, selected so that the required fan rotational speed will be obtained with the motor sheave set approximately in mid-position and have the specified pitch diameter in that position. Sheaves for motors fifteen (15) HP and larger shall be fixed pitch type. Provide any changes to the sheaves, belts, pulleys or drive package to obtain the specified airflow, if required. Any changes shall be installed under Division 23, Section "Air Distribution".

- F. Select the motor of a capacity needed to operate the equipment at the specified mid-position operating condition. Where non-overloading motors are specified, select the motor capacity rating at the most closed position of the motor sheave. In no case shall motors be a smaller size than those indicated on the drawings.
- G. Do not select fan sheave smaller in diameter than thirty (30) percent of the fan wheel diameter.
- H. Construct sheaves of cast iron or steel, bored to fit properly on the shafts, and secured with key ways of proper size (not set screws). Key ways may be omitted for sheaves having 1/2 inch or smaller bores where set screws may be used.

PART 3 - EXECUTION

3.1 WORKMANSHIP

- A. Each Subcontractor shall furnish the services of an experienced superintendent who shall be constantly in charge of the installation of the work.
- B. The quality of workmanship required, for each trade, in the execution of work shall be the finest and highest obtainable in that trade working with the materials specified. Workmanship shall be satisfactory to the Architect and his decision as to acceptable quality is final.
- C. Workmanship proven to be of poor quality or unsatisfactory in the commissioning phase of the project as deemed by the Architect shall be removed and replaced to the satisfaction of the Architect.

3.2 EQUIPMENT PERFORMANCE

- A. All equipment, devices, controls, and hardware shall be proven to operate successfully throughout the guarantee period. Systems shall be proven during all weather seasons and be demonstrated to affect the design conditions at times. System components or equipments items that fail to consistently deliver the design conditions shall be removed and replaced as directed by the Architect. The cost of required equipment replacements shall be borne by the Contractor.
- B. All equipment shall be tested after installation and be proven to deliver the manufacturers quoted design capacity. When capacity is in question as deemed by the Architect, the Contractor shall perform a detailed and comprehensive field performance test to certify the equipment capacity. System effect or installed performance factors may not be applied to performance ratings unless they were previously included when the equipment was submitted for approval. Equipment that fails to deliver manufacturers quoted design capacity shall be removed and replaced at the Contractors expense.
- C. Workmanship proven to be of poor quality or unsatisfactory in the commissioning phase of the project as deemed by the Architect shall be removed and replaced to the satisfaction of the Architect.

3.3 EQUIPMENT CONNECTIONS

- A. All equipment shall be installed and connected in accordance with the best engineering practice and in accordance with manufacturer's instructions and recommendations. Auxiliary piping, piping specialties, water seals, valves, and electric connections recommended by the manufacturer, required by code or required for proper operation shall be provided.

3.4 WATERPROOFING

- A. Under no circumstances shall waterproofing be damaged or penetrated. Should conditions arise which indicate such necessity, notify the Architect.

3.5 CUTTING AND PATCHING

- A. Cutting and patching associated with the work in the existing structure shall be performed in a neat and workmanlike manner. Existing surfaces, which are damaged by the Contractor, shall be repaired or provided with new materials. All patching shall be done with materials and methods similar to existing adjacent work, subject to approval of the Architect. Structural members shall not be cut or penetrated. Holes cut through concrete and/or masonry to accommodate new work shall be cut by reciprocating or rotary, non-percussive methods.
- B. The Contractor shall submit to the Architect for approval dimensioned drawings showing all penetrations through structural slabs or walls required for mechanical and electrical work. Drawings shall clearly show opening size, plan location, and/or elevation as applicable. All openings shall be approved by the Architect prior to starting work.
- C. Patching of areas disturbed by installation of new work shall match existing adjacent surfaces in material, texture, and color.

3.6 PROTECTION OF EXISTING WORK

- A. When working in and around the existing building, extreme care shall be exercised with regard to protection of the existing structure and mechanical and electrical services. Repair or replace, to the satisfaction of the Architect, any existing work damaged in the performance of the new work.

3.7 SURVEYS AND MEASUREMENTS

- A. Base all measurements (both horizontal and vertical) from established bench marks. All work shall agree with these established lines and levels. Verify all measurements at site and check correctness of same as related to the work. Verify locations of existing utilities and inverts of same prior to the start of any systems shown connecting to existing utilities.
- B. Should the Contractor discover any discrepancy between actual measurements or conditions, and those indicated, which prevent following good practice or the intent of the drawings and specifications, he shall notify the Architect and shall not proceed with his work until he has received instruction from the Architect.

3.8 WELDING

- A. Welding shall conform to current standards and recommendations of the National Certified Pipe Welding Bureau, with all South Carolina Occupational Safety and Health Acts, State, City and County Fire Prevention Code Requirements, and NFPA Standard 241 including provision of appropriate portable fire extinguishers.
- B. Before assigning any welders to work covered by this specification, the Contractor shall provide the Architect with the names of pipe welders to be employed for the work, together with each welder's assigned number, letter, or symbol which shall be used to identify the work of that welder and which shall be affixed immediately upon completion of each weld. Contractor shall also submit, with the list of names, copies of each welder's certified qualification tests prescribed by the National Certified Welding Bureau or by other reputable testing laboratory using procedures covered in the American Society of Mechanical Engineers Building Construction Code, Section IX, "Qualification Standard Welding and Brazing Procedures, Welders, Brazers, and Welding and Brazing Operators". Welders must be certified for all positions.
- C. If requested by the Architect, the Contractor shall submit identifying stenciled test coupons made by any welder in question. The Contractor shall require any welder to retake the tests when, in the opinion of the Architect, the work of the welder creates a reasonable doubt as to his proficiency. Tests, when required, shall be conducted at no additional expense to the Owner; and the welder in question shall not be permitted to work as a welder on this project until he has been recertified. Recertification of the welder shall be made to the Architect only after the welder has taken and passed the required test; welder must pass the test without benefit of retests in order to resume work as a welder on this project.
- D. Welding shall conform to the ANSI Code for Pressure Piping ANSI B31.9, Building Services Piping. The Contractor shall be responsible for the quality of welding and shall repair or replace any work not in accordance with these specifications. Contractor shall, without cost to the Owner, check welds by radiograph, ultrasonic testing, sectioning or a combination of these methods wherever there is a question raised by the Architect as to the quality of a weld. Examination of the questionable weld shall be in addition to other system tests specified. Welds shall have penetration complete to the inside diameter of the pipe. The recommended spacing and levels between ends of pipes prior to welding shall be used in all cases to assure full penetration.
- E. Welders on pressure piping shall be certified and carry their identification stamp with them. Welds on lines with operating pressures above 100 psig shall be stamped.

3.9 HANDLING AND STORAGE OF MATERIAL

- A. Proper and suitable tools, equipment and appliances for the safe and convenient handling and placing of all materials and equipment shall be used. During loading, unloading, and placing, care shall be taken in handling the equipment and materials so that no equipment or materials are damaged.
- B. All mechanical and/or electrical equipment delivered to the job site shall be stored on pedestals, above the ground and under roof or other approved covering. All enclosures for equipment shall be weatherproof. All motors, drives, switchgear, panels, etc. which are not totally

enclosed, that are involved in the work, shall be stored in a heated, dry, water protected area with a minimum temperature of fifty degrees (50) Fahrenheit. All valves shall be stored under roof on wood pedestals, above ground. All insulation shall be stored under roof or in trailers, adequately protected from the weather. The Contractor shall follow all written instructions and recommendations of the manufacturer and all requirements of the Architect in oiling, protection and maintenance of equipment during storage. It shall be the Contractor's complete responsibility for the storage and care of the equipment and materials.

- C. If any equipment and/or materials are found to be in poor condition at the time of installation the Architect may, at his discretion, order the Contractor to furnish and install new equipment and/or material at no cost to the Owner.

3.10 COOPERATION WITH OTHER TRADES

- A. Mechanical and Electrical trades shall give full cooperation to other trades and shall furnish in writing, with copies to Architect any information necessary to permit the work of all trades to be installed satisfactorily and with least possible interference or delay. Exact location of all mechanical and electrical equipment, devices, etc. in finished spaces shall be coordinated with Architectural reflected ceiling plans, elevations and details.

3.11 CLEANING AND PAINTING

- A. Thoroughly clean all exposed surfaces of equipment and material and leave in a neat, clean condition ready for painting. Restore and touch-up factory finishes which have been damaged during construction. Finished painting will be performed under another Division.
- B. Miscellaneous requirements include:
 1. Touch-up threads of zinc coated screwed pipe with Rust-O-Leum primer and one (1) coat of enamel conforming with painting specification.
 2. Paint behind grilles and registers in finished areas with two (2) coats of flat black paint following the proper surface preparation of the zinc coated metal.

3.12 ACCESSIBILITY

- A. Locate all equipment which must be serviced, operated, or maintained, in fully accessible positions to eliminate the need for access panels and doors. Equipment shall include, but not be limited to, valves, clean-outs, motors, controllers, dampers, drain points, etc.
- B. Where overhead equipment cannot be located above spaces with either no ceilings or removable acoustical ceiling tiles, contractor shall provide, as part of the contract and no expense to the Owner, fourteen (14) gauge painted steel access doors where required and/or where directed (color shall match ceiling). Locations shall be coordinated with the Architect and indicated on the composite installation and coordination drawings.
- C. Access panels shall be Milcor or approved equal to suit material in which installed. Access doors installed in fire rated walls or shafts shall be labeled and shall match rating of the construction. Doors shall be of sufficient size to allow access to all components; minimum size

shall be eighteen (18) inches by eighteen (18) inches. Doors in Toilet Rooms and Janitor's Closets shall be Type 304 stainless steel.

- D. Equipment deemed inaccessible by the Architect shall be reworked by the Contractor at no expense to the Owner. All doors shall have cylinder locks operable from same key. Submit shop drawings for approval.

3.13 EXCAVATION AND BACKFILL:

A. Excavation:

1. See Division 31 for additional requirements.
2. Trenches shall be excavated to the necessary width and depth as shown on the drawings. The trench subgrade shall be such as to allow the bedding of the utility with a uniform and continuous bearing on solid, undisturbed earth for the full length of each pipe, except for that portion at the bell holes. The subgrade shall be graded with sufficient accuracy to assure this minimum. The bottom portion of all trenches from the subgrade to a point two (2) feet above the crown or top of the utility shall be as nearly vertical as practicable and at the minimum width.
3. Trenches in fill areas shall not be excavated until embankment construction has been completed to a point at least two (2) feet above the crown or top of the utility being placed.
4. Any part of the bottom of the trench excavated below the specified subgrade shall be backfilled, at the Contractor's expense, with bedding materials as hereinafter specified. Whenever wet, or otherwise unstable, subgrade is encountered below the elevation of the original ground surface which existed prior to the time of construction, such soil shall be removed to the depth and extent direct by the Architect and the trench backfilled to the proper grade with bedding material as hereinafter specified. Reimbursement for extra work performed by the Contractor shall be in accordance with the General Conditions. Whenever the Architect requires the removal of wet or otherwise unstable subgrade from the fill material previously placed by the Contractor, the cost of all removal of unstable soil, together with backfilling of the trench as herein specified shall be borne by the Contractor.
5. Excavation for manholes and similar structures shall be of sufficient size to leave a minimum of twelve (12) inches and a maximum of twenty-four (24) inches clearance on all sides. Any over-depth excavation shall be filled with concrete as directed and at the expense of the Contractor.
6. Provide shoring and sheet piling necessary for excavation and for the safety of personnel and property as directed. Unless otherwise directed, the sides of all excavations over four (4) feet deep must be braced. All shoring, bracing, sheet piling, etc., must be solidly installed heavy timber suitable for the purpose. No lumber shall be buried when excavations are backfilled, except by authority of the Architect.

B. Backfill:

1. See Division 31 for additional requirements.
2. No backfill and/or bedding shall be placed until the construction adjacent thereto or the utility to be backfilled has been inspected, tested and approved. Notify the Architect when inspections are required.
3. Backfill material shall be earth materials only, free from perceptible amounts of wood,

debris, or topsoil and shall not contain marble or other elements which tend to keep it in a plastic state. The material shall be free of frost at the time of placement. Backfill for plastic pipe shall be clean sand, free of foreign materials.

4. Bedding material, for use where trench subgrade is excavated below specified depth of for use at Contractor's option, shall be crushed stone or gravel, meeting the requirements of S.R.C. No. 6 aggregate or crusher run S.R.C. Cr-6 and shall be free of frost at the time of placing.
5. Mechanical tampers, for compacting backfill, shall be tampers capable of exerting a blow equal to 250 foot-pounds per square foot (FT²) of area of the tamping face.
6. Work broken or ruptured by improperly placed backfill shall be removed and replaced by the Contractor at no additional cost to the Owner.
7. Following inspection as specified above, approved backfill material shall be deposited in the trench with hand shovels, not by means of wheelbarrows, carts, trucks, bulldozers, or similar equipment, in four (4) inch layers and compacted by mechanical tampers until the pipe has a cover of not less than two (2) feet. The remainder of the backfill material shall then be deposited in the trench in eight (8) inch layers and compacted. Any trenches improperly backfilled shall be reopened, then refilled and compacted to the required grade and smoothed off. Backfill shall be placed and tamped to achieve ninety-five (95) percent (percent of dry weight) compaction.
8. Field density tests may be required by the Architect in areas where, in his opinion, a question exists with respect to compliance with compaction requirements. These tests will be paid for at standard rates by the Owner, where the test results indicate compliance with the compaction requirements, and by the Contractor where the test results indicate non-compliance with compaction requirements. Density tests shall be performed by the methods specified in A.A.S.H.O. Designation T-147, the Field Determination of Density of Soil-In-Place.

3.14 EQUIPMENT BASES AND SUPPORTS

- A. Refer to Division 23, "Mechanical Vibration, Sound and Seismic Controls" for vibration isolation and seismic restraint requirements.
- B. Concrete bases, curbs, and supports will be furnished and installed under this Division and shall be in accordance with Division 3.
- C. The Subcontractors shall furnish, to the General Contractor, all required foundation sizes, bolts, washers, sleeves, plates and templates for equipment.
- D. The size of the foundation bolts shall be as recommended by the manufacturer.
- E. All equipment shall be set on the foundations, shimmed level with steel shims, and grouted up under base for uniform bearing by the Subcontractor.
- F. Under this Section, provide all equipment supports; consisting of inertia pads, platforms, gratings, structural members and related materials required for the mechanical and electrical work.
- G. The type and size of the supporting channels and supplementary steel shall be determined by the Subcontractor and shall be of sufficient strength and size to allow only a minimum deflection in conformance with the manufacturer's requirements for loading.

3.15 SLEEVES AND PLATES

- A. Sleeves shall be provided by the trade installing the pipes or ducts for which sleeves are to be used. The sleeves shall be carefully located in advance of the construction of walls and floors, where new construction is involved. All cutting and patching necessary to set sleeves which are not placed prior to construction shall be the responsibility of the trade providing the sleeves.
- B. Sleeves shall be provided for all piping, conduits, and ducts passing through all floor slabs and concrete, masonry, tile, and gypsum wall construction.
- C. Fasten sleeves securely in floors and walls so that they will not become displaced when concrete is poured or when other construction is built around them. Take precautions to prevent concrete, plaster or other materials from being forced into space between pipe and sleeve during construction.
- D. Where pipe motion due to expansion and contraction will occur, make sleeves of sufficient diameter to permit free movement of pipe. Where insulated pipes and ducts pass through sleeves, the sleeves shall be large enough to pass the pipe or duct and the insulation. Check floor and wall construction to determine proper length for various locations; make actual lengths to suit the following:
 - 1. Terminate sleeves flush with walls, partitions, and ceilings.
 - 2. Terminate sleeves two (2) inches above finished floors. Fill all voids between sleeves and structures with an approved sealant or grout as determined by the Architect. Refer to Architectural drawings and specifications for sealing requirements of sleeves in floor.
- E. Submit, for approval, shop drawings showing size, type, and location of all sleeves and penetrations through poured concrete walls or existing structure. Sleeves installed in load bearing concrete or masonry construction shall be completely grouted in place. See Architectural drawings for extent and location of such walls. Single and multiple pipe or conduit penetrations, as well as duct openings, shall be accurately located by field measurements and indicated on the drawings. The drawings shall be prepared sufficiently in advance for approval by the Architect and shall be prepared at a minimum scale of 1/8 inch equals one (1) foot.
- F. Structural members shall not be cut or penetrated. Notify the Architect where penetrations of structural members are required. Holes cut through concrete and/or masonry, to accommodate new work, shall be cut by reciprocating or rotary, non-percussive methods.

3.16 FLASHING

- A. Openings for pipes and ducts through waterproofed floors and roof areas shall be flashed. Vent pipes through roof shall be flashed with spun aluminum base having a minimum of five (5) inch roof surface flange. Base shall extend five (5) inches above roof surface.
- B. Fan bases shall be provided with prefabricated curbs as specified elsewhere in this Division.

3.17 DEMOLITION

- A. All existing piping, conduit, equipment, ductwork, and materials not required for re-use or re-installation shall be removed. Any existing materials and equipment which are removed and are desired by the Owner, or are indicated to remain the property of the Owner, shall be delivered to him on the premises by the Contractor where directed by the Architect. All other materials and equipment which are removed shall become the property of the Contractor and shall be removed by him from the premises.
- B. Existing piping that remains concealed, buried, or otherwise contained in the remaining slabs and walls shall be capped, plugged, or otherwise sealed. All pipes shall be cut so that their capped or plugged ends will be below the finished floors or behind finished surfaces.
- C. Existing wiring, where possible, shall be removed or pulled through conduits. Wiring remaining shall be cut back behind the termination of conduits so that conduits can be adequately capped, plugged, or sealed.

3.18 CONNECTIONS AND ALTERATIONS TO EXISTING WORK

- A. When existing mechanical and electrical work is removed, all pipes, valves, ducts, and materials shall be removed to a point below the finished floors or behind finished walls and capped. Such points shall be far enough behind finished surfaces to allow for the installation of the normal thickness of finished material.
- B. When the work specified hereinafter connects to existing equipment, piping, or ductwork, the Contractor shall perform all necessary alterations, cuttings, or fitting of existing work as may be necessary or required to make satisfactory connections between the new and existing work and to leave the completed work in a finished and workmanlike condition, to the entire satisfaction of the Architect.
- C. When the work specified hereinafter or under other divisions of the contract necessitates relocation of existing equipment, piping, or ductwork, the Contractor shall perform all work and make all necessary changes to existing work as may be required to leave the completed work in a finished and workmanlike condition, to the satisfaction of the Architect. All work resulting in an extra to the contract shall be approved by the Owner and Architect before proceeding.
- D. All cutting and patching necessary for the installation of the mechanical work shall be done under this Division. Any damage done to the work already in place shall be repaired at the Contractor's expense. Patching shall be uniform in appearance and shall match the surrounding surface.

3.19 INTERRUPTION OF EXISTING UTILITIES

- A. Notify the Owner in writing at least seven (7) days in advance of any required shutdown of water, sewage, gas, electrical service or other utility. Upon written receipt of approval from Owner, shutdowns shall be performed between the hours of six (6) p.m. and six (6) a.m. including clean-up or as directed otherwise and shall be accomplished at no additional cost
- B. At the end of each interruption, all services shall be restored so that normal use of the building

can continue.

END OF SECTION 230500

SECTION 230513 - MOTORS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. The drawings and general provisions of the Contract, including General and Supplementary Conditions, General Requirements and all other Specification Sections apply to the work specified in this section. In the event of conflict between specific requirements of the various documents, the more restrictive, the more extensive (i.e.: more expensive) requirement shall govern.
- B. Motors for equipment specified in other Sections of the Specification shall comply with the requirements of this Section. In the absence of a requirement in another Section, the requirements in this Specification shall be met.

1.2 SUMMARY

- A. This Section includes basic requirements for factory-installed motors.

1.3 DEFINITIONS

- A. **Factory-Installed Motor:** A motor installed by motorized-equipment manufacturer as a component of equipment.

1.4 SUBMITTALS

- A. **Shop Drawings and Product Data:** Shop drawings and product data for motors shall be provided with the submittal package for the piece of equipment that it serves. In accordance with Division 01, Section "Submittals" provide the following:
 - 1. Product catalog data: nameplate data and ratings; materials of construction; mounting arrangement, size and location of motor terminal box and conduit entry, grounding lugs and coatings.
 - 2. Completed tabulation sheet (template provided at the end of this Section).
 - 3. For motors over 100 hp, submit routine test report for a similar motor. Routine tests shall be as described in NEMA MG 1 using IEEE Method 112 forms.
- B. **Warranties**
 - 1. In addition to the guarantee requirements of the General Conditions, warranties for each motor shall be covered in the warranty for the entire mechanical assembly (fan & motor, pump and motor, etc).
- C. **Manufacturer Seismic Qualification Certification:** Submit certification that motors, accessories, and components will withstand seismic forces defined in Division 23, Section "Mechanical

Vibration, Sound and Seismic Controls. Include the following:

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
 - a. 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."
 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. Operation and Maintenance Data: For factory-installed motors to include in emergency, operation, and maintenance manuals.

1.5 DESIGN REQUIREMENTS

- A. Each motor shall be sized to provide adequate operating torque at the operating speed(s) for the equipment served without exceeding the motor's nominal horsepower. The manufacturer of the driven equipment shall provide the motor for that particular piece of equipment. In no case shall the Contractor supply the motor separately for the driven piece of equipment.
- B. Motor speed listed in Section 15 is the synchronous speed for both squirrel cage induction and synchronous motor types. It shall be the responsibility of the driven equipment supplier to match the driven equipment speed requirements with the motor, including motor slip and synchronizing torque requirements.

1.6 QUALITY ASSURANCE

- A. Source Limitations: Obtain factory-installed motors through one source from a single manufacturer.
- B. Product Options for Factory-Installed Motors: Drawings indicate size, profiles, and dimensional requirements of motors and are based on the specific system indicated. Refer to Division 1 Section "Product Requirements."
- C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- D. Comply with NFPA 70, "National Electrical Code."
- E. NRTL Listing: Motors shall be NRTL-listed.
 1. Term "Listed": As defined in "National Electrical Code," Article 100.
 2. Listing Agency Qualifications: "Nationally Recognized Testing Laboratory" (NRTL) as defined in OSHA Regulation 1910.

- F. Comply with NEMA MG 1, "Motors and Generators."
- G. Comply with UL 1004, "Motors, Electric."
- H. Provide factory test reports in accordance with Part 2 of this Section.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Whenever possible, motor and driven equipment shall be shipped complete as an entire assembly.
- B. Inspect equipment immediately upon arrival and any irregularities or damage shall be reported to the Manufacturer/Supplier and Designer immediately.
- C. Store in accordance with manufacturer's recommendations.

1.8 IDENTIFICATION

- A. Nameplates: All motors shall have a stainless steel nameplate attached with stainless steel fasteners on the motor. The nameplate shall be stamped with nameplate markings listed in NEMA MG 1 20.60, plus the following:
 - 1. Manufacturer
 - 2. Model Number
 - 3. Serial Number
 - 4. Nominal efficiency
 - 5. Minimum efficiency
 - 6. Temperature Rise
 - 7. Bearing manufacturer's name and catalog number

1.9 COORDINATION

- A. Coordinate features of motors, installed units, and accessory devices and features that comply with the following:
 - 1. Compatible with the following:
 - a. Magnetic controllers.
 - b. Multispeed controllers.
 - c. Reduced-voltage controllers.
 - 2. Designed and labeled for use with variable frequency controllers, and suitable for use throughout speed range without overheating.
 - 3. Matched to torque and horsepower requirements of the load.
 - 4. Matched to ratings and characteristics of supply circuit and required control sequence.
- B. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 3.

PART 2 - PRODUCTS

2.1 MOTOR REQUIREMENTS

- A. Motor requirements apply to factory-installed motors except as follows:
1. Different ratings, performance, or characteristics for motor are specified in another Section.
 2. Motorized-equipment manufacturer requires ratings, performance, or characteristics, other than those specified in this Section, to meet performance specified.
- B. Motors shall be sized to drive the equipment, and perform the specified duty, but in no case less than the size shown or specified. If a motor larger than that specified is required, the Contractor shall bear the expense of changes in foundations, supports, wire and conduit connections, circuit protective devices, or other affected elements of the system. Each motor shall have sufficient capacity to start and operate the machine it drives without exceeding the motor nameplate rating at the speed specified or at the load which may be obtained by the drive actually provided. Motors shall be Class F insulation, Class B temperature rise at 1.0 service factor and 1.15 (minimum) service factor for continuous duty of 115 percent of rated capacity with maximum temperature rise in accordance with NEMA Chapter 12 Tables.
- C. Contractor assumes responsibility for the correct direction of rotation required by the equipment drives. In the event of damage due to reverse rotation, the equipment shall be repaired or replaced at no charge to the Owner.
- D. Motors shall have the following enclosure types in accordance with NEMA MG 1:
1. For clean dry indoor areas: open drip proof (ODP) fully-guarded
 2. For outdoor locations: totally-enclosed fan-cooled for small and medium machines, weather protected type II for large machines
 3. Explosion-proof machines shall be provided for hazardous areas classified in accordance with NFPA 70 (National Electrical Code). Explosion proof motors shall be NRTL-listed for the hazardous area classification.
- E. Motors, 1/2 HP and larger, shall be three (3) phase, Class B, general purpose, squirrel cage, open type, premium efficiency, induction motors in accordance with NEMA MG1, wound for voltage indicated on the drawings, sixty (60) Hertz, alternating current, unless otherwise indicated on the drawings or specified herein. Motors smaller than 1/2 HP shall be single phase, open capacitor type in accordance with NEMA standards wound for 115 volts, 60 Hertz, alternating current. Motors 1/6 HP and under may be split phase type. Motors 1 HP and larger shall have nameplate rating and efficiency per NEMA MG 1. Ratings shall be based on IEEE Test Procedure 112, Method B.
- F. Each motor, 1 HP or larger, or motor driven equipment, 1 HP or larger shall have a composite power factor (PF) rating of ninety (90) percent to 100 percent when the driven equipment is operating at the design duty defined on the drawings. Power factor correction devices shall be provided to meet the stated criteria.
- G. Devices such as capacitors, or equipment such as solid state power factor controllers, shall be provided as part of the motor or item of motor driven equipment when required for power factor

correction. Devices shall be completely mounted and wired to the motor terminal except as follows:

1. For a motor or motor driven equipment requiring other than across-the-line starting, power factor (PF) correcting capacitors, or other equipment, shall be connected to motor terminals via a contactor (controller) with a 120 volt alternating current (VAC) coil. The 120 volt alternating current (VAC) coil shall be energized via an auxiliary contact on the contactor (controller) used to establish the "run" operating mode for the motor driven equipment.
 2. For two (2) speed motors, power factor (PF) shall be corrected at each speed via separate groups of capacitors or other equipment for each speed. Each group of PF correcting components shall be connected to motor terminals via a separate contactor (controller) with a 120 volt alternating current (VAC) coil. Each 120 volt alternating current (VAC) coil shall be energized via an auxiliary contact on the contactor or controller used to establish "run" operations at each speed.
- H. Locked rotor kVA shall not exceed NEMA Code Letter F for motors over 10 horsepower.
- I. Motor Insulation: The insulation system shall consist of Class F or better insulation materials and shall utilize a process of one cycle of vacuum impregnation of 100% polyester resins and two cycles of treatment with a polyester varnish. All materials shall be non-hygroscopic. No asbestos materials shall be used. Motors over 600V shall have windings tested in a water-filled tank in accordance with NEMA MG 1 12.62.
- J. Motor Bearings: Motor bearings shall be specifically designed for the drive application, and shall be approved by the Engineer. Bearings shall have a minimum bearing life of B-10 or L-10 as defined by the AFBMA. Bearings shall be designed to carry the total hydraulic and static thrust developed by the driven load. Bearings shall be grease or oil lubricated. Oil lubricated motors shall be fitted with gravity-feed oil reservoirs. Grease lubricated bearings shall be regreasable (not sealed) and shall be supplied with grease fittings and drain plugs. Medium voltage and variable frequency controlled motor bearings shall be electrically isolated from the shaft on at least one end to prevent transmission of electric current. Current drain brushes shall be fitted where it is necessary to divert the flow of electrical current from bearings. Bearings, housing and brackets shall be constructed to permit access, removal and replacement of the bearings without disassembly of the motor.
- K. Rotor: The rotor shall be dynamically and statically balanced. Assembled motor shall be tested at the factory in accordance with latest applicable NEMA MG 1 and IEEE 112 methods of testing, and balanced at no more than 0.001 inches total peak-to-peak deflection on the bearing housing and the shaft. Overall vibration readings, including all vibration frequencies, shall be taken and recorded at no load and design speed.
- L. Terminal Box: Motors shall have a watertight cable terminal box. Terminal box shall be oversized, diagonally split, and rotatable in 90o increments to allow conduit and cable entry from top, bottom and sides.
- M. Motor Leads: Motor leads shall be a minimum of 6 inches in length. All motor leads shall be extended from the conduit box. Motors rated over 200 HP or over 600V shall have insulated tin plated copper busbar terminals with bolt holes for compression wire lugs.
- N. Drains and Breathers: Provide drain(s) in the bottom of the motor at the lowest point(s).

Enclosed motors shall be fitted with breathers.

- O. Screens: Provide stainless steel screens at motor ventilation openings.
- P. Rotation: Motor rotation shall be coordinated with the requirements of the pump or fan.
- Q. Motor Shaft: The motor shaft shall be ASTM A322 GR140 (AISI 4140) steel and shall be sized to accommodate the required power and torque. Provide shaft end with keyway for connection to coupling with the pump shaft. Coordinate shaft design requirements with driven load.
- R. Stainless Steel Hardware: Provide corrosion resistant hardware for motor components including grease fittings, plugs, nuts, bolts, washers and screws.
- S. Motor Casing and Coating: The motor housing shall be cast iron for small and medium machines and fabricated steel plate for large machines. Housings shall be degreased, primed and painted both inside and outside with a rust inhibitive primer and corrosion resistant polyester paint. Painting shall be performed prior to installing the motor stator windings. The primer and paint materials selected shall be suitable for the environment encountered, both inside and outside of the casing.
- T. Motors connected to Variable Frequency Drives shall be “inverter duty” with additional magnet wire insulation to achieve a minimum motor impulse voltage rating equal to the VFD manufacturer’s recommendations for the motor, cable size, and cable length actually installed.
- U. Shaft Grounding Ring: Each motor shaft shall be provided with a Shaft Grounding Ring (SGR) that will provide a reliable low resistance path from the motor shaft to the motor frame to prevent the build up of destructive high frequency shaft currents that are created by the Pulse Width Modulation of the Variable Frequency Drive units. The SGR shall encircle the shaft and shall be designed to promote efficient discharge of the high frequency shaft currents to the motor frame. The motor frame shall be inherently grounded by design.
- V. Power Factor Correction Capacitors: Provide motor power factor correction capacitors for all motors rated 600V or less (except variable frequency controlled motors) with less than 90% uncorrected power factor. Motor power factor correction capacitors shall be sized as recommended by the motor manufacturer to correct the motor power factor to over 90%. Motor power factor correction capacitor sizes shall not be larger than the maximum size recommended by the motor manufacturer. Enclosure type shall be NEMA 12. Capacitors shall be dry film type with fuses and discharge resistors.
- W. Motor winding temperature protection shall be provided for motors 400 HP and larger. Winding temperature detectors shall consist of six 100 ohm RTD’s (resistance temperature detectors) with three leads each, imbedded in pairs in each phase of the stator windings, and brought out to labeled terminal in a separate motor RTD terminal box. Provide compatible motor winding temperature monitoring at the motor controller to shut down the motor when the temperature exceeds 50 deg. F. above the Class B temperature rise, and provide three conductor shielded cable in rigid galvanized steel conduit from the RTD’s to the motor controller.

2.2 MOTOR CHARACTERISTICS

- A. Motors 1/2 HP and Larger: Three phase.

- B. Motors Smaller Than 1/2 HP: Single phase.
- C. Frequency Rating: 60 Hz.
- D. Voltage Rating: NEMA standard voltage selected to operate on nominal circuit voltage to which motor is connected.
- E. Service Factor: 1.15 for open dripproof motors; 1.0 for totally enclosed motors.
- F. Duty: Continuous duty at ambient temperature of 105 deg F and at altitude of 3300 feet above sea level.
- G. Capacity and Torque Characteristics: Sufficient to start, accelerate, and operate connected loads at designated speeds, at installed altitude and environment, with indicated operating sequence, and without exceeding nameplate ratings or considering service factor.
- H. Enclosure: Open dripproof.

2.3 POLYPHASE MOTORS

- A. Description: NEMA MG 1, Design B, medium induction motor.
- B. Efficiency: Premium, as defined in NEMA MG 1. Refer to Motor Efficiency Table for average motor efficiencies.

Motor Efficiency			
Motor Size (HP)	6-pole	4-pole	2-pole
1	82.5%	85.5%	77.0%
1.5	86.5%	86.5%	84.0%
2	87.5%	86.5%	85.5%
3	88.5%	89.5%	85.5%
5	89.5%	89.5%	86.5%
7.5	90.2%	91.0%	88.5%
10	91.7%	91.7%	89.5%
15	91.7%	93.0%	90.2%
20	92.4%	93.0%	91.0%
25	93.0%	93.6%	91.7%
30	93.6%	94.1%	91.7%
40	94.1%	94.1%	92.4%
50	94.1%	94.5%	93.0%

- C. Stator: Copper windings, unless otherwise indicated.
 - 1. Multispeed motors shall have separate winding for each speed.
- D. Rotor: Squirrel cage, unless otherwise indicated.
- E. Bearings: Double-shielded, prelubricated ball bearings suitable for radial and thrust loading.
- F. Temperature Rise: Match insulation rating, unless otherwise indicated.
- G. Insulation: Class F, unless otherwise indicated.
- H. Code Letter Designation:
 - 1. Motors 15 HP and Larger: NEMA starting Code F or Code G.
 - 2. Motors Smaller Than 15 HP: Manufacturer's standard starting characteristic.
- I. Enclosure: Cast iron for motors 7.5 HP and larger; rolled steel for motors smaller than 7.5 HP.
 - 1. Finish: Gray enamel.

2.4 POLYPHASE MOTORS WITH ADDITIONAL REQUIREMENTS

- A. Motors Used with Reduced-Inrush Controllers: Match wiring connection requirements for controller with required motor leads. Provide terminals in motor terminal box, suited to control method.
- B. Motors Used with Variable Frequency Controllers: Ratings, characteristics, and features coordinated with and approved by controller manufacturer.
 - 1. Designed with critical vibration frequencies outside operating range of controller output.
 - 2. Temperature Rise: Matched to rating for Class B insulation.
 - 3. Insulation: Class H.
 - 4. Thermal Protection: Comply with NEMA MG 1 requirements for thermally protected motors.
- C. Rugged-Duty Motors: Totally enclosed, with 1.25 minimum service factor, greased bearings, integral condensate drains, and capped relief vents. Windings insulated with non-hygroscopic material.
 - 1. Finish: Chemical-resistant paint over corrosion-resistant primer.
- D. Source Quality Control for Field-Installed Motors: Perform the following tests on each motor according to NEMA MG 1:
 - 1. Measure winding resistance.
 - 2. Read no-load current and speed at rated voltage and frequency.
 - 3. Measure locked rotor current at rated frequency.
 - 4. Perform high-potential test.

2.5 SINGLE-PHASE MOTORS

- A. Type: One of the following, to suit starting torque and requirements of specific motor application:
 - 1. Permanent-split capacitor.
 - 2. Split-phase start, capacitor run.
 - 3. Capacitor start, capacitor run.
- B. Shaded-Pole Motors: For motors 1/20 HP and smaller only.
- C. Thermal Protection: Internal protection to automatically open power supply circuit to motor when winding temperature exceeds a safe value calibrated to temperature rating of motor insulation. Thermal-protection device shall automatically reset when motor temperature returns to normal range.
- D. Bearings: Ball type for belt-connected motors and other motors with high radial forces on motor shaft; sealed, prelubricated-sleeve type for other single-phase motors.

PART 3 - EXECUTION

3.1 COMMISSIONING

- A. Check operating motors for unusual conditions during normal operation. Coordinate with the commissioning of the equipment for which the motor is a part.
- B. Report unusual conditions.
- C. Correct deficiencies.

END OF SECTION 230513

SECTION 230530 - BASIC MATERIALS AND METHODS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. The drawings and general provisions of the Contract, including General and Supplementary Conditions, General Requirements and all other Specification Sections apply to the work specified in this section. In the event of conflict between specific requirements of the various documents, the more restrictive, the more extensive (i.e.: more expensive) requirement shall govern.

1.2 SCOPE

- A. This section includes requirements for items of equipment, materials and procedures which are common to more than one section of Division 22 and 23 and which are general in nature and use. This section applies to all sections of Divisions 21, 22 and 23.
- B. The requirements of Division 23, Section "Mechanical and Electrical General Provisions" shall apply to all work specified under this section.
- C. This section specifies the color schemes for painting exposed and insulated piping in the mechanical rooms. Refer to Division 9 for painting specifications.

1.3 SHOP DRAWINGS

- A. Submit shop drawings for all items of materials specified in this section in accordance with the General Requirements.

1.4 TESTS AND ADJUSTMENTS

- A. The Contractor shall furnish labor, instruments, equipment, and materials required to perform tests prescribed in the sections describing the various systems. All tests shall be performed in the presence of the Owner and/or the Architect. Forty-eight (48) hours prior notice shall be given to the Owner and Architect for all tests. A written test report shall be submitted following all tests and before systems are insulated.
- B. Replace or repair defects found during inspection or tests with new materials. Caulking of welded joints, screwed joints, cracks, or holes is not acceptable. Correct leaks in screwed fittings by remaking joints. Cut out and reweld. Repeat tests after defects have been eliminated.
- C. Where reasonable doubt exists as to a system's ability to comply with contract requirements, perform any reasonable test required by the Architect.
- D. Make static pressure tests and prove to the satisfaction of the Architect the piping is tight before

pipes are concealed. Tests shall be provided as hereinafter specified.

- E. Use test instruments tested for accuracy by an approved laboratory or by the instrument manufacturer, and furnish certificates showing degree of accuracy to the Architect when requested. Make calibration histories for each instrument available for examination.
- F. Where gauges, thermometers and other instruments which are to be left permanently installed are used for tests, do not install until just prior to the tests to avoid possible changes in calibration.

1.5 REFERENCES AND DEFINITIONS

- A. Unless otherwise specifically indicated, the term, and requirements of, “domestic” water systems shall universally apply to all potable, HVAC make-up and industrial laboratory water systems.

PART 2 - PRODUCTS

2.1 HANGERS:

- A. See Division 23, Section “Mechanical and Electrical General Provisions” for general requirements.
- B. Hangers and accessories shall be Anvil International, Carpenter-Patterson, Michigan, B-Line, or Basic Engineering of the types specified in Division 23, Section “Mechanical and Electrical General Provisions”.
- C. It shall be the responsibility of the Contractor to provide an adequate pipe suspension system in accordance with recognized engineering practices, using standard, commercially accepted pipe hangers and suspension equipment.
- D. The Contractor shall engage a qualified professional engineer to design an engineered pipe hanger and support system for all pipe systems of this Contract. Contractor shall perform calculations to ensure that the pipe support system being provided is adequate for the service. For all pipe hangers, supports, anchors, guides, etc., the Contractor shall submit a pipe hanger assembly drawing in accordance with the recommendations provided by MSS SP-89. Provide proposed equipment manufacturer, manufacturer's model number and size, construction, finish, quantities and/or lengths. Utilize columns shown on Contract Drawings for the location plan. Indicate pipe system, line size, insulation thickness, and Contract Drawing for which the plan view of the pipe hanger location can be found.
 - 1. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of hangers and supports that are similar to those indicated for this Project in material, design, and extent.
- E. All brackets used for supporting piping shall be provided by the Contractor and shall be of

welded steel construction with a design safety factor of not less than five.

- F. The design of all hangers and supports shall conform to the latest requirements of ANSI/ASME B31.1 or ANSI/B31.9 and Manufacturers' Standardization Society (MSS) Standard Practice SP-58, SP-69 and SP-89, unless otherwise made more stringent below.
 - 1. Hangers for steel pipe, except as noted otherwise, shall be spaced at least every ten (10) feet.
 - 2. Hangers for cast iron pipe shall be provided at each joint.
 - 3. Hangers for copper pipe shall be placed at least every eight (8) feet, except pipes 3/4 inch and smaller shall have hangers at six (6) foot intervals.
 - 4. Plastic and polypropylene piping systems 1 1/4" and smaller shall be provided with continuous pipe support using light gauge sheetmetal angles strapped to pipes.
 - 5. Hangers shall be placed within one (1) foot of each horizontal and vertical elbow.
- G. Where concentrated loads of valves, fittings and similar items occur, closer hanger spacing will be necessary.
- H. Generally, hangers shall be clevis type, standard weight for lines 2-1/2 inch and larger.
- I. Vibration hangers shall be provided as hereinafter specified in Division 23, Section "Mechanical Vibration, Sound and Seismic Controls".
- J. Pipe Shields
 - 1. On insulated piping 2" and larger, provide Pipe Shields, Inc. Model No. A3000 and A5000 for use on warm systems and Model No. A4000 and A6000 for use on cold systems. Contractor shall select appropriate shield for support application.
 - 2. On insulated piping smaller than 2", provide insulation protection shield equal to Anvil International Figure 167. Shield shall comply with Manufacturers Standardization Society (MSS) SP-58 (Type 40).
- K. Hangers in direct contact with copper piping systems shall be copper plated.
- L. All hangers shall be prime painted for interior locations and galvanized coated for exterior locations.
- M. Hangers shall be provided with seismic restraints as required by IBC 2009 and ASCE 05-07.

2.2 IDENTIFICATION, VALVE TAGS AND CHARTS

- A. A complete identification system shall be provided for all mechanical and electrical components which conform to the requirements published in ASME A13.1, NFPA 13 and the Fuel Gas Code.
- B. Product Data and Samples: In accordance with Division 1 Section "Submittal Procedures", submit the following:
 - 1. Manufacturer's technical product data and installation instructions for each type of identification device specified. Include a list of all piping systems indicating a proposed

- nomenclature where a manufacturer's standard pre-printed nomenclature does not match up exactly with what is specified.
2. Samples of each color, lettering style, and other graphic representation required for:
 - a. Brass valve identification tag.
 - b. Pipe contents and identification markers.
 - c. Valve Schedules: For each piping system. Reproduce on standard-size bond paper. Tabulate valve number, piping system, system abbreviation as shown on tag, room or space location of valve, and variations for identification. Mark valves intended for emergency shut-off and similar special uses. Besides mounted copies, furnish copies from maintenance manuals specified in Division 1.
 - d. Plastic equipment identification plates.
 - e. Paint colors for piping systems.
 - f. Stencils.
 - C. All control devices, i.e.; panels, switches, starters, pushbutton stations, relays, temperature controls, etc., shall be clearly identified as to their function and the equipment controlled. All equipment such as pumps, fans, heaters, etc., shall be marked to clearly identify equipment and space or duty they serve. Mechanical equipment shall be identified using engraved laminated black and white phenolic legend plates. Letters shall be minimum 3/4 inch high white on surrounding black. Plates shall be mounted by means of sheet metal screws. Submit nameplate list for approval.
 - D. Piping shall be identified with colored, prerolled, semirigid plastic labels as manufactured by Seton or approved equal. Labels shall be Seton "Set mark" system and shall be set around pipes with a field installed high strength cement compound applied along their longitudinal edge. Labels shall be placed around the piping or insulation every twenty (20) feet and with one (1) label on each pipe in rooms smaller than ten (10) feet. Provide labels on branch lines not more than 5 ft from main header. Provide labels on lines that penetrate walls or floors on each side of penetration not more than 5 ft from penetration. A label shall be placed at every major valve and at least six (6) feet from exit or entrance to an item of equipment. On exterior piping, utilize stencils to paint contrasting letters identifying pipe contents and direction of flow. Letter size and color shall comply with the requirements of adhesive pipe labels.
 - E. For supply and exhaust air terminal units located above the ceiling, in addition to a label on the device, labels are to be permanently affixed to the ceiling grid framing as near to the item as possible using epoxy glue. Where hard ceilings are used, the label is to be affixed to the frame of the access panel for the unit. Labels are to be black core white or beige Bakelite. The lettering is to be 3/8" inches high. The minimum label size is 3/4" wide by 1" long. Terminal units shall be identified as indicated on the mechanical drawings and ATC graphics. The thermostat that controls each air terminal unit shall be identified with an identical but appropriately sized label.
 - F. For fire, smoke and fire/smoke dampers located above the ceiling, labels are to be permanently affixed to the ceiling grid framing as near to the item as possible using epoxy glue. Where hard ceilings are used, the label is to be affixed to the frame of the access panel for the damper. Labels are to be black core white or beige Bakelite. The lettering is to be 3/8" inches high. The minimum label size is 3/4" wide by 1" long. Dampers shall be identified as "Fire Damper", "Smoke Damper" or "Fire/Smoke Damper".
 - G. Labels shall have minimum 3/4 inch high black letters for pipes one (1) inch and larger, and 1/2

inch letters for smaller pipes. All labels shall have flow arrows. Color coding and stencil designations shall be as follows:

<u>Service</u>	<u>Color</u>	<u>Stencil Designation</u>
Potable Cold Water	Green	Potable Cold Water
Potable Hot Water	Green	Potable Hot Water
Potable Hot Water Recirc	Green	Potable Hot Water Recirc.
Sanitary	Brown	Sanitary Sewer
Storm Water	Brown	Storm Water
Condensate Drain, Drain	Brown	Drain Water
Refrigerant Liquid	Green	Refrigerant Liquid
Refrigerant Suction	Green	Refrigerant Suction

- H. All valves, except as specified below, shall be provided with colored plastic valve tags with stamped-in numbers. Tags shall be secured to valve wheels with a metal chain. Stop valves on individual fixtures or equipment where their function is obvious, or where the fixture or equipment is immediately adjacent, need not be so equipped. Care shall be exercised in scheduling and selecting valve numbers to be indicated on a drawing. Drawing shall show locations, details of arrangements, identity, and function of all service and control valves. One (1) copy of each drawing and schedule shall be mounted and framed under plastic protection where directed. Blueprints are not acceptable. A copy of each drawing and schedule shall also be included as a part of the operations and maintenance manuals. Valve tags shall be Seton or approved equal minimum 1-1/2 inch round tags with white characters describing system and valve designation.
- I. Use color scheme indicated below for painting exposed and insulated piping in the mechanical rooms. Colors for piping not identified below shall be as indicated by Owner. Exterior non-insulated piping shall be painted with two coats of rust inhibitive paint. Colors shall be approved by the Owner after a sample is provided for each service. Do not paint aluminum jackets. Do not paint exposed copper or galvanized piping.

<u>Service</u>	<u>Color</u>
Potable Water	Green
Sanitary	Brown
Storm Water	Brown
Condensate Drain, Drain	Brown
Refrigerant Piping	Green

- J. Identify fire protection systems (sprinkler and fire alarm) as hereinafter specified as required by NFPA Standards

2.3 PIPE, FITTINGS AND JOINTS

- A. General: Items are referred to by type and shall conform to the latest editions of standards listed below:
- B. Provide pipe and fittings for fire protection as hereinafter specified in Division 21, Sections "Fire Protection."

C. All piping shall be new domestic pipe material, manufactured in the United States of America (USA) and be suitable for the specific use indicated on drawings and in the specifications.

D. Piping Material:

<u>Service</u>	<u>Piping</u>	<u>Fittings</u>	<u>Joints</u>
1. Sanitary drainage:			
a. Underground:	A	I	a
b. Above ground within building	J	VIII	i
c. Vent piping	J	VIII	i
2. Storm water and drain:			
a. Underground	A	I	a
b. Above ground	J	VIII	i
3. Foundation drain:	H	VI	-
4. Cold Water:			
a. Above ground - 4" and larger	F	III	e
b. Above ground - 3" and smaller	F	III	e
c. Underground - 3-1/2" and larger	K	IX	j
d. Underground - 3" and smaller	E	III	f
5. Domestic hot water, tempered water and hot water recirc:	F	III	e
6. Condensate Drain/Drain:			
a. Optional	J	VIII	i
b. Optional	B	II	e
7. Refrigerant Relief:	F	III	f
8. Refrigerant Piping:	F	III	f

E. Piping Assembly:

Type

Designation

1. Cast iron hub and spigot pipe, service weight ASTM A74. All pipe and fittings shall be marked with the collective trademark of the Cast Iron Soil Pipe Institute and listed by NSF International. A
2. Copper drainage tubing, drain, waste, and vent, DWV, ASTM B306 B
3. Black steel pipe, ASTM A53/106 Grade B Seamless ANSI Schedule 40 C
4. Black steel pipe, ASTM A53/106 Grade B Seamless ANSI Schedule 80 D
5. Seamless copper water tube, ASTM B88, Type K, soft E
6. Seamless copper water tube, ASTM B88, Type L, hard F
7. Seamless copper water tube, ASTM B819 Type L, hard, prepared and labeled for oxygen service and sealed when delivered to the site G
8. Corrugated and perforated black polyethylene drain pipe ASTM F-405 with three (3) rows of perforations and snap-lock ends H
9. Cast iron soil pipe, service weight No-Hub, ASTM A-888. All pipe and fittings shall be marked with the collective trademark of the Cast Iron Soil Pipe Institute and listed by NSF International. J
10. Ductile iron water pipe, outside coated, AWWA C104/A21.4 cement mortar-lined, ANSI/AWWA C151/A 21.51 pipe K
11. Black steel pipe ASTM A53/106 Grade B Seamless ANSI Schedule 40 with "X-Tru-Coat" Polyethylene or polypropylene coating (25 to 60 mils thickness) L
12. Galvanized steel pipe ASTM A53/106, Grade B seamless ANSI Schedule 40 M
13. Enfield flame retardant polypropylene acid resistant drainage pipe, ASTM D635, Schedule 40 N

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| 14. | Polypropylene (PP) pipe by George Fischer, Asahi, or Orion, equal to George Fischer PPro-Seal, suitable for use in reverse osmosis/deionized (RO/DI) water systems. Natural virgin copolymer polypropylene with no added plasticizers, pigments or re-grind that is manufactured to schedule 80 wall thickness and is compliant with US Food and Drug Administration regulations 21.CFR 177.1520 Sections A1, B & C and conforms to ASTM D4101. Pipe shall be manufactured to the dimensions and tolerances of ASTM D1785. All pipes shall be packaged in polybags at the point of manufacturing to preserve pipe cleanliness. | P |
| 15. | Plenumline FR-PVDF flame retardant polyvinylidene fluoride (PVDF) acid resistant drainage pipe, ASTM F 1673, Schedule 40, meeting the requirements of ASTM E84 and UL723 | Q |

F. Fitting Materials:

<u>Type</u>	<u>Designation</u>
1. Cast iron soil pipe fittings, service weight, ASTM A74	I
2. Wrought copper and bronze drainage fittings, ANSI A16.29	II
3. Wrought copper solder joint fittings, 150 pound ANSI B16.22	III
4. Black malleable iron screwed fittings, 150 pound, ANSI B16.3 for less than seventy-five (75) pounds per square inch and 300 pounds for seventy-five (75) pounds per square inch or more	IV
5. Black malleable iron grooved fittings, ASTM A47, Victaulic Style 07, Zero Flex. Galvanized fittings shall be used for domestic water.	V
6. Corrugated polyethylene snap-lock drain fittings for snap-together assembly	VI
7. Steel butt-welding fittings ANSI B16.9 using long-turn ells, ANSI B16.5 weld neck or slip on flanges & Bonney Forge Weldolets and Threadolets. Wall thickness to match pipe.	VII
8. Cast iron soil pipe fittings, No Hub, ASTM A-888	VIII

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|-----|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|
| 9. | Cast iron pressure fittings AWWA Class D, 250 pounds per square inch | IX |
| 10. | Steel butt-welding fittings ANSI B16.9 using long-turn ells with field applied "X-Tru-Coat" coating in accordance with manufacturer's recommendations | X |
| 11. | Galvanized malleable cast iron screwed fittings, ANSI B16.3, 150 pounds for less than seventy-five (75) pounds per square inch and 300 pounds for seventy five (75) pounds per square inch or more. Provide drainage fittings for drain pipe. | XI |
| 12. | Black Cast iron screwed fittings, ANSI B16.4, 125 pound for less than seventy-five (75) pounds per square inch and 250 pounds for seventy-five (75) pounds per square inch or more | XII |
| 13. | Forged steel socket-welding fittings, ANSI B16.11, Class 3000, Schedule 40. | XIII |
| 14. | Enfield mechanical joints and adapters. Connections containing EVA components are prohibited. | XIV |
| 15. | Polypropylene (PP) fittings by George Fischer, Asahi, or Orion, equal to George Fischer PPro-Seal, suitable for use in reverse osmosis/deionized (RO/DI) water systems. Natural virgin copolymer polypropylene with no added plasticizers, pigments or re-grind that is manufactured to schedule 80 wall thickness and is compliant with US Food and Drug Administration regulations 21.CFR 177.1520 Sections A1, B & C and conforms to ASTM D4101. Pipe shall be manufactured to the dimensions and tolerances of ASTM D1785. All fittings shall be packaged in polybags at the point of manufacturing to preserve pipe cleanliness. | XVI |
| 16. | Plenumline acid waste fittings and adapters. Fittings shall be third party certified to ASTM F 1673 and ASTM E84, and IAPMO approved. Connections containing EVA components are prohibited, meeting the requirements of ASTM E84 and UL723 | XVII |

G. Joint Materials:

Type

Designation

1. Premolded rubber gaskets Tyler Pipe Industries, TY-Seal or Multiple Seal, ASTM C564 a
2. Welded: Mechanical Contractors Association of America, Inc. Guidelines for Quality Piping Installation (1995), Section 2.1.O b
3. Threaded: American Standard for Pipe Threads, ANSI B2.1 c
4. Mechanical: Grooved pipe joints: Victaulic Style 07, Zero Flex. Roll grooving shall be prohibited d
5. Soldered: ASTM B32 tin-antimony 95-5 e
6. Brazed: Silver alloy brazing equal to Silfos and Easy-Flo by Handy and Harman. The use of flux is prohibited f
7. Brazed: Silver alloy brazing equal to Silfos and Easy-Flo by Handy and Harman. The use of flux is prohibited g
8. Tongue and groove joint sealed with mortar h
9. No-Hub neoprene gasket and stainless steel corrugated shield, Tyler No-Hub coupling i
10. Mechanical: Specification for Mechanical Joint or cast iron pressure pipe and fittings, ANSI A21.10 j
11. Enfield mechanical joints and adapters. Connections containing EVA components are prohibited. k
12. Butt-welded joint construction with an approved welding device, certified personnel and meeting the requirements of ASTM F1290/ASTM D2657 Section 9. All equipment should utilize electronically controlled heating elements for accurate welding temperatures. Tools should also incorporate planing units to face ends prior to heating. Butt-fusion equipment supplied shall weld joints based on force and/or pressure and not mechanical stops. m
13. Plenumline mechanical joints and adapters meeting the requirements of ASTM E84 and UL723, XVII. Connections containing EVA components are prohibited n

H. Pre-Insulated Direct Buried Piping System

1. Refer to Division 23, Section "Underground Distribution Piping".

2.4 VALVES

A. General:

1. Valves shall be provided where indicated on the drawings and as herein specified.
2. Valves shall be placed in such manner as to be easily accessible for hand wheel operation and stuffing maintenance.
3. Install shut-off valves in piping where shown or where listed below:
 - a. To isolate all items of equipment.
 - b. To isolate branch lines and riser at mains.
4. Valve pipe connections shall be screw, solder or weld flange as required to be consistent with other parts of the piping system.
5. Where piping or equipment may subsequently need to be removed, provide valves with bodies having integral flanges or full lugs drilled and tapped to hold valve in place so that downstream piping or equipment can be disconnected and replaced with blank-off plate while valve is still in service.
6. Valves over ten (10) feet above standing level and above six (6) inches in size shall have chain wheel with chain extending to within six (6) feet of standing level. All wheel operated valves shall have an indicator to show the position of the disc or plug.
7. Where valves specified are not available in the pipe size noted on the drawing, the next larger size valve shall be provided.
8. Valves shall be provided for fire protection systems as specified in Division 21, Section "Fire Protection."

B. Balancing Valves:

1. Provide balancing valves where indicated and required to balance water flow through the piping system.
2. Balancing valves, 1 1/4 inches and larger, for systems piping shall be DeZurik as follows: PEC, flanged above two (2) inches with Buna filled PTFE U-ring seal and isobutene-isoprene plug facing, suitable for 250 degrees Fahrenheit continuous operation. Valves in chilled water and tower water systems may have seal and plug facing suitable for 180 degrees Fahrenheit. Valves six (6) inches and smaller shall have lever actuators and valves eight (8) inches and larger shall have gear operators. All actuators shall have adjustable memory stops.
3. Balancing valves one (1) inch and smaller shall be Armstrong Model CBV or as manufactured by TA Hydronics or approved equal.

C. Ball Valves:

1. Ball valves shall be used in all water systems size two (2) inches and smaller.
2. Ball valves shall be Nibco, Jamesbury, Apollo or Watts.
3. Two (2) piece ball valves sizes one (1) inch and smaller may be used for domestic water systems where replacement of internal parts is not critical. Valves shall be equal to Nibco Figure No. 585-70-66, bronze body, full port, stainless steel ball and stem (ASTM A-276, Type 316), TFE seat, blowout proof stem, extended stem for insulation thickness, and suitable for 150 pounds per square inch saturated steam service.
4. Three (3) piece ball valves sizes 1/2 inch to two (2) inch shall be used for all water piping systems to accommodate replacement of internal parts. Valves shall be equal to Nibco

Figure No. 595-Y-66, swing out design, bronze body, full port, stainless steel ball, and stainless steel stem (ASTM A-276 Type 316), reinforced TFE seats. Body bolts and nuts shall be zinc dichromate plated steel and valve shall be suitable for 150 pounds per square inch saturated steam service. Valves shall be threaded or soldered to suit piping systems which they are installed.

5. Three (3) piece ball valves sizes 1/2 inch to four (4) inch shall be used for all medical gas piping systems to accommodate replacement of internal parts. Valves shall be equal to Nibco Figure No. 595-Y-66, swing out design, bronze body, full port, stainless steel ball, and stainless steel stem (ASTM A-276 Type 316), reinforced TFE seats. Body bolts and nuts shall be zinc dichromate plated steel and valve shall be suitable for 150 pounds per square inch saturated steam service. Valves shall be threaded or soldered to suit piping systems which they are installed. All valves shall be serviceable in the line and supplied clean and prepared for oxygen service. Valves shall be packaged in a polyethylene bag to keep them clean on the job site.
6. Three (3) piece ball valves size 1/2 inch to two (2) inch shall be used for all steam and condensate piping systems to accommodate replacement of internal parts. Valves shall be equal to Nibco Figure No. 590-CS-R-66, stainless steel trim (A-276 type 316) with threaded or socket weld ends to suit system wherein installed.
7. Valves shall be equipped with lever handle with extended stem for insulation thickness which shall indicate position of ball orifice and have stops for fully open and closed position. Construction shall be such that power actuator can be used. Ball opening shall be full pipe size.
8. Valve shall be suitable for flow in either direction and must be leak proof at all pressures up to 150 pounds per square inch gauge (psig) and temperatures from minus twenty (-20) degrees Fahrenheit to 350 degrees Fahrenheit in open or shut position.

D. Drain Valves:

1. Drain valves shall be ball type as hereinbefore specified with hose end adapter and shall be provided at low points of all piping systems, and where indicated, 3/4 inch minimum.

E. Valve Schedule:

1. Unless otherwise specified, valves shall be Nibco, Stockham, or Crane equal to the Nibco figure numbers indicated below:

a. Domestic Hot, Cold, Tempered and Recirculated Water Systems:

Globe - Solder end	S-211-Y
Check - Solder end	S-413-Y
Gate - Flanged end	F-619

b. Pumped Discharge:

Check - 2-1/2" and over	F-918-BL&W with lever and weight
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2.5 PIPING SPECIALTIES

- A. Manual air vents shall be key-operated type installed as shown on drawings or as required for proper venting of equipment. Vents at top of vent chambers and coils shall be 1/4 inch ball

valves.

B. Pressure regulating valves on water fill lines serving hydronic systems shall be designed for 125 pounds per square inch gauge (psig) working pressure and set as required and shall be Watts Series U5B. Relief valves shall be Watts Series 174A, ASTM stamped for HVAC water systems.

C. Backflow Prevention Assemblies

1. The backflow prevention assembly selection and installation shall be meet the requirements set by the University of Southern California Foundation for Cross-Connection Control and Hydraulic Research (USCFCCC & HR), SC Department of Health and Environmental Control (SC-DHEC), all current ICC plumbing codes and regulations, and local specifications.
2. Reduced pressure backflow prevention assembly shall be Watts Series 909 or approved equal for domestic water piping systems ¾" through 10".
3. Double check valve backflow prevention assemblies shall be Watts Series 709 or approved equal for non-hazard domestic water piping systems 2 ½" and larger, Watts Series 007 or approved equal for non-hazard domestic water piping systems 2" and smaller, and Watts Series 709 or approved equal for fire protection systems.
4. Any reduced pressure or double check valve backflow prevention assembly installed in the vertical position must have been previously evaluated and approved by the University of Southern California Foundation for Cross-Connection Control and Hydraulic Research (USCFCCC & HR) for a vertical orientation.
5. Vacuum breakers shall be Watts Series 288A for equipment and No. 8A for hose bibbs.

D. Strainers shall be Mueller Steam Specialty Company, Inc., or approved equal, No. 351 for two (2) inch and smaller, No. 758 (125 lbs.) or No. 725 (250 lbs.) for 2-1/2 inch and larger. Basket strainers shall be Mueller Steam Specialty Company, Inc. or approved equal, No. 185. Provide valved blow-down connections on each strainer consisting of a ball valve set between two (2) short nipples. Blow-down valve shall be full size of strainer blow-down connection. Steam and condensate strainers shall be laid parallel to the floor to prevent the accumulation of condensate in the strainer body. Screens shall be stainless steel with perforations as follows:

Water Service up to 2 inches	1/32 inch perforations
Water Service 2.5 inches to 4 inches	1/16 inch perforations
Water Service 5 inches and larger	1/8 inch perforations

1. Contractor shall provide coarse construction strainers in each strainer or inline cone strainers in the piping system during equipment start-up periods. A list of construction strainers with their proposed location shall be submitted to the Architect for approval. After systems have been flushed clean and are fully operational construction strainers shall be removed and turned over to the Owner for accounting. Final strainer elements shall be installed after all construction strainers have been accounted for.

E. HVAC Piping Pressure Gauges:

1. Shall be Ashcroft, Trerice, Crosby or Marsh equal to Ashcroft "Quality" Type 1010 or 1014, 4-1/2 inches diameter case, bottom or back connected for easy reading. Dial shall have black letters on white background.
2. Each gauge shall be mounted within six (6) feet of the floor on backboard or on pipe.

Submit gauge locations and scale ranges for approval. Normal operating point shall occur at 1/3 to 2/3 of the gauges range. Pressure gauges shall be suitable for field calibration and be provided with pressure snubbers.

3. Provide Crane 1/4 inch ball valve where "gauge cocks" are indicated.
4. Select gauge such that at normal service the gauge pointer is at the middle half of the scale range.

F. Thermometers shall be digital vari-angle thermometer manufactured by Weiss Instruments, Inc. or equal. Provide extension necks where services are insulated. The digital thermometers shall have the following characteristics:

1. Casing: Hi-impact ABS
2. Range: -50°F to 300°F
3. Display: 1/2" LCD digits, wide ambient formula
4. Accuracy: 1% of reading or 1°F, whichever is greater
5. Resolution: 1/10° between -19.9°F to 199.9°F
6. Recalibration: Through case potentiometer adjustment
7. Lux rating: 10 Lux (one foot-candle)
8. Update: 10 seconds
9. Ambient Operating Temperature: -30°F to 140°F
10. Ambient Temperature Error: Zero
11. Ambient Operating Humidity: 100%
12. Sensor: Glass passivated thermistor - NTC
13. Steam Assemblies:

- a. INDUSTRIAL GLASS - Full conformance with Federal Spec GG-T-321D. Fully interchangeable with Industrial Glass Thermometers.
- b. BIMETALLIC - Full conformance with ASME B40.3-1990. Fully interchangeable with Bimetallic Dial Thermometers.

G. All gauge ports, nipples and fittings shall be brass. Steel is not acceptable.

2.6 TEST PLUGS

A. Pressure and temperature test plugs where indicated or required shall be 1/4 inch npt fittings, suitable to receive either a 1/8 inch outside diameter (OD) temperature or pressure probe. Fittings shall be solid brass with Nordel valve core, fitted with a color coded marked cap with gasket. The entire assembly shall be rated at 1000 pounds per square inch gauge (psig). Plugs shall be manufactured by Peterson Equipment Company, Inc., Richardson, Texas, or Sisco P/T plugs.

2.7 DIELECTRIC FITTINGS

- A. General: Provide assembly or fitting with insulating material isolating joining of dissimilar metals, to prevent galvanic action and stop corrosion.
- B. Description: Combination of copper alloy and ferrous; threaded, soldered, plain end, or weld neck types matching piping system materials.

- C. Insulating Material: Suitable for system fluid, pressure, and temperature.
- D. Dielectric Unions: Factory-fabricated, union assembly, for 250 psig minimum working pressure at 180 deg. F.
- E. Dielectric Flange Insulating Kits: Field assembled, companion flange assembly, full face or ring type. Components include neoprene or phenolic gasket, phenolic or polyethylene bolt sleeves, phenolic washers, and steel backing washers. Provide Class 150 or Class 300 flanges to match system pipe requirements.
- F. Dielectric Couplings: Galvanized steel coupling with inert and non-corrosive, thermoplastic lining, threaded with 300 psig minimum working pressure at 225 deg. F.
- G. Dielectric Nipples: Electroplated steel nipple with inert and non-corrosive, thermoplastic lining, threaded with 300 psig minimum working pressure at 225 deg. F.

2.8 FLEXIBLE CONNECTORS

- A. General: Provide stainless steel braided flexible connectors with design pressure and temperature rating meeting or exceeding the test pressures and operating temperatures of the systems in which they are installed. Pipe sizes 2-inch and smaller shall be socket welded or threaded matching system requirements. Pipe sizes above 2-inch shall be Class 150 or Class 300 flanged matching system requirements.
- B. Stainless steel hose / Steel pipe, flexible connectors: Corrugated, stainless steel inner tubing covered with stainless steel single wire braid. Include steel nipples or steel flanges welded to hose. Minimum length shall be three times pipe diameter up to 4-inch pipe size and two times pipe diameter up to 18-inch pipe size.

2.9 PIPE ANCHORS

- A. All pipe lines shall be anchored where specified herein, indicated on drawings and where required to prevent uncontrolled movement. Anchors shall be constructed of steel sections and plates, assembled by bolting or welding and secured to the building structure by means of bolts, clamps or welding. Anchors shall prevent both axial and lateral movement of the lines. Anchor vertical pipes by means of clamps welded to pipe and secured to wall or floor construction. Submit details of anchors for approval.
- B. Anchor piping adjacent to flexible pipe connectors to prevent connector from expanding against its restraining bolts and also to keep the pipe on both sides of the connector in alignment.

2.10 EXPANSION

- A. All piping shall be so installed that it will in no way be distorted or strained by expansion or contraction. Except as noted, all expansion and contraction shall be taken up by means of swing joints, loops, bends or long offsets. Swing joints made up with at least three (3) elbows shall be provided in branches from mains in runouts. Size loops for the total pipe expansion without cold springing, but field cold spring 1/2 the pipe on expansion corrected for ambient

temperature.

- B. Where expansion joints are indicated or required, select joints with a traverse of 150 percent of the pipe expansion from an ambient of forty (40) degrees Fahrenheit to the maximum system operating temperature.
- C. Expansion joints two (2) inches and larger shall have flanged ends, except when installed in copper piping systems.
- D. All expansion joints shall be suitable for minimum operating pressure and temperature of 150 pounds per square inch (psi) and 300 degrees Fahrenheit respectively.
- E. Expansion joints shall be of the following types:
 - 1. Corrugated Type - Flexonics "Low-Corr" joints for pipes three (3) inches and larger. Flexonics Model H or HB for pipes smaller than three (3) inches.
 - 2. Slip Type - Flexonics "Slip Pakt" with anchor base.
- F. Submit, for approval, manufacturers' shop drawings of each expansion joint provided depicting length of pipe, location of anchors and guides, calculated expansion offset and type of joint employed.

2.11 PIPE GUIDES

- A. Install pipe guides where indicated on drawings or where required for proper installation of expansion loop. Limit use of guides with expansion loop to points shown or where required to prevent buckling of pipe whether indicated or not.
- B. Do not use pipe guides as pipe supports.
- C. Provide factory made cast semi-steel or other heavy fabricated steel consisting of a bolted two (2)-section outer cylinder and base with a two (2)-section guiding spider welded or bolted tight to the pipe, of sufficient size to clear pipe insulation and long enough to prevent over-travel of spider in cylinder. Furnish a guide sleeve of a length not less than the length of pipe expansion plus the spider length.
- D. When installed in cooling systems, guides must permit the application of thermal insulation.

2.12 MISCELLANEOUS MATERIALS FOR SUPPORTS, HANGERS, ANCHORS AND GUIDES

- A. The Contractor shall provide all miscellaneous materials required to properly install all supports, hangers, anchors and guides, including:
 - 1. Steel Plates, Shapes and Bars: Provide products complying with ASTM A36.
 - 2. Cement Grout: Portland Cement (ASTM C 150, Type I or Type III) and clean uniformly graded, natural sand (ASTM C 404, Size No. 2). Mix at a ratio of 1.0 part cement to 3.0 parts sand, by volume, with minimum amount of water required for placement and hydration.
 - 3. Heavy-Duty Steel Trapezes: Fabricate from steel shapes selected for loads required; weld steel in accordance with AWS standards.

PART 3 - EXECUTION

3.1 PIPING INSTALLATION

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems; indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Shop Drawings.
- B. Install refrigerant piping according to ASHRAE 15.
- C. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.
- D. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- E. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
- F. Install piping adjacent to machines to allow service and maintenance.
- G. Install piping free of sags and bends.
- H. Install fittings for changes in direction and branch connections.
- I. Select system components with pressure rating equal to or greater than system operating pressure.
- J. Install piping as short and direct as possible, with a minimum number of joints, elbows, and fittings.
- K. Arrange piping to allow inspection and service of refrigeration equipment. Install valves and specialties in accessible locations to allow for service and inspection. Install access doors or panels as specified in Section 083113 "Access Doors and Frames" if valves or equipment requiring maintenance is concealed behind finished surfaces.
- L. Install refrigerant piping in protective conduit where installed belowground.
- M. Install refrigerant piping in rigid or flexible conduit in locations where exposed to mechanical injury.
- N. Slope refrigerant piping as follows:
 - 1. Install horizontal hot-gas discharge piping with a uniform slope downward away from compressor.
 - 2. Install horizontal suction lines with a uniform slope downward to compressor.
 - 3. Install traps and double risers to entrain oil in vertical runs.
 - 4. Liquid lines may be installed level.
- O. When brazing or soldering, remove solenoid-valve coils and sight glasses; also remove valve

stems, seats, and packing, and accessible internal parts of refrigerant specialties. Do not apply heat near expansion-valve bulb.

- P. Install piping with adequate clearance between pipe and adjacent walls and hangers or between pipes for insulation installation.
- Q. Install sleeves for piping penetrations of walls, ceilings, and floors.
- R. Install sleeve seals for piping penetrations of concrete walls and slabs.
- S. Install escutcheons for piping penetrations of walls, ceilings, and floors.

3.2 PIPE JOINT CONSTRUCTION

- A. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
- B. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
- C. Fill pipe and fittings with an inert gas (nitrogen or carbon dioxide), during brazing or welding, to prevent scale formation.
- D. Soldered Joints: Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook."
- E. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," Chapter "Pipe and Tube."
- F. Use Type BcuP, copper-phosphorus alloy for joining copper socket fittings with copper pipe.
- G. Use Type BAg, cadmium-free silver alloy for joining copper with bronze or steel.

3.3 FIELD QUALITY CONTROL

- A. Perform tests and inspections and prepare test reports.
- B. Tests and Inspections:
 - 1. Comply with ASME B31.5, Chapter VI.
 - 2. Test refrigerant piping, specialties, and receivers. Isolate compressor, condenser, evaporator, and safety devices from test pressure if they are not rated above the test pressure.
 - 3. Test high- and low-pressure side piping of each system separately at not less than the pressures indicated in Part 1 "Performance Requirements" Article.
 - a. Fill system with nitrogen to the required test pressure.
 - b. System shall maintain test pressure at the manifold gage throughout duration of test.
 - c. Test joints and fittings with electronic leak detector or by brushing a small amount of soap and glycerin solution over joints.

- d. Remake leaking joints using new materials, and retest until satisfactory results are achieved.

3.4 CLEANING, FLUSHING, INSPECTING

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems; indicated locations and arrangements were used to size pipe and other design considerations. Install piping as indicated unless deviations to layout are approved on Shop Drawings.
- B. Refill and vent water systems being sure to add water after venting to completely fill system.
- C. Disinfect new or repaired water mains and water service piping in accordance with AWWA A601 and section 610 of the 2006 International Plumbing Code
- D. Install refrigerant piping according to ASHRAE 15.
- E. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.
- F. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- G. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
- H. Install piping adjacent to machines to allow service and maintenance.
- I. Install piping free of sags and bends.
- J. Install fittings for changes in direction and branch connections.
- K. Select system components with pressure rating equal to or greater than system operating pressure.
- L. Install piping as short and direct as possible, with a minimum number of joints, elbows, and fittings.
- M. Arrange piping to allow inspection and service of refrigeration equipment. Install valves and specialties in accessible locations to allow for service and inspection. Install access doors or panels as specified in Section 083113 "Access Doors and Frames" if valves or equipment requiring maintenance is concealed behind finished surfaces.
- N. Install refrigerant piping in protective conduit where installed belowground.
- O. Install refrigerant piping in rigid or flexible conduit in locations where exposed to mechanical injury.
- P. Slope refrigerant piping as follows:
 - 1. Install horizontal hot-gas discharge piping with a uniform slope downward away from

- compressor.
 - 2. Install horizontal suction lines with a uniform slope downward to compressor.
 - 3. Install traps and double risers to entrain oil in vertical runs.
 - 4. Liquid lines may be installed level.
- Q. When brazing or soldering, remove solenoid-valve coils and sight glasses; also remove valve stems, seats, and packing, and accessible internal parts of refrigerant specialties. Do not apply heat near expansion-valve bulb.
- R. Install piping with adequate clearance between pipe and adjacent walls and hangers or between pipes for insulation installation.
- S. Identify refrigerant piping and valves.
- T. Install sleeves for piping penetrations of walls, ceilings, and floors.
- U. Install escutcheons for piping penetrations of walls, ceilings, and floors.

3.5 PIPING INSTALLATION

- A. Install piping without undue stress or strain in locations shown and run parallel to the lines of the building, except to grade them as specified in neat and workmanlike manner using a minimum of fittings. Provide such fittings, valves and accessories as may be required to meet the conditions of installation. Contractor shall inform himself fully regarding any peculiarities and limitations of space available for installation of material under each section of specifications. Install piping to suit necessities of clearance with ducts, conduits, and other work, and so as not to interfere with any passages or doorways and allow sufficient head room at all places. Use proper reducing fittings for changing piping sizes.
- B. Cut pipes accurately to measurements established in the field in a neat and workmanlike manner without damage or without forcing or springing. Perform cutting by means of an approved type of mechanical cutter of the wheel type where practicable. Ream pipe after cutting to remove all burrs.
- C. Because of the small scale of the drawings, it is not possible to indicate all offsets, fittings and accessories that may be required. Carefully investigate the architectural and structural conditions affecting the work, and arrange such work accordingly, providing such fittings, and accessories as may be required to meet such conditions. Drawings (plans, schematics, and diagrams) indicate the general location arrangement and restrictions of the piping systems. Location and arrangement of piping layout shall take into consideration pipe sizing and friction loss, expansion, pump sizing, and other design considerations. So far as practical, install piping as indicated on the Contract Drawings unless deviations to layout are approved on the Coordination Drawings. The Contract Drawings are diagrammatic in nature and are not welding fit-up documents. The Contractor is responsible for a complete installation. Refer to individual system specifications for requirements for coordination drawing submittals.
- D. Install at low points of gas piping and at the foot of each riser and each drip, a "T" fitting and six (6) inch long capped drip pocket of same size and riser or drip. Grade horizontal gas pipe to prevent traps. Pipe all green gas vents to the exterior as required by Code. Make all joints with graphite and oil and in accordance with National Fuel Gas Code requirements.

- E. Install unions and flanges where shown and on each side of all pieces of equipment and other similar items, and in such a manner that the unions can be readily disconnected. Do not place any union or flange in a location which will be inaccessible after completion of the project unless so shown on drawings or specified.
 - 1. Unions in steel pipe 2 1/2 inches and smaller, shall be 250 pound malleable iron, brass seat type. Use 150 pound forged steel flanges for piping three (3) inches and larger. Gaskets shall be 1/8 inch thick.
 - 2. Unions in copper pipe two (2) inches and smaller shall be wrought copper with red bronze ring nut. Use 150 pound ASME copper flanges for piping 2 1/2 inches and larger. Use dielectric unions or couplings where nonferrous metal is joined to ferrous metal.
- F. Use reducing fittings, eccentric where required to prevent pocketing of air and water or both, to make changes to pipe sizes.
- G. HVAC piping shall be installed plumb, level, and square with low point drains and high point vents. Steam, condensate, drain and sanitary waste and vent piping shall be sloped per code.
- H. Contractor shall fully coordinate the installation of all piping systems with all other trades including sheet metal, electrical, sprinkler, ceiling systems, etc.

3.6 JOINTS

A. Steel Pipe Joints:

- 1. Threaded Pipe Joints, 2" and Smaller: Thread pipe with tapered pipe threads in accordance with ANSI B1.20.1. Cut threads full and clean using sharp dies. Ream threaded ends to remove burrs and restore full inside diameter. Apply pipe joint lubricant or sealant suitable for the service for which the pipe is intended on the male threads at each joint and tighten joint to leave not more than 3 threads exposed. Align threads at point of assembly. Tighten joint with wrench. Do not use pipe or pipe fittings with threads that are damaged or corroded. Do not use pipe sections that have cracked or open welds. Comply with the provided pipe material classification requirements for allowance of threaded pipe within each service type. Threaded pipe will not be allowed for high temperature hot water service.
- 2. Pipe Larger Than 2":
 - a. Weld Pipe joints in accordance with ASME Code for Building Services Piping, 31.9. Bevel weld end to end. Sleeve welds shall not be permitted.
 - b. Install flanges on all valves, apparatus, and equipment. Weld pipe flanges to pipe ends in accordance with ASME Code for Building Services Piping. Clean flange faces and install gaskets. Tighten bolts gradually and uniformly using a torque wrench to torque specified by manufacturer or flange and sequence flange bolts, to provide uniform compression of gaskets. Use suitable lubricants on bolt threads.

B. Non-Ferrous Pipe Joints:

- 1. Brazed and Soldered Joints: For copper tube and fitting joints, braze joints in accordance with ANSI B31.31.0 – Standard Code for Pressure Piping, Power Piping and ANSI B9.1 – Standard Safety Code for Mechanical Refrigeration.

2. Thoroughly clean tube surface and inside surface of the cup of the fittings, using very fine emory cloth, prior to making soldered or brazed joints. Wipe tube and fittings clean and apply flux. Flux shall not be used as the sole means for cleaning tube and fitting surfaces.
- C. Weld pipe joints in accordance with ASME Code for Building Services Piping, B31.9. Weld piping in accordance with recognized industry practice and as follows:
1. Weld pipe joints only when ambient temperature is above 0 degree F.
 2. Bevel pipe ends at a 37.5 degree angle, smooth rough cuts, and clean to remove slag, metal particles, and dirt.
 3. Use pipe clamps or tack-weld joints with 1" long welds; 4 welds for pipe sizes to 10", 8 welds for pipe sizes 12" to 20".
 4. Build up welds with stringer-bead pass, followed by hot pass, followed by cover or filler pass. Eliminate valleys at center and edges of each weld. Weld by procedures which will ensure elimination of unsound or unfused metal, cracks, oxidation, blow-holes, and non-metallic inclusions.
 5. Do not weld out piping system imperfections by tack-welding procedures; refabricate to comply with requirements.
- D. Flanged Joints: Match flanges within piping system, and at connections with valves and equipment. Clean flange faces and install gaskets. Tighten bolts to provide uniform compression of gaskets.
- E. Hubless Cast-Iron Joints: Comply with coupling manufacturer's installation instructions.

3.7 WORKMANSHIP

- A. Cut pipes accurately to measurements established at structure. Install pipes without springing or forcing.
- B. Clear windows, doors, and other openings with all pipes and ductwork.
- C. Arrange pipes to permit expansion and contractions without misalignment or damage.
- D. During construction all openings in piping and equipment shall be closed with caps or plugs to keep out all foreign matter and to prevent leakage.
- E. All piping in finished spaces shall be run concealed unless otherwise indicated.

3.8 WELDING

- A. Refer to Division 23, Section "Mechanical and Electrical General Provisions".

3.9 SLEEVES AND PLATES

- A. Sleeves shall be provided by the trade installing the pipes for which sleeves are to be used. The sleeves shall be carefully located in advance of the construction of walls and floors where new construction is involved. All cutting and patching necessary to set sleeves which are not placed

prior to construction shall be the responsibility of the trade providing the sleeves.

- B. Sleeves shall be provided for all piping passing through all floor slabs and concrete, plaster, gypsum, or masonry wall construction.
- C. Where pipe motion due to expansion and contraction will occur, make sleeves of sufficient diameter to permit free movement of pipe. Where sleeves pass insulated pipes, the sleeves shall be large enough to pass the pipe and the insulation. Check floor and wall construction to determine proper length for various locations; make actual lengths to suit the following:
 - 1. Terminate sleeves flush with wall.
 - 2. Terminate sleeves two (2) inches above finished floors.
- D. Submit for approval shop drawings showing size, type, and location of all sleeves and penetrations through poured concrete walls. See Architectural Drawings for extent and location of such walls.
- E. All pipe sleeves shall be constructed of Schedule 40 steel pipe unless otherwise indicated on the drawings.
- F. See drawings for additional sleeve requirements.
- G. Fasten sleeves securely in floors and walls so that they will not become displaced when concrete is poured or when other construction is built around them. Take precautions to prevent concrete, plaster or other materials from being forced into space between pipe and sleeve during construction. Caulk the annular space with elastic caulk compound or as noted to make tight.
- H. Where watertight sleeves are indicated, provide Link Seal rubber seals, as manufactured by Thunderline Corporation, between pipes and sleeves, or provide sleeves as detailed.

3.10 TESTS

- A. The following tests shall be conducted by the Contractor and all piping shall be proven tight in the presence of the Architect or his representative. These tests shall be conducted before any insulation is installed and any insulation installed prior to tests shall be removed. Provide all equipment and labor required. Tests shall be at least four (4) hours in duration, after all piping has been proven tight. Piping may be tested in sections as approved by the Architect. Tests shall be as specified herein and a written test report shall be submitted to the Architect within two (2) days following each individual test. All test reports shall be included in the operation and maintenance manuals.
- B. The domestic water piping shall be hydrostatically tested to 150 pounds per square inch gauge (psig). All openings in the water piping shall be plugged; the system, or portion thereof, filled with water, and tested with a pump to a pressure of 150 pounds per square inch gauge (psig). Domestic water system piping shall be disinfected after tests in accordance with Baltimore City and Maryland State Health Department Requirements.
- C. The sanitary and miscellaneous drain systems shall be hydrostatically tested. Tests shall be as required by code and as a minimum shall comprise of the plugging of all openings in the lines, filling the system (or portion thereof), with water until all joints are proven tight. Piping shall

be tested with a minimum head of ten (10) feet of water.

- D. Fire protection system shall be tested in accordance with applicable NFPA Standards. Refer to Division 15, Section "Fire Protection".
- E. Refrigerant piping shall be cleaned, dehydrated, and evacuated. Piping shall be evacuated and held to less than 2.5 MM HG vacuum for a period of not less than twelve (12) hours without appreciable pressure rise. Vacuum shall then be broken with refrigerant or dry nitrogen and re-evacuated to 2.5 MM HG vacuum for an additional twelve (12) hours. Systems shall then be charged and piping tested with halide torch to assure no leaks. All procedures shall be in accordance with air conditioning equipment manufacturer's recommendations.

3.11 STERILIZATION

- A. Domestic water system piping shall be disinfected in accordance with State of South Carolina Health Department requirements and Section 610 of the 2006 International Plumbing Code. A written test report shall be submitted to the Owner and Architect within five (5) days following the sterilization process and before occupancy is granted. All written reports shall be included in the operation and maintenance manuals.
- B. After final testing for leaks, all new domestic water lines shall be thoroughly flushed by Contractor to remove foreign material. Before placing the systems in service, Contractor shall engage a qualified water service Contractor to sterilize the new water lines. Sterilization shall include as a minimum the following procedure:
 1. Through a 3/4" hose connection in the main entering the building, pump in sufficient sodium hypochlorite to produce a free available chlorine residual of not less than 200 parts per million. The Contractor shall provide plumbing connections and power for pumping chlorine into the system.
 2. Proceed upstream from the point of chlorine application opening all faucets and taps until chlorine is detected. Close faucets and taps when chlorine is evident.
 3. When chlorinated water has been brought to every faucet and tap with a minimum concentration of 200 parts per million chlorine, retain this water in the system for three (3) hours. CAUTION: Over-concentration of chlorine and more than three (3) hours of retention may result in damage to piping system which shall be replaced by the Contractor at no additional cost.
 4. At the end of the retention period, no less than 100 parts per million of chlorine shall be present at the extreme end of the system.
 5. Proceed to open all faucets and taps and thoroughly flush all new lines until the chlorine residual in the water is less than 1.0 parts per million.
 6. Obtain representative water samples, at least two (2), from the system for analysis by a recognized bacteriological laboratory.
 7. If the samples tested for coliform organisms is negative, a letter and laboratory report shall be submitted by the water service organization to the Contractor, certifying successful completion of the sterilization.
 8. If any samples tested indicate the presence of coliform organism, the entire sterilization procedure shall be repeated.

3.12 MOLD AND CONDENSATION PREVENTION

- A. Piping Systems: Cold piping systems (such as cold water) shall not be operated prior to insulation and vapor barrier installation in order to prevent condensation on the piping.
- B. Air Systems: Air handling systems shall not be operated at supply air temperatures below fifty (50) degrees F and all supply air ductwork shall be insulated prior to operation. Coils shall be insulated to prevent condensation when heating valve is closed. Air systems shall not be operated in portions of the building not yet fully enclosed, where systems can be exposed to warm, humid air conditions.
- C. Room thermostats shall not be set lower than sixty-eight (68) degrees F. Programmable thermostats shall be set to prevent lower temperature setting from the exterior of the thermostat by room occupants.
- D. Contractor shall notify the Architect immediately if signs of condensation or mold are discovered.

END OF SECTION 230530

SECTION 230548 - MECHANICAL VIBRATION, SOUND AND SEISMIC CONTROLS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. The drawings and general provisions of the Contract, including General and Supplementary Conditions, General Requirements and all other Specification Sections apply to the work specified in this section. In the event of conflict between specific requirements of the various documents, the more restrictive, the more extensive (i.e.: more expensive) requirement shall govern.
- B. The 2015 International Building Code and SEI/ASCE 7-05 Standard apply to all work associated with the seismic installation of all new mechanical and electrical equipment. Refer to Architectural and Structural drawings for seismic loads and additional seismic information.

1.2 SCOPE

- A. This section includes requirements for items of equipment, materials and procedures which are common to more than one section of Division 22 and 23. This section applies to all sections of Divisions 22 and 23.

1.3 SUMMARY

- A. This Section includes the following:
 - 1. Elastomeric isolation pads and mounts.
 - 2. Restrained elastomeric isolation mounts.
 - 3. Freestanding and restrained spring isolators.
 - 4. Housed spring mounts.
 - 5. Elastomeric hangers.
 - 6. Spring hangers.
 - 7. Spring hangers with vertical-limit stops.
 - 8. Thrust limits.
 - 9. Pipe riser resilient supports.
 - 10. Resilient pipe guides.
 - 11. Freestanding and restrained air spring isolators.
 - 12. Restrained vibration isolation roof-curb rails.
 - 13. Seismic snubbers.
 - 14. Restraining cables.
 - 15. Steel and inertia vibration isolation equipment bases.
 - 16. Certification of seismic restraint designs and installation supervision.
 - 17. Certification of seismic attachment of housekeeping pads.
- B. Work includes vibration control devices, materials, and related items for mechanical and electrical systems. Perform all work as shown on the drawings and as specified herein to

provide complete vibration isolation systems in proper working order.

- C. The requirements of Division 15, Section "Mechanical and Electrical General Provisions" shall apply to work specified under this section.

1.4 DEFINITIONS

- A. A_v : Effective peak velocity related acceleration coefficient.
- B. OSHPD: Office of Statewide Health Planning & Development for the State of California. OSHPD assigns a unique anchorage preapproval "R" number to each seismic restraint it tests. The number describes a specific device applied as tested.
- C. Life Safety Systems:
 - 1. All systems involved with fire protection including sprinkler piping, fire pumps, jockey pumps, fire pump control panels, service water supply piping, water tanks, fire dampers and smoke exhaust systems.
 - 2. All systems involved with and/or connected to emergency power supply including all generators, transfer switches, transformers and all flowpaths to fire protection and/or emergency lighting systems.
 - 3. Fresh air relief systems on emergency control sequence including air handlers, conduit, duct, dampers, etc.
 - 4. All life safety equipment has an asterisk on the equipment schedule.
- D. Positive Attachment: A positive attachment is defined as a cast-in anchor, a drill-in wedge anchor, a double sided beam clamp loaded perpendicular to a beam, or a welded or bolted connection to structure. Single sided "C" type beam clamps for support rods of overhead piping, ductwork, fire protection, electrical conduit, bus duct, or cable trays, or any other equipment are not acceptable on this project as seismic anchor points.
- E. Transverse Bracing: Restraint(s) applied to limit motion perpendicular to the centerline of the pipe, duct or conduit.
- F. Longitudinal Bracing: Restraint(s) applied to limit motion parallel to the centerline of the pipe, duct or conduit.
- G. Failure: For the purposes of this project, failure is defined as the discontinuance of any attachment point between equipment or structure, vertical permanent deformation greater than 1/8" and/or horizontal permanent deformation greater than 1/4".

1.5 SUBMITTALS

- A. Product Data: Include load deflection curves for each vibration isolation device.
- B. Shop Drawings: Signed and sealed by the manufacturer's qualified professional engineer. Before ordering any products, submit shop drawings of the items listed below. The shop drawings must be complete when submitted, be based on equipment actually purchased and must be presented in a clear, easily understood form. Incomplete or unclear presentation of

shop drawings may be reason for rejection of the submittal. Include the following:

1. Product Description: A complete description of products to be supplied, including product data, dimensions, specifications, and installation instructions.
 2. Selection Data: Detailed selection data for each vibration isolator supporting equipment, including:
 - a. Equipment identification mark;
 - b. Isolator type;
 - c. Actual load;
 - d. Static deflection expected under the actual load
 - e. Specified minimum static deflection.
 3. Design Calculations: Calculate requirements for selecting vibration isolators and seismic restraints and for designing vibration isolation bases. Seismic restraint calculations must be provided for all connections of equipment to the structure. Calculations must be stamped by the manufacturer's registered professional engineer with at least five years of seismic design experience, licensed in the state of the job location.
 4. Riser Supports: Include riser diagrams and calculations showing anticipated expansion and contraction at each support point, initial and final loads on building structure, spring deflection changes, and seismic loads. Include certification that riser system has been examined for excessive stress and that none will exist.
 5. Vibration Isolation Base Details: Detail fabrication, including anchorages and attachments to structure and to supported equipment. Include auxiliary motor slides and rails, base weights, equipment static loads, power transmission, component misalignment, and cantilever loads.
 6. Seismic-Restraint Details: Detail fabrication and attachment of seismic restraints and snubbers. Show anchorage details and indicate quantity, diameter, and depth of penetration of anchors.
 7. Submittals for Interlocking Snubbers: Include load deflection curves up to 1/2-inch deflection in x, y, and z planes.
 8. Seismic restraint calculations.
 9. Provide Approved Agencies Certificate of Compliance meeting Seismic Category D for all components. Tests shall include anchorage, structural and on line capability from analytical or shaker test method.
- C. Submission of samples may be requested for each type of vibration isolation device. After approval, samples will be returned for installation at the job if requested. All costs associated with submission of samples shall be borne by the Contractor.
- D. Welding certificates.
- E. Manufacturer Seismic Qualification Certification: Submit certification that all specified equipment will withstand seismic forces identified in "Performance Requirements" Article above. Include the following:
1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculations.
 - a. 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."

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.

1.6 MANUFACTURER RESPONSIBILITIES

- A. Manufacturer of vibration isolation and seismic restraint equipment shall have the following responsibilities:
 1. Determine vibration isolation and seismic restraint sizes and locations.
 2. Provide piping and equipment isolation systems and seismic restraints as scheduled or specified.
 3. Guarantee specified isolation system deflection.
 4. Provide installation instructions, drawings and field supervision to assure proper installation and performance.
 5. Provide certification by a licensed engineer employed by the manufacturer that all mounts and restraints meet the project requirements for seismic loading.
- B. Substitution of internally isolated mechanical equipment in lieu of the specified isolation of this Section must be approved for individual equipment units and is acceptable only if above acceleration loads are certified in writing by the equipment manufacturer and stamped and sealed by a licensed civil or structural engineer.

1.7 RELATED WORK

- A. Housekeeping Pads
 1. Housekeeping pad reinforcement and monolithic pad attachment to the structure details and design shall be prepared by the restraint vendor if not already indicated on the drawings.
 2. Housekeeping pads shall be coordinated with restraint vendor and sized to provide a minimum edge distance of ten (10) bolt diameters all around the outermost anchor bolt to allow development of full drill-in wedge anchor ratings. If cast-in anchors are to be used, the housekeeping pads shall be sized to accommodate the ACI requirements for bolt coverage and embedment.
- B. Supplementary Steel
 1. Provide any incidental materials and supplementary support steel for all equipment, piping, ductwork, roof mounted equipment, etc., such as mounting brackets, attachments and other accessories, that may be needed to meet the requirements stated herein, even if not expressly specified or shown on the drawings, at no additional cost.
- C. Attachments

1. Contractor shall supply restraint attachment plates cast into housekeeping pads, concrete inserts, double sided beam clamps, etc. in accordance with the requirements of the vibration vendor's calculations.

1.8 QUALITY ASSURANCE

- A. Seismic-restraint devices shall have horizontal and vertical load testing and analysis performed according to OSHPD and shall bear anchorage preapproval "R" number, from OSHPD or another agency acceptable to authorities having jurisdiction, showing maximum seismic-restraint ratings. Ratings based on independent testing are preferred to ratings based on calculations. If preapproved ratings are not available, submittals based on independent testing are preferred. Calculations (including combining shear and tensile loads) to support seismic-restraint designs must be signed and sealed by a qualified professional engineer. Testing and calculations must include both shear and tensile loads and 1 test or analysis at 45 degrees to the weakest mode.
- B. Seismic restraints for mechanical systems shall comply with 2009 IBC and ASCE 7-05.
- C. Welding: Qualify procedures and personnel according to AWS D1.1, "Structural Welding Code--Steel."
- D. Verify correctness of equipment model numbers and conformance of each component with manufacturer's specifications.
- E. Should any rotating or electrical equipment cause excessive noise or vibration when properly installed on the specified isolators, the Contractor shall be responsible for rebalancing, realignment, or other remedial work required to reduce noise and vibration levels. Excessive is defined as exceeding the manufacturer's specifications for the unit in question.
- F. Upon completion of the work, the Architect shall inspect the installation and shall inform the installing contractor of any further work that must be completed. Make all adjustments as directed by the Architect that result from the final inspection. This work shall be done before vibration isolation systems are accepted.
- G. The contractor shall provide a quality assurance plan prepared by a registered design professional for all mechanical, plumbing and electrical equipment and systems. The plan shall include the provisions of the 2015 International Building Code, per section 1705.2 and 1705.3. The plan shall be submitted to the Architect for review and approval. The contractor shall coordinate the requirements of the plan with the Owner and shall cooperate with the Owner's Seismic Quality Assurance coordinator.

1.9 COORDINATION

- A. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into base. Concrete, reinforcement, and formwork requirements are specified in Division 3.
- B. Coordinate installation of roof curbs, equipment supports, and roof penetrations.

1.10 EXTRA MATERIALS

- A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Seismic Snubber Units: Furnish replacement neoprene inserts for all snubbers.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. In other Part 2 articles where subparagraph titles below introduce lists, the following requirements apply for product selection:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified.

2.2 VIBRATION ISOLATORS

- A. Manufacturers:
 - 1. Ace Mounting Co., Inc.
 - 2. Amber/Booth Company, Inc.
 - 3. B-Line Systems, Inc.
 - 4. California Dynamics Corp.
 - 5. Isolation Technology, Inc.
 - 6. Kinetics Noise Control, Inc.
 - 7. Mason Industries, Inc.
 - 8. Vibration Eliminator Co., Inc.
 - 9. Vibration Isolation Co., Inc.
 - 10. Vibration Mountings & Controls/Korfund.
- B. General:
 - 1. Select vibration isolating units for the lowest operating speed of equipment, so designed that natural frequency of equipment and base mass is not less than 1.5 times the lowest operating frequency of the moving equipment, but not a multiple or harmonic of the base frequency. Furnish vibration isolation producing a uniform loading and deflection even when equipment weight is not evenly distributed, vibration isolation shall be stable during starting and stopping of equipment without excessive traverse and eccentric movement of equipment.
 - 2. Concrete pads under the isolation units shall be reinforced. Use concrete having a minimum compressive strength of 2,500 pounds per square inch and structural reinforcing bars conforming to ASTM A-615 Grade 60.
 - 3. The installed vibration isolation system for each floor or ceiling mounted item of equipment shall have a maximum lateral motion under equipment start up and shut down conditions of 1/4 inch. Motions in excess shall be restrained by approved spring type mounting.

4. All electrical connections, drain connections, etc., made to equipment which rests on vibration isolators, shall be sufficiently flexible to permit the equipment to be properly isolated.
5. The type of isolation, base, and minimum static deflection shall be as required for each specific equipment application, but not less than that specified herein when supported on a solid concrete structural slab having a thickness of not less than four (4) inches. If vibration isolators with a deflection greater than the minimum specified are required to meet the noise criteria for the adjacent spaces, suitable isolation system shall be submitted. Should vibration isolators installed for the equipment prove inadequate to prevent transmission of equipment vibrations to the building structure or limit equipment vibration originated noise in the building spaces to acceptable levels, the isolators shall be replaced with units having the largest deflection that can be practicably installed.
6. Where designated in the schedules, spring and combination rail and spring isolation supports are for installation with equipment structurally built or supported on a rigid structural steel frame suitable for these types of isolation. Where these types of isolation are not suitable for the equipment construction or operation, the equipment shall be mounted on a structural steel base as herein specified.
7. Equipment affected by wind pressure or with operating weight different from installed weight shall have built-in adjustable vertical stops to prevent rising of equipment when weight is removed. (Equipment containing liquid such as boilers, cooling towers, and chilled water refrigeration units shall have vertical stops.)
8. All springs installed out-of-doors shall be cadmium-plated, zinc electroplated or powder-coated after fabrication. Hardware and other metal parts shall be cadmium-plated or galvanized. Galvanizing shall meet ASTM Salt Spray Test Standards and Federal Test Standard No. 14.
9. All isolators installed out-of-doors shall have base plates with bolt holes for fastening the isolators to the support members.
10. Isolator types are scheduled to establish minimum standards. At the Contractor's option, labor-saving accessories can be an integral part of isolators supplied to provide initial lift of equipment to operating height, hold piping at fixed elevations during installation and initial system filling operations, and similar installation advantages. Accessories and seismic restraint features must not degrade the isolation performance of the isolators.
11. Static deflection of isolators shall be as provided in the EXECUTION section and as shown on the drawings. All static deflections stated are the minimum acceptable deflection for the mounts under actual load. Isolators selected solely on the basis of rated deflections are not acceptable and will be disapproved.

C. Elastomeric Isolator Pads: Oil- and water-resistant elastomer or natural rubber, arranged in single or multiple layers, molded with a nonslip pattern and galvanized steel baseplates of sufficient stiffness for uniform loading over pad area, and factory cut to sizes that match requirements of supported equipment.

1. Material: Standard neoprene.
2. Durometer Rating: 40.
3. Number of Layers: 1 or 2.

D. Elastomeric Mounts: Double-deflection type, with molded, oil-resistant rubber or neoprene isolator elements with factory-drilled, encapsulated top plate for bolting to equipment and with baseplate for bolting to structure. Color-code otherwise identify to indicate capacity range.

1. Durometer Rating: 40.

- E. Restrained Elastomeric Mounts: All-directional elastomeric mountings with seismic restraint.
 - 1. Materials: Cast-ductile-iron housing containing two separate and opposing, molded, bridge-bearing neoprene elements that prevent central threaded sleeve and attachment bolt from contacting the casting during normal operation.
 - 2. Neoprene: Shock-absorbing materials compounded according to the standard for bridge-bearing neoprene as defined by AASHTO.

- F. Spring Isolators: Freestanding, laterally stable, open-spring isolators.
 - 1. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
 - 2. Minimum Additional Travel: 50 percent of the required deflection at rated load.
 - 3. Lateral Stiffness: More than 80 percent of the rated vertical stiffness.
 - 4. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
 - 5. Baseplates: Factory drilled for bolting to structure and bonded to 1/4-inch thick, rubber isolator pad attached to baseplate underside. Baseplates shall limit floor load to 100 psig.
 - 6. Top Plate and Adjustment Bolt: Threaded top plate with adjustment bolt and cap screw to fasten and level equipment.

- G. Restrained Spring Isolators: Freestanding, steel, open-spring isolators with seismic restraint.
 - 1. Housing: Steel with resilient vertical-limit stops to prevent spring extension due to wind loads or if weight is removed; factory-drilled baseplate bonded to 1/4-inch thick, elastomeric isolator pad attached to baseplate underside; and adjustable equipment mounting and leveling bolt that acts as blocking during installation.
 - 2. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
 - 3. Minimum Additional Travel: 50 percent of the required deflection at rated load.
 - 4. Lateral Stiffness: More than 80 percent of the rated vertical stiffness.
 - 5. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.

- H. Housed Spring Mounts: Housed spring isolator with integral seismic snubbers.
 - 1. Housing: Ductile-iron or steel housing to provide all-directional seismic restraint.
 - 2. Base: Factory drilled for bolting to structure.
 - 3. Snubbers: Vertically adjustable to allow a maximum of 1/4-inch travel before contacting a resilient collar.

- I. Elastomeric Hangers: Double-deflection type, with molded, oil-resistant rubber or neoprene isolator elements bonded to steel housings with threaded connections for hanger rods. Color-code or otherwise identify to indicate capacity range.

- J. Spring Hangers: Combination coil-spring and elastomeric-insert hanger with spring and insert in compression.
 - 1. Frame: Steel, fabricated for connection to threaded hanger rods and to allow for a maximum of 30 degrees of angular hanger-rod misalignment without binding or reducing isolation efficiency.

2. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
 3. Minimum Additional Travel: 50 percent of the required deflection at rated load.
 4. Lateral Stiffness: More than 80 percent of the rated vertical stiffness.
 5. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
 6. Elastomeric Element: Molded, oil-resistant rubber or neoprene. Steel-washer-reinforced cup to support spring and bushing projecting through bottom of frame.
- K. Spring Hangers with Vertical-Limit Stop: Combination coil-spring and elastomeric-insert hanger with spring and insert in compression and with a vertical-limit stop.
1. Frame: Steel, fabricated for connection to threaded hanger rods and to allow for a maximum of 30 degrees of angular hanger-rod misalignment without binding or reducing isolation efficiency.
 2. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
 3. Minimum Additional Travel: 50 percent of the required deflection at rated load.
 4. Lateral Stiffness: More than 80 percent of the rated vertical stiffness.
 5. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
 6. Elastomeric Element: Molded, oil-resistant rubber or neoprene.
 7. Adjustable Vertical Stop: Steel washer with neoprene washer "up-stop" on lower threaded rod.
- L. Thrust Limits: Combination coil spring and elastomeric insert with spring and insert in compression and with a load stop. Include rod and angle-iron brackets for attaching to equipment.
1. Frame: Steel, fabricated for connection to threaded rods and to allow for a maximum of 30 degrees of angular rod misalignment without binding or reducing isolation efficiency.
 2. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
 3. Minimum Additional Travel: 50 percent of the required deflection at rated load.
 4. Lateral Stiffness: More than 80 percent of the rated vertical stiffness.
 5. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
 6. Elastomeric Element: Molded, oil-resistant rubber or neoprene.
 7. Coil Spring: Factory set and field adjustable for a maximum of 1/4-inch movement at start and stop.
- M. Pipe Riser Resilient Support: All-directional, acoustical pipe anchor consisting of 2 steel tubes separated by a minimum of 1/2-inch thick, 60-durometer neoprene. Include steel and neoprene vertical-limit stops arranged to prevent vertical travel in both directions. Design support for a maximum load on the isolation material of 500 psig and for equal resistance in all directions.
- N. Resilient Pipe Guides: Telescopic arrangement of 2 steel tubes separated by a minimum of 1/2-inch thick, 60-durometer neoprene. Factory set guide height with a shear pin to allow vertical motion due to pipe expansion and contraction. Shear pin shall be removable and reinsertable to allow for selection of pipe movement. Guides shall be capable of motion to meet location requirements.

2.3 RESTRAINED VIBRATION ISOLATION ROOF-CURB RAILS

- A. Manufacturers:
1. Amber/Booth Company, Inc.
 2. California Dynamics Corp.
 3. Isolation Technology, Inc.
 4. Kinetics Noise Control, Inc.
 5. Mason Industries, Inc.
 6. Vibration Eliminator Co., Inc.
 7. Vibration Isolation Co., Inc.
 8. Vibration Mountings & Controls/Korfund.
- B. Description: Factory-assembled, fully enclosed, insulated, air- and watertight curb rail designed to resiliently support equipment and to withstand 125-mph wind impinging laterally against side of equipment. The roof curbs shall be built to seismically contain the rooftop unit. Curb shall have anchorage preapproval "R" from OSHPD in the state of California attesting to the maximum certified horizontal and vertical load ratings.
- C. Lower Support Assembly: Sheet-metal "Z" section containing adjustable and removable steel springs that support upper floating frame. Upper frame shall provide continuous support for equipment and shall be captive to resiliently resist wind and seismic forces. Lower support assembly shall have a means for attaching to building structure and a wood nailer for attaching roof materials, and shall be insulated with a minimum of 2 inches of rigid, glass-fiber insulation on inside of assembly.
- D. Spring Isolators: Adjustable, restrained spring isolators shall be mounted on 1/4-inch- thick, elastomeric vibration isolation pads and shall have access ports, for level adjustment, with removable waterproof covers at all isolator locations. Isolators shall be located so they are accessible for adjustment at any time during the life of the installation without interfering with the integrity of the roof.
1. Restrained Spring Isolators: Freestanding, steel, open-spring isolators with seismic restraint.
 - a. Housing: Steel with resilient vertical-limit stops and adjustable equipment mounting and leveling bolt.
 - b. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
 - c. Minimum Additional Travel: 50 percent of the required deflection at rated load.
 - d. Lateral Stiffness: More than 80 percent of the rated vertical stiffness.
 - e. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
 2. Elastomeric Isolator Pads: Oil- and water-resistant elastomer or natural rubber, arranged in single or multiple layers, molded with a nonslip pattern and galvanized steel baseplates of sufficient stiffness for uniform loading over pad area, and factory cut to sizes that match requirements of supported equipment.
 - a. Material: Standard neoprene.
 - b. Durometer Rating: 40.

- c. Number of Layers: 1 or 2.
- E. Snubber Bushings: All-directional, elastomeric snubber bushings at least 1/4 inch thick.
- F. Water Seal: Continuous galvanized sheet metal with EPDM seals at corners, attached to upper support frame, extending down past wood nailer of lower support assembly, and counterflashed over roof materials.
- G. The floating member of the roof curb shall have a perimeter angle cross members to support two layers of 5/8" waterproof sheetrock laid on with staggered joints. Sheetrock must surround ducts to provide a continuous sound break. This acoustical barrier shall be caulked to minimize sound transmission between the rooftop air handling unit and the building. Where the mechanical arrangement makes attachment to the floating member unfeasible, the barrier shall be attached at the highest practical elevation of the fixed curb with provision for 1" thick closed cell neoprene flexible seals around any ductwork. A four inch layer of 1.5 density fiberglass shall cover the entire solid roof surface under the unit. Ductwork shall be externally lined with sound absorbent material coated with a dampening compound such as Mason Industries MDC-10 or approved equal. Complete instructions shall be provided by the spring isolation curb manufacturer. Acoustical package shall be Mason Industries, Inc. Type RSC-dB or approved equal.

2.4 SEISMIC-RESTRAINT DEVICES

- A. Manufacturers:
 1. Amber/Booth Company, Inc.
 2. B-Line Systems, Inc.
 3. California Dynamics Corp.
 4. Kinetics Noise Control, Inc.
 5. Loos & Co., Inc.; Cableware Technology Division.
 6. Mason Industries, Inc.
 7. TOLCO Incorporated.
 8. Unistrut Diversified Products Co.; Wayne Manufacturing Division.
 9. Vibration Eliminator Co., Inc.
 10. Vibration Isolation Co., Inc.
 11. Vibration Mountings & Controls/Korfund.
- B. Resilient Isolation Washers and Bushings: 1-piece, molded, bridge-bearing neoprene complying with AASHTO M 251 and having a durometer of 40, plus or minus 5, with a flat washer face.
- C. Seismic Snubbers: Factory fabricated using welded structural-steel shapes and plates, anchor bolts, and replaceable resilient isolation washers and bushings.
 1. Anchor bolts for attaching to concrete shall be seismic-rated, drill-in, and stud-wedge or female-wedge type.
 2. Resilient Isolation Washers and Bushings: 1-piece, molded, bridge-bearing neoprene complying with AASHTO M 251 and having a durometer of 40, plus or minus 5.
- D. Restraining Cables: Galvanized steel aircraft cables with end connections made of steel

assemblies that swivel to final installation angle and utilize two clamping bolts for cable engagement.

- E. Anchor Bolts: Seismic-rated, drill-in, and stud-wedge or female-wedge type. Select anchor bolts with strength required for anchor and as tested according to ASTM E 488/E 488M.
- F. General Requirements:
 - 1. Equipment, piping, ductwork and conduit shall be braced and supported in accordance with International Building Code, 2009 - Chapter 16.
 - 2. This Contractor shall provide the services of a professionally registered Seismic consultant to perform duties indicated below. The Contractor shall submit with his bid, the hourly billing rate for their Seismic consultant to provide additional services beyond the specified scope..
- G. Mechanical Equipment:
 - 1. All equipment bases and mounting tabs shall be provided integral to the equipment and designed to distribute Seismic loads without failure. Equipment bases mounting tabs shall be certified by the manufacturer to be in accordance with the requirements of this specification.
 - 2. The size, type and quantity of anchors and fasteners required to anchor the equipment will be provided in accordance with the Seismic consultant.
 - 3. Equipment submittals shall include Seismic anchoring details.
- H. HVAC Ductwork:
 - 1. Attachments and supports for HVAC ductwork systems shall be designed to meet the force and displacement provisions of SEI/ASCE 7-05 Standard.
- I. Piping
 - 1. Attachments and supports for piping systems shall be designed to meet the force and displacement provisions of SEI/ASCE 7-05 Standard.
- J. Mechanical Equipment, Attachments and Supports
 - 1. Attachments and supports for mechanical equipment shall be designed to meet the force and displacement provisions of SEI/ASCE 7-05 Standard.
- K. The Seismic details indicated on the drawings are not intended to limit the Contractor. Alternated methods of support, attachment and bracing must be designed by the Seismic Consultant and submitted to the Architect for review.
- L. Sprinkler and standpipe system piping shall be supported and braced in accordance with NFPA 13 and NFPA 14.

2.5 VIBRATION ISOLATION EQUIPMENT BASES

- A. Manufacturers:

1. Amber/Booth Company, Inc.
2. California Dynamics Corp.
3. Isolation Technology, Inc.
4. Kinetics Noise Control, Inc.
5. Mason Industries, Inc.
6. Vibration Eliminator Co., Inc.
7. Vibration Isolation Co., Inc.
8. Vibration Mountings & Controls/Korfund.

B. Steel Base : Factory-fabricated, welded, structural-steel bases and rails.

1. Design Requirements: Lowest possible mounting height with not less than 1-inch clearance above the floor. Include equipment anchor bolts and auxiliary motor slide bases or rails. Include supports for suction and discharge elbows for pumps.
2. Structural Steel: Steel shapes, plates, and bars complying with ASTM A 36/A 36M. Bases shall have shape to accommodate supported equipment.
3. Support Brackets: Factory-welded steel angles on frame for outrigger isolation mountings and to provide for anchor bolts and equipment support.

C. Inertia Base: Factory-fabricated, welded, structural-steel bases and rails ready for field-applied, cast-in-place concrete.

1. Design Requirements: Lowest possible mounting height with not less than 1-inch clearance above the floor. Include equipment anchor bolts and auxiliary motor slide bases or rails. Include supports for suction and discharge elbows for pumps.
2. Structural Steel: Steel shapes, plates, and bars complying with ASTM A 36/A 36M. Bases shall have shape to accommodate supported equipment.
3. Support Brackets: Factory-welded steel angles on frame for outrigger isolation mountings and to provide for anchor bolts and equipment support.
4. Fabrication: Fabricate steel templates to hold equipment anchor-bolt sleeves and anchors in place during placement of concrete. Obtain anchor-bolt templates from supported equipment manufacturer.

2.6 RESILIENT PENETRATION SLEEVE/SEAL

- A. Resilient penetration sleeve/seals shall be field-fabricated from a pipe or sheet metal section that is 1/2 inch to 3/4 inch larger than the penetrating element in all directions around the element, and shall be used to provide a sleeve through the construction penetrated. The sleeve shall extend one (1) inch beyond the penetrated construction on each side. The space between the sleeve and the penetrating element shall be packed with glass fiber or mineral wool to within 1/4 inch of the ends of the sleeve. The remaining 1/4 inch space on each end shall be filled with acoustical sealant to form an airtight seal. The penetrating element shall be able to pass through the sleeve without contacting the sleeve. Alternatively, prefabricated sleeves accomplishing the same result are acceptable.

2.7 RESILIENT LATERAL SUPPORTS

- A. These units shall either be a standard product of the vibration isolation mounting manufacturer, or be custom fabricated from standard components. These units shall incorporate neoprene

isolation elements that are specifically designed to provide resilient lateral bracing of ducts or pipes.

2.8 FLEXIBLE DUCT CONNECTIONS

- A. Flexible duct connections shall be made from coated fabric. The clear space between connected parts shall be a minimum of three (3) inches and the connection shall have a minimum of 1.5 inches of slack material.

2.9 FLEXIBLE PUMP CONNECTIONS

- A. Install flexible connectors at all suction and discharge pump connections to relieve pump and piping stresses. Flexible hose section to be 304 stainless steel, close pitch, annular corrugated hose with a type 304 braided outer covering. End connections to be ANSI class 150 carbon steel plate flanges. Overall length to allow for a minimum of 1" intermittent flexing or per manufacturer's recommendations for additional motion.
- B. Connectors mounted at the suction side of pumps shall be located upstream of the inlet elbow, and incorporate specially designed stationary vanes that impart a rotational motion as the fluid enters the elbow. Vanes to be capable of counteracting elbow induced turbulence, enabling the fluid to negotiate the turn uniformly, and exit with a flat velocity profile. Suction side flexible connectors shall be approved equal to model "CRV Flex" as manufactured by Metraflex.
- C. Connectors at the discharge side of pumps shall incorporate internal flow straightening vanes to reduce turbulence prior to the balancing valve. Vanes to be capable of reducing discharge turbulence equal to 5-10 pipe diameters of straight pipe, while allowing full rated movement of the connector. Discharge side flexible connectors shall be approved equal to model "Vane Flex" as manufactured by Metraflex.

2.10 FLEXIBLE PIPE CONNECTIONS

- A. Flexible pipe connections shall be fabricated of multiple plies of nylon cord, fabric, and neoprene; and shall be vulcanized so as to become inseparable and homogeneous. Flexible connections shall be formed in a double sphere shape, and shall be able to accept compressive, elongating, transverse, and angular movements.
- B. The flexible connections shall be selected and specially fitted, if necessary, to suit the system temperature, pressure, and fluid type. In addition, suitable flexible connections should be selected which do not require rods or cables to control extension of the connector.
- C. Connectors for pipe sizes two (2) inches or smaller shall have threaded female union couplings on each end. Larger sizes shall be fitted with metallic flange couplings.

2.11 GROMMETS:

- A. Grommets shall be specially formed to prevent bolts from directly contacting the isolator base plate, and shall be sized so that they will be loaded within the manufacturer's recommended load range.

- B. Grommets shall either be custom made by combining a neoprene washer and sleeve, or a manufactured product:

2.12 ACOUSTICAL SEALANT:

- A. Sealants for acoustical purposes as described in this specification shall be silicone or a nonsetting sealants.

2.13 FLEXIBLE ELECTRICAL CONNECTIONS

A. Type A:

1. Flexible Electrical Connection Type A shall be a prefabricated unit incorporating a flexible and watertight outer jacket, grounding strap, plastic inner sleeve to maintain smooth wire way, and end hubs with tapered electrical threads to fit standard threaded rigid metal conduit.
2. Flexible Electrical Connection Type A shall be Crouse-Hinds "XD Expansion/Deflection Coupling", Spring City Electrical Mfg. Co. "Type DF Expansion and Deflection Fitting", or approved equal.

B. Type B:

1. Flexible Electrical Connection Type B shall be field fabricated using a minimum two (2) foot length of flexible conduit or cable.

C. Type C:

1. Flexible Electrical Connection Type C shall be field fabricated using a minimum equal four (4) foot length of flexible conduit or cable.

2.14 FACTORY FINISHES

- A. Finish: Manufacturer's standard paint applied to factory-assembled and -tested equipment before shipping.

1. Powder coating on springs and housings.
2. All hardware shall be electrogalvanized. Hot-dip galvanized metal components for exterior use.
3. Baked enamel for metal components on isolators for interior use.
4. Color-code or otherwise mark vibration isolation and seismic-control devices to indicate capacity range.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and equipment to receive vibration isolation and seismic-control devices for

compliance with requirements, installation tolerances, and other conditions affecting performance.

- B. Examine roughing-in of reinforcement and cast-in-place anchors to verify actual locations before installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 APPLICATION:

A. General:

- 1. Refer to the PRODUCTS section of this specification for vibration isolation devices identified on the drawings or specified herein.
- 2. The static deflections of all isolators specified herein are the minimum acceptable deflections for the mounts under actual load. Isolators selected solely on the basis of rated deflection are not acceptable and will be disapproved.

B. Major Equipment:

- 1. Unless otherwise shown or specified, all floor-mounted major equipment shall be set on four (4) inch high concrete housekeeping pads provided under another Division. Housekeeping pads shall rest on a structural floor and shall be reinforced with steel rods and interconnected with floor. See Architectural or Structural drawings for details.
- 2. Types and minimum static deflections of vibration isolation devices for major equipment items shall be as specified hereinafter.
- 3. Flexible duct connections shall be installed at all fan unit intakes, fan unit discharges, and wherever else shown on the drawings.
- 4. Flexible pipe connections shall be installed at all pipe connections to equipment and machines with rotating parts.
- 5. Electrical connections to vibration-isolated equipment shall be flexible, as called for in the electrical portion of this specification.
- 6. Thrust restraints shall be installed on all suspended fans and on all floor-mounted fans developing three (3) inches or more of static pressure, unless the horizontal component of the thrust force can be demonstrated to be less than ten (10) percent of the equipment weight.
- 7. Each electric motor shall be mounted on the same foundation as the driven machine. Piping connections, including strainer at pumps, shall be supported on the same foundation as the pumps.

C. Miscellaneous Mechanical Equipment:

- 1. Miscellaneous pieces of mechanical equipment such as converters, pressure reducing stations, dryers, strainers, storage tanks, condensate receiver tanks, and expansion tanks which are connected to isolated piping systems shall be vibration-isolated from the building structure by neoprene pad or neoprene isolators (selected for 0.1" static deflection) unless their position in the piping system requires a higher degree of isolation as called for under Pipe Isolation.

D. Pipes:

1. All chilled water, heating water, reheat water, preheat water, steam, and drain piping that is connected to vibration-isolated equipment shall be isolated from the building structure at their first three support points.
2. Piping shall be isolated from the building structure by means of vibration isolators, resilient lateral supports, and resilient penetration sleeve/seals.
3. Isolators for the first three support points adjacent to connected equipment shall achieve one half the specified static deflection of the isolators supporting the connected equipment. When the required static deflection of these isolators is greater than 1/2 inch, spring neoprene isolators shall be used. When the required static deflection is less than or equal to 1/2 inch, neoprene isolators shall be used. All other pipe support isolators within the specified limits shall be either neoprene achieving at least 1/4 inch static deflection.
4. Where lateral support of pipes is required within the specified limits, this shall be accomplished by use of resilient lateral supports.
5. Pipes within the specified limits that penetrate the building construction shall be isolated from the building structure by use of resilient penetration sleeve/seals.
6. Provide flexible pipe connections as called for under Major Equipment above and wherever shown on the drawings.
7. All pipe risers within mechanical rooms over three (3) inches in diameter shall be isolated under each pipe riser floor support with either two layers of 3/4 inch thick, maximum 50 durometer neoprene pads or with load bearing plates or neoprene mounts with a minimum 0.2 inch static deflection.

E. Ductwork:

1. All sheet metal ducts and air plenums that are connected to vibration-isolated equipment shall be isolated from the building structure at their first three support points by neoprene isolators. All isolators shall achieve 0.1 inch minimum static deflection.
2. Ducts within the specified limits that penetrate the building construction shall be isolated from the building structure by use of resilient penetration sleeve/seals.
3. Flexible duct connections shall be provided as called for above under Major Equipment and wherever shown on the drawings.

F. Mechanical Equipment:

1. Electrical connections to vibration isolated mechanical equipment shall be made using flexible electrical connections Type A or Type C.

3.3 INSTALLATION

A. Install thrust limits at centerline of thrust, symmetrical on either side of equipment.

B. General:

1. Locations of all vibration isolation devices shall be selected for ease of inspection and adjustment as well as for proper operation.
2. Installation of vibration isolation equipment shall be in accordance with the manufacturer's instructions.
3. In all cases, isolated electrical equipment shall be positioned so that it is free standing and does not come in rigid contact with the building structure or other systems.
4. Isolators:

- a. All vibration isolators shall be aligned squarely above or below mounting points of the supported equipment.
- b. Isolators for equipment with bases shall be located on the sides of the bases which are parallel to the equipment shaft unless this is not possible because of physical constraints.
- c. Locate isolators to provide stable support for equipment, without excess rocking. Consideration shall be given to the location of the center of gravity of the system and the location and spacing of the isolators. If necessary, a base with suitable footprint shall be provided to maintain stability of supported equipment, whether or not such a base is specifically called for herein.
- d. If a housekeeping pad is provided, the isolators shall bear on the housekeeping pad and the isolator base plates shall rest entirely on the pad.
- e. Hanger rods for vibration-isolated support shall be connected to structural beams or joists, not the floor slab between beams and joists. Provide suitable intermediate support members as necessary.
- f. Vibration isolation hanger elements shall be positioned as high as possible in the hanger rod assembly, but not in contact with the building structure, and so that the hanger housing may rotate a full 360 degrees about the rod axis without contacting any object.
- g. Parallel running pipes may be hung together on a trapeze that is isolated from the building. Isolator deflections must be the greatest required by the provisions for pipe isolation for any single pipe on the trapeze. Do not mix isolated and unisolated pipes on the same trapeze.
- h. Pipes, ducts and equipment shall not be supported from other pipes, ducts and equipment.
- i. Resiliently isolated pipes, ducts and equipment shall not come in rigid contact with the building construction or rigidly supported equipment.
- j. The installed and operating heights of equipment vibration-isolated with floor spring and neoprene travel limited isolators or roof isolators or with roof curb or roof rail isolation bases shall be identical. Limit stops shall be out of contact during normal operation. Adjust isolators to provide 1/4 inch clearance between the limit stop brackets and the isolator top plate, and between the travel limit nuts and travel limit brackets.
- k. Adjust all leveling bolts and hanger rod bolts so that the isolated equipment is level and in proper alignment with connecting ducts or pipes.
- l. Roof isolators shall be installed in strict accordance with the manufacturer's instructions.

5. Bases:

- a. No equipment unit shall bear directly on vibration isolators unless its own frame is suitably rigid to span between isolators and such direct support is approved by the equipment manufacturer. This provision shall apply whether or not a base frame is called for on the schedule. In the case that a base frame is required for the unit because of the equipment manufacturer's requirements and is not specifically called for on the equipment schedule, a base frame recommended by the equipment manufacturer shall be provided at no additional expense.
- b. Unless otherwise indicated, there is to be a minimum operating clearance of one (1) inch between steel rails, steel frame bases or inertia bases and the floor beneath the equipment. The isolator mounting brackets shall be positioned and the isolators adjusted so that the required clearance is maintained. The clearance space

- shall be checked by the Contractor to ensure that no construction debris has been left to short circuit or restrict the proper operation of the vibration isolation system.
- c. Roof curb and roof rail isolation bases shall be installed in strict accordance with the manufacturer's instructions.
6. Flexible Duct Connections:
 - a. Sheet metal ducts and plenum openings shall be squarely aligned with the fan discharge, fan intake, or adjacent duct section prior to installation of the flexible connection, so that the clear length is approximately equal all the way around the perimeter. Flexible duct connections shall not be installed until this provision is met. There shall be no metal-to-metal contact between connected sections, and the fabric shall not be stretched taut.
 7. Flexible Pipe Connections:
 - a. Install flexible pipe connections in strict accordance with the manufacturer's instructions.
 8. Thrust Restraints:
 - a. Thrust restraints shall be attached on each side of the fan at the vertical centerline of thrust. The two rods of the thrust restraint shall be parallel to the thrust force. This may require custom brackets or standoffs. The body of the thrust restraint shall not come in contact with the connected elements. Thrust restraints shall be adjusted to constrain equipment movement to the specified limit.
 9. Grommets:
 - a. Where grommets are required at hold down bolts of isolators, bolt holes shall be properly sized to allow for grommets. The hold down bolt assembly shall include washers to distribute load evenly over the grommets. Bolts and washers shall be galvanized.
 10. Resilient Penetration Sleeve/Seals:
 - a. Maintain an airtight seal around the penetrating element and prevent rigid contact between the penetrating element and the building structure. Fit the sleeve tightly to the building construction and seal airtight on both sides of the construction penetrated with acoustical sealant.
 11. Flexible Electrical Connections:
 - a. Type C connections shall be installed in a grossly slack "U" shape or a 360 degree loop.
 - b. Rigid conduit on the isolated-equipment side of the flexible connection, and the flexible connection itself, shall not be tied to the building construction or other rigid structures.
- C. Install seismic snubbers on isolated equipment. Locate snubbers as close as possible to vibration isolators and bolt to equipment base and supporting structure.

- D. Install restraining cables at each trapeze and individual pipe hanger. At trapeze anchor locations, shackle piping to trapeze. Install cables so they do not bend across sharp edges of adjacent equipment or building structure.
- E. Install steel angles or channel, sized to prevent buckling, clamped with ductile-iron clamps to hanger rods for trapeze and individual pipe hangers. At trapeze anchor locations, shackle piping to trapeze. Requirements apply equally to hanging equipment. Do not weld angles to rods.
- F. Install resilient bolt isolation washers on equipment anchor bolts.

3.4 EQUIPMENT BASES

- A. Fill concrete inertia bases, after installing base frame, with 3000-psi concrete; trowel to a smooth finish.
 - 1. Cast-in-place concrete materials and placement requirements are specified in Division 3.
- B. Concrete Bases: Anchor equipment to concrete base according to supported equipment manufacturer's written instructions for seismic codes at Project site.
 - 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 the base.
 - 2. Install epoxy-coated anchor bolts for supported equipment 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.
 - 5. Install anchor bolts according to anchor-bolt manufacturer's written instructions.
 - 6. Cast-in-place concrete materials and placement requirements are specified in Division 3.

3.5 FIELD QUALITY CONTROL

- A. Testing: Perform the following field quality-control testing:
 - 1. Isolator seismic-restraint clearance.
 - 2. Isolator deflection.
 - 3. Snubber minimum clearances.
 - 4. Air-Mounting System Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
 - 5. Air-Mounting System Operational Test: Test the compressed-air leveling system. Remove malfunctioning units, replace with new units, and retest.
 - 6. Test and adjust air-mounting system controls and safeties. Replace damaged and malfunctioning controls and equipment.
- B. Air-Mounting System Manufacturer's Field Service: Engage a factory-authorized service representative to inspect field-assembled components and equipment installation, including piping connections. Report results in writing.
 - 1. Isolator seismic-restraint clearance.

2. Isolator deflection.
3. Snubber minimum clearances.
4. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
5. Operational Test: Test the compressed-air leveling system. Remove malfunctioning units, replace with new units, and retest.
6. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

3.6 ADJUSTING

- A. Adjust isolators after piping systems have been filled and equipment is at operating weight.
- B. Adjust limit stops on restrained spring isolators to mount equipment at normal operating height. After equipment installation is complete, adjust limit stops so they are out of contact during normal operation.
- C. Attach thrust limits at centerline of thrust and adjust to a maximum of 1/4-inch movement during start and stop.
- D. Adjust air spring leveling mechanism.
- E. Adjust active height of spring isolators.
- F. Adjust snubbers according to manufacturer's written recommendations.
- G. Adjust seismic restraints to permit free movement of equipment within normal mode of operation.
- H. Torque anchor bolts according to equipment manufacturer's written recommendations to resist seismic forces.

3.7 CLEANING

- A. After completing equipment installation, inspect vibration isolation and seismic-control devices. Remove paint splatters and other spots, dirt, and debris.

3.8 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain air-mounting systems. Refer to Division 1.

3.9 VIBRATION ISOLATOR AND SEISMIC-RESTRAINT SCHEDULE

Vibration Isolation Schedule

<u>Equipment</u>	<u>Isolation Type</u>	<u>Base Deflection</u>	<u>Base Type</u>	<u>Remarks</u>
MECHANICAL VIBRATION, SOUND AND SEISMIC CONTROLS LOWCOUNTRY REGIONAL AIRPORT TERMINAL EXPANSION				230548-21 1509

Fan in AHU's	Floor Spring Neoprene	1.5"	Base- Inertia Base	Thrust Restraints
Domestic Water Pump	Floor Neoprene	0.4"	---	Under Skid
Suspended Fans	Hanger Spring Neoprene	1.5"	---	-----
In-Line Pumps	Flexible Neoprene	0.25"	---	-----
Piping Hangers Within 50 Feet of Isolated Equipment	Spring Hangers	1.5"	---	-----
First Two (2) Pipe Hangers near Non- Isolated Equipment	Spring Hangers	1.0"	---	-----

3.10 SEISMIC INSTALLATION INSPECTION

- A. On completion of installation of all vibration isolation and seismic restraint devices herein specified, a representative of the isolation materials manufacturer shall inspect the completed system and report in writing any installation errors, improperly selected isolation or restraint devices, or other faults that could affect the performance of the system. Contractor shall submit a report to the Architect, including the manufacturer's representative's final report, indicating all isolation reported as properly installed or requiring correction, and include a report by the Contractor on steps taken to properly complete the isolation work.
- B. All special inspections must be performed in accordance with IBC 2009 and as specified herein.
- C. Continuous inspection: The full-time observation of work by an approved special inspector pursuant to IBC 2009 section 1704. The following pieces of equipment require these inspections:
 - 1. All equipment using combustible or toxic energy sources.
 - 2. All electric motors, transformers, switchgear unit substations and motor control centers.
 - 3. Reciprocating and rotating type machinery.
 - 4. Pipe, 3" & larger.
 - 5. Tanks, heat exchangers & pressure vessels.
- D. Periodic inspection: intermittent observation of work by an approved special inspector of the following pieces of equipment in compliance with IBC 2009 section 1704.
 - 1. Isolator units for seismic isolation systems.
 - 2. All flammable, combustible and highly toxic piping and their associated mechanical systems.
 - 3. All ductwork containing hazardous materials.
 - 4. All electrical components for standby or emergency power systems.

END OF SECTION 230548

SECTION 230593 - TESTING AND BALANCING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and General Requirements, apply to work specified in this Section.

1.2 SUMMARY

- A. This Section includes TAB to produce design objectives for the following:
 - 1. Air Systems:
 - a. Constant-volume air systems.
 - 2. HVAC equipment quantitative-performance settings.
 - 3. Space pressurization testing and adjusting.
 - 4. Vibration measuring.
 - 5. Sound level measuring.
 - 6. Smoke-control systems testing and adjusting.
 - 7. Indoor-air quality measuring (LEED-NC Credit 3.2).
 - 8. Existing systems TAB.
 - 9. Verifying that automatic control devices are functioning properly.
 - 10. Reporting results of activities and procedures specified in this Section.

1.3 DEFINITIONS

- A. Adjust: To regulate fluid flow rate and air patterns at the terminal equipment, such as to reduce fan speed or adjust a damper.
- B. Balance: To proportion flows within the distribution system, including submains, branches, and terminals, according to design quantities.
- C. Barrier or Boundary: Construction, either vertical or horizontal, such as walls, floors, and ceilings that are designed and constructed to restrict the movement of airflow, smoke, odors, and other pollutants.
- D. Draft: A current of air, when referring to localized effect caused by one or more factors of high air velocity, low ambient temperature, or direction of airflow, whereby more heat is withdrawn from a person's skin than is normally dissipated.
- E. NC: Noise criteria.
- F. Procedure: An approach to and execution of a sequence of work operations to yield repeatable results.

- G. RC: Room criteria.
- H. Report Forms: Test data sheets for recording test data in logical order.
- I. Smoke-Control System: An engineered system that uses fans to produce airflow and pressure differences across barriers to limit smoke movement.
- J. Smoke-Control Zone: A space within a building that is enclosed by smoke barriers and is a part of a zoned smoke-control system.
- K. Stair Pressurization System: A type of smoke-control system that is intended to positively pressurize stair towers with outdoor air by using fans to keep smoke from contaminating the stair towers during an alarm condition.
- L. Static Head: The pressure due to the weight of the fluid above the point of measurement. In a closed system, static head is equal on both sides of the pump.
- M. Suction Head: The height of fluid surface above the centerline of the pump on the suction side.
- N. System Effect: A phenomenon that can create undesired or unpredicted conditions that cause reduced capacities in all or part of a system.
- O. System Effect Factors: Allowances used to calculate a reduction of the performance ratings of a fan when installed under conditions different from those presented when the fan was performance tested.
- P. TAB: Testing, adjusting, and balancing.
- Q. Terminal: A point where the controlled medium, such as fluid or energy, enters or leaves the distribution system.
- R. Test: A procedure to determine quantitative performance of a system or equipment.
- S. Testing, Adjusting, and Balancing (TAB) Firm: The entity responsible for performing and reporting TAB procedures.

1.4 QUALIFICATIONS

- A. Work included in this section must be performed by an independent testing and balancing agency and an approved member of the Associated Air Balance Council (AABC) or National Environmental Balancing Bureau (NEBB) who shall provide a complete and comprehensive total system balance process to test, adjust, and balance the air and water systems for this project. Submit the name of the air balance firm for approval within thirty (30) days after award of contract. See Section 15000 for approved Contractors.
- B. If the Contractor fails to submit the name of an acceptable agency within the specified time, the (Architect/Engineer) will select a firm to accomplish the work, and the selection shall be binding at no additional cost to the Owner.
- C. All work shall be performed under direct supervision of a qualified engineer. All instruments used shall be accurately calibrated and maintained in good working order. If requested,

calibration tests of equipment to be used shall be performed in the presence of the (Architect/Engineer).

- D. Submit for review and approval within ten (10) working days after the notice to proceed, the names of the personnel who will be responsible for the work and those who will actually perform the testing and balancing and their qualification, which shall demonstrate that they have balanced and tested systems of comparable size and complexity.

1.5 SUBMITTALS

- A. Qualification Data: Submit evidence that TAB firm and this Project's TAB team members meet the qualifications specified in "Quality Assurance" Article.
- B. Contract Documents Examination Report: Submit Contract Documents review report as specified in Part 3.
- C. Strategies and Procedures Plan: Submit TAB strategies and step-by-step procedures as specified in Part 3 "Preparation" Article. Include a complete set of report forms intended for use on this Project.
- D. Certified TAB Reports: Submit reports prepared, as specified in this Section, on approved forms certified by TAB firm.
- E. Warranties specified in this Section.

1.6 QUALITY ASSURANCE

- A. TAB Firm Qualifications: Engage a TAB firm certified by either AABC or NEBB.
- B. TAB Conference: Meet with Owner's and Architect's representatives on approval of TAB strategies and procedures plan to develop a mutual understanding of the details. Ensure the participation of TAB team members, equipment manufacturers' authorized service representatives, HVAC controls installers, and other support personnel. Provide seven days' advance notice of scheduled meeting time and location.

1. Agenda Items: Include at least the following:

- a. Submittal distribution requirements.
- b. The Contract Documents examination report.
- c. TAB plan.
- d. Work schedule and Project-site access requirements.
- e. Coordination and cooperation of trades and subcontractors.
- f. Coordination of documentation and communication flow.

C. Certification of TAB Reports: Certify TAB field data reports. This certification includes the following:

- 1. Review field data reports to validate accuracy of data and to prepare certified TAB reports.
- 2. Certify that TAB team complied with approved TAB plan and the procedures specified

and referenced in this Specification.

- D. TAB Report Forms: Use standard forms from AABC's "National Standards for Testing and Balancing Heating, Ventilating, and Air Conditioning Systems" or NEBB's "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems."
- E. Instrumentation Type, Quantity, and Accuracy: As described in AABC's "National Standards for Testing and Balancing Heating, Ventilating, and Air Conditioning Systems and NEBB's "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems," Section II, "Required Instrumentation for NEBB Certification."
- F. Instrumentation Calibration: Calibrate instruments at least every six months or more frequently if required by the instrument manufacturer.
 - 1. Keep an updated record of instrument calibration that indicates date of calibration and the name of party performing instrument calibration.

1.7 PROJECT CONDITIONS

- A. Full Owner Occupancy: Owner will occupy the site and existing building during entire TAB period. Cooperate with Owner during TAB operations to minimize conflicts with Owner's operations.
- B. Partial Owner Occupancy: Owner may occupy completed areas of building before Substantial Completion. Cooperate with Owner during TAB operations to minimize conflicts with Owner's operations.

1.8 COORDINATION

- A. Coordinate the efforts of factory-authorized service representatives for systems and equipment, HVAC controls installers, and other mechanics to operate HVAC systems and equipment to support and assist TAB activities.
- B. Notice: Provide seven days' advance notice for each test. Include scheduled test dates and times.
- C. Perform TAB after leakage and pressure tests on air and water distribution systems have been satisfactorily completed.

1.9 WARRANTY

- A. National Project Performance Guarantee: If AABC standards are used, provide a guarantee on AABC's "National Standards for Testing and Balancing Heating, Ventilating, and Air Conditioning Systems" forms stating that AABC will assist in completing requirements of the Contract Documents if TAB firm fails to comply with the Contract Documents. Guarantee includes the following provisions:
- B. Special Guarantee: If NEBB standards are used, provide a guarantee on NEBB forms stating that NEBB will assist in completing requirements of the Contract Documents if TAB firm fails

to comply with the Contract Documents.

C. Guarantee includes the following provisions:

1. The certified TAB firm has tested and balanced systems according to the Contract Documents.
2. Systems are balanced to optimum performance capabilities within design and installation limits.

1.10 TEST PROCEDURE

- A. System may be tested in sections when approved by the (Architect/Engineer).
- B. When testing and balancing involve the building temperature control systems, cooperate with the temperature control subcontractor to achieve the desired results.
- C. At the time of final inspection, recheck in the presence and at the request of the (Architect/Engineer) not to exceed ten (10) percent of the previously recorded readings from the certified report selected at random from the log by the (Architect/Engineer).
- D. Permanently mark the settings of valves, dampers, and other adjustment devices so that adjustment can be restored if disturbed at any time. Do not permanently mark devices before final acceptance.
- E. Perform all tests in accordance with AABC standard procedures. Any deviation from same must be approved by the (Architect/Engineer).
- F. Should the basic system or any of its components fail to meet contract requirements, and thereby make the testing and balancing work invalid, notify the (Architect/Engineer) and stop all tests until such time that the failure is corrected.

PART 2 - PRODUCTS

2.1 TEST INSTRUMENTS

- A. Use instruments of equal or better quality than those described in the technical portions of Associated Air Balance Council--"National Standards for Testing and Balancing Heating, Ventilating and Air Conditioning Systems, Fifth Edition 1989.
- B. Instruments used for balancing air and water systems must have been calibrated within a period of six (6) months prior to balancing.
- C. List in the report types, serial numbers, and dates of calibration of all instruments used in the final air and water balance tests.
- D. Instrumentation shall include, as a minimum, the following items of equipment:
 1. Pressure gauges and fittings.
 2. Dry bulb and wet bulb thermostats.

3. Contact pyrometer.
4. Portable flow meter and, if required, orifice plates.
5. Pitot tube and manometers.
6. Alnor Velometer with attachments.
7. Amprobe.
8. Tachometer.
9. Special wrenches and tools.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine the Contract Documents to become familiar with Project requirements and to discover conditions in systems' designs that may preclude proper TAB of systems and equipment.
 1. Contract Documents are defined in the General and Supplementary Conditions of Contract.
 2. Verify that balancing devices, such as test ports, gage cocks, thermometer wells, flow-control devices, balancing valves and fittings, and manual volume dampers, are required by the Contract Documents. Verify that quantities and locations of these balancing devices are accessible and appropriate for effective balancing and for efficient system and equipment operation.
- B. Examine approved submittal data of HVAC systems and equipment.
- C. Examine project record documents described in Division 1 Section "Project Record Documents."
- D. Examine design data including HVAC system descriptions, statements of design assumptions for environmental conditions and systems' output, and statements of philosophies and assumptions about HVAC system and equipment controls.
- E. Examine equipment performance data including fan and pump curves. Relate performance data to Project conditions and requirements, including system effects that can create undesired or unpredicted conditions that cause reduced capacities in all or part of a system. Calculate system effect factors to reduce the performance ratings of HVAC equipment when installed under conditions different from those presented when the equipment was performance tested at the factory. To calculate system effects for air systems, use tables and charts found in AMCA 201, "Fans and Systems," Sections 7 through 10; or in SMACNA's "HVAC Systems--Duct Design," Sections 5 and 6. Compare this data with the design data and installed conditions.
- F. Examine system and equipment installations to verify that they are complete and that testing, cleaning, adjusting, and commissioning specified in individual Specification Sections have been performed.
- G. Examine system and equipment test reports.
- H. Examine HVAC system and equipment installations to verify that indicated balancing devices, such as test ports, gage cocks, thermometer wells, flow-control devices, balancing valves and

fittings, and manual volume dampers, are properly installed, and that their locations are accessible and appropriate for effective balancing and for efficient system and equipment operation.

- I. Examine systems for functional deficiencies that cannot be corrected by adjusting and balancing.
- J. Examine HVAC equipment to ensure that clean filters have been installed, bearings are greased, belts are aligned and tight, and equipment with functioning controls is ready for operation.
- K. Examine strainers for clean screens and proper perforations.
- L. Examine three-way valves for proper installation for their intended function of diverting or mixing fluid flows.
- M. Examine heat-transfer coils for correct piping connections and for clean and straight fins.
- N. Examine system pumps to ensure absence of entrained air in the suction piping.
- O. Examine equipment for installation and for properly operating safety interlocks and controls.
- P. Examine automatic temperature system components to verify the following:
 - 1. Dampers, valves, and other controlled devices are operated by the intended controller.
 - 2. Dampers and valves are in the position indicated by the controller.
 - 3. Integrity of valves and dampers for free and full operation and for tightness of fully closed and fully open positions. This includes dampers in multizone units, mixing boxes, and variable-air-volume terminals.
 - 4. Thermostats and humidistats are located to avoid adverse effects of sunlight, drafts, and cold walls.
 - 5. Sensors are located to sense only the intended conditions.
 - 6. Sequence of operation for control modes is according to the Contract Documents.
 - 7. Controller set points are set at design values.
 - 8. Interlocked systems are operating.
 - 9. Changeover from heating to cooling mode occurs according to indicated values.
- Q. Report deficiencies discovered before and during performance of TAB procedures. Observe and record system reactions to changes in conditions. Record default set points if different from indicated values.

3.2 PREPARATION

- A. Prepare a TAB plan that includes strategies and step-by-step procedures.
- B. Complete system readiness checks and prepare system readiness reports. Verify the following:
 - 1. Permanent electrical power wiring is complete.
 - 2. Hydronic systems are filled, clean, and free of air.
 - 3. Automatic temperature-control systems are operational.
 - 4. Equipment and duct access doors are securely closed.

5. Balance, smoke, and fire dampers are open.
6. Isolating and balancing valves are open and control valves are operational.
7. Ceilings are installed in critical areas where air-pattern adjustments are required and access to balancing devices is provided.
8. Windows and doors can be closed so indicated design conditions for system operations can be met.

3.3 GENERAL PROCEDURES FOR TESTING AND BALANCING

- A. Perform testing and balancing procedures on each system according to the procedures contained in AABC's "National Standards for Testing and Balancing Heating, Ventilating, and Air Conditioning Systems" or NEBB's "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems" and this Section.
- B. Cut insulation, ducts, pipes, and equipment cabinets for installation of test probes to the minimum extent necessary to allow adequate performance of procedures. After testing and balancing, close probe holes and patch insulation with new materials identical to those removed. Restore vapor barrier and finish according to the insulation Specifications for this Project.
- C. Mark equipment and balancing device settings with paint or other suitable, permanent identification material, including damper-control positions, valve position indicators, fan-speed-control levers, and similar controls and devices, to show final settings.
- D. Take and report testing and balancing measurements in inch-pound (IP) units.

3.4 GENERAL PROCEDURES FOR BALANCING AIR SYSTEMS

- A. All air distribution systems including supply, return, outdoor air and exhaust ductwork shall be tested and balanced.
- B. Prepare test reports for both fans and outlets. Obtain manufacturer's outlet factors and recommended testing procedures. Crosscheck the summation of required outlet volumes with required fan volumes.
- C. Prepare schematic diagrams of systems' "as-built" duct layouts.
- D. Determine the best locations in main and branch ducts for accurate duct airflow measurements.
- E. Check the airflow patterns from the outside-air louvers and dampers and the return- and exhaust-air dampers, through the supply-fan discharge and mixing dampers.
- F. Locate start-stop and disconnect switches, electrical interlocks, and motor starters.
- G. Verify that motor starters are equipped with properly sized thermal protection.
- H. Check dampers for proper position to achieve desired airflow path.
- I. Check for airflow blockages.
- J. Check condensate drains for proper connections and functioning.

- K. Check for proper sealing of air-handling unit components.
- L. Check for proper sealing of air duct system.
- M. Where the system cannot be properly balanced or equipment tested due to system deficiencies such as inability to properly adjust fan speeds, improperly sized motors, excessively noisy equipment, malfunctioning controls, excessively out of balance air distribution system branch runs, and similar items, furnish to the (Architect/Engineer) in writing a list of the deficiencies prior to the submission of the test report.
- N. Air Outlets and Inlets: Adjust total to within plus or minus 10 percent of design to space. Adjust individual outlets and inlets in space to within plus or minus 10 percent of design.

3.5 PROCEDURES FOR CONSTANT-VOLUME AIR SYSTEMS

- A. Adjust fans to deliver total indicated airflows within the maximum allowable fan speed listed by the fan manufacturer.
 1. Measure fan static pressures to determine actual static pressure as follows:
 - a. Measure outlet static pressure as far downstream from the fan as practicable and upstream from restrictions in ducts such as elbows and transitions.
 - b. Measure static pressure directly at the fan outlet or through the flexible connection.
 - c. Measure inlet static pressure of single-inlet fans in the inlet duct as near the fan as possible, upstream from flexible connection and downstream from duct restrictions.
 - d. Measure inlet static pressure of double-inlet fans through the wall of the plenum that houses the fan.
 2. Measure static pressure across each component that makes up an air-handling unit, rooftop unit, and other air-handling and -treating equipment.
 - a. Simulate dirty filter operation and record the point at which maintenance personnel must change filters.
 3. Measure static pressures entering and leaving other devices such as sound traps, heat recovery equipment, and air washers under final balanced conditions.
 4. Compare design data with installed conditions to determine variations in design static pressures versus actual static pressures. Compare actual system effect factors with calculated system effect factors to identify where variations occur. Recommend corrective action to align design and actual conditions.
 5. Obtain approval from Architect for adjustment of fan speed higher or lower than indicated speed. Make required adjustments to pulley sizes, motor sizes, and electrical connections to accommodate fan-speed changes.
 6. Do not make fan-speed adjustments that result in motor overload. Consult equipment manufacturers about fan-speed safety factors. Modulate dampers and measure fan-motor amperage to ensure that no overload will occur. Measure amperage in full cooling, full heating, economizer, and any other operating modes to determine the maximum required brake horsepower.

- B. Adjust volume dampers for main duct, submain ducts, and major branch ducts to indicated airflows within specified tolerances.
 - 1. Measure static pressure at a point downstream from the balancing damper and adjust volume dampers until the proper static pressure is achieved.
 - a. Where sufficient space in submains and branch ducts is unavailable for Pitot-tube traverse measurements, measure airflow at terminal outlets and inlets and calculate the total airflow for that zone.
 - 2. Remeasure each submain and branch duct after all have been adjusted. Continue to adjust submains and branch ducts to design airflows within specified tolerances.
- C. Measure terminal outlets and inlets without making adjustments.
 - 1. Measure terminal outlets using a direct-reading hood or outlet manufacturer's written instructions and calculating factors.
- D. Adjust terminal outlets and inlets for each space to indicated airflows within specified tolerances of indicated values. Make adjustments using volume dampers rather than extractors and the dampers at air terminals.
 - 1. Adjust each outlet in same room or space to within specified tolerances of indicated quantities without generating noise levels above the limitations prescribed by the Contract Documents.
 - 2. Adjust patterns of adjustable outlets for proper distribution without drafts.

3.6 PROCEDURES FOR DOMESTIC HOT WATER CIRCULATION SYSTEMS

- A. Check the settings and operation of each hot water balancing valve to ensure design flow.
- B. Test and record temperature and pressure drop across each balancing valve.

3.7 GENERAL PROCEDURES FOR EQUIPMENT

- A. Conduct performance tests only after the air and water systems have been balanced and the proper flow rates established.
- B. Test and record capacity of heat transfer equipment including all coils. Air side and water side capacities must agree within five (5) percent of each other. Include the manufacturer's rated capacity at the test operating conditions with the report. Perform tests where possible at design conditions. If tests are not performed under design conditions, interpolate results to determine capacity at full load operating conditions.
- C. Calculate efficiency of pumps and fans by recognized methods using test data.
- D. Test refrigeration equipment to determine heat extracted from or heat added to the building by the equipment and the heat ejected from the device. Record date, time and outside weather conditions including ambient dry bulb, wet bulb, wind speed and direction, cloud cover, rain, and any special conditions pertinent to the test.

3.8 PROCEDURES FOR MOTORS

- A. Motors, 1/2 HP and Larger: Test at final balanced conditions and record the following data:
 - 1. Manufacturer, model, and serial numbers.
 - 2. Motor horsepower rating.
 - 3. Motor rpm.
 - 4. Efficiency rating.
 - 5. Nameplate and measured voltage, each phase.
 - 6. Nameplate and measured amperage, each phase.
 - 7. Starter thermal-protection-element rating.
- B. Motors Driven by Variable-Frequency Controllers: Test for proper operation at speeds varying from minimum to maximum. Test the manual bypass for the controller to prove proper operation. Record observations, including controller manufacturer, model and serial numbers, and nameplate data.

3.9 PROCEDURES FOR CONDENSING UNITS

- A. Verify proper rotation of fans.
- B. Measure entering- and leaving-air temperatures.
- C. Record compressor data.

3.10 PROCEDURES FOR HEAT-TRANSFER COILS

- A. Refrigerant Coils: Measure the following data for each coil:
 - 1. Dry-bulb temperature of entering and leaving air.
 - 2. Wet-bulb temperature of entering and leaving air.
 - 3. Airflow.
 - 4. Air pressure drop.
 - 5. Refrigerant suction pressure and temperature.

3.11 PROCEDURES TEMPERATURE TESTING

- A. During TAB, report the need for adjustment in temperature regulation within the automatic temperature-control system.
- B. Measure indoor wet- and dry-bulb temperatures every other hour for a period of two successive eight-hour days, in each separately controlled zone, to prove correctness of final temperature settings. Measure when the building or zone is occupied.
- C. Measure outside-air, wet- and dry-bulb temperatures.

3.12 PROCEDURES FOR SPACE PRESSURIZATION MEASUREMENTS AND ADJUSTMENTS

- A. Before testing for space pressurization, observe the space to verify the integrity of the space boundaries. Verify that windows and doors are closed and applicable safing, gaskets, and sealants are installed. Report deficiencies and postpone testing until after the reported deficiencies are corrected.
- B. Measure, adjust, and record the pressurization of each room, each zone, and each building by adjusting the supply, return, and exhaust airflows to achieve the indicated conditions.
- C. Measure space pressure differential where pressure is used as the design criteria, and measure airflow differential where differential airflow is used as the design criteria for space pressurization.
 - 1. For pressure measurements, measure and record the pressure difference between the intended spaces at the door with all doors in the space closed. Record the high-pressure side, low-pressure side, and pressure difference between each adjacent space.
 - 2. For applications with cascading levels of space pressurization, begin in the most critical space and work to the least critical space.
 - 3. Test room pressurization first, then zones, and finish with building pressurization.
- D. To achieve indicated pressurization, set the supply airflow to the indicated conditions and adjust the exhaust and return airflow to achieve the indicated pressure or airflow difference.
- E. For spaces with pressurization being monitored and controlled automatically, observe and adjust the controls to achieve the desired set point.
 - 1. Compare the values of the measurements taken to the measured values of the control system instruments and report findings.
 - 2. Check the repeatability of the controls by successive tests designed to temporarily alter the ability to achieve space pressurization. Test overpressurization and underpressurization, and observe and report on the system's ability to revert to the set point.
 - 3. For spaces served by variable-air-volume supply and exhaust systems, measure space pressurization at indicated airflow and minimum airflow conditions.
- F. In spaces that employ multiple modes of operation, such as normal mode and emergency mode or occupied mode and unoccupied mode, measure, adjust, and record data for each operating mode.
- G. Record indicated conditions and corresponding initial and final measurements. Report deficiencies.

3.13 PROCEDURES FOR VIBRATION MEASUREMENTS

- A. Use a vibration meter meeting the following criteria:
 - 1. Solid-state circuitry with a piezoelectric accelerometer.
 - 2. Velocity range of 0.1 to 10 inches per second.

3. Displacement range of 1 to 100 mils.
 4. Frequency range of at least 0 to 1000 Hz.
 5. Capable of filtering unwanted frequencies.
- B. Calibrate the vibration meter before each day of testing.
1. Use a calibrator provided with the vibration meter.
 2. Follow vibration meter and calibrator manufacturer's calibration procedures.
- C. Perform vibration measurements when other building and outdoor vibration sources are at a minimum level and will not influence measurements of equipment being tested.
1. Turn off equipment in the building that might interfere with testing.
 2. Clear the space of people.
- D. Perform vibration measurements after air and water balancing and equipment testing is complete.
- E. Clean equipment surfaces in contact with the vibration transducer.
- F. Position the vibration transducer according to manufacturer's written instructions and to avoid interference with the operation of the equipment being tested.
- G. Measure and record vibration on rotating equipment over 3 hp.
- H. Measure and record equipment vibration, bearing vibration, equipment base vibration, and building structure vibration. Record velocity and displacement readings in the horizontal, vertical, and axial planes.
1. Pumps:
 - a. Pump Bearing: Drive end and opposite end.
 - b. Motor Bearing: Drive end and opposite end.
 - c. Pump Base: Top and side.
 - d. Building: Floor.
 - e. Piping: To and from the pump after flexible connections.
 2. Fans and HVAC Equipment with Fans:
 - a. Fan Bearing: Drive end and opposite end.
 - b. Motor Bearing: Drive end and opposite end.
 - c. Equipment Casing: Top and side.
 - d. Equipment Base: Top and side.
 - e. Building: Floor.
 - f. Ductwork: To and from equipment after flexible connections.
 - g. Piping: To and from equipment after flexible connections.
 3. Chillers and HVAC Equipment with Compressors:
 - a. Compressor Bearing: Drive end and opposite end.
 - b. Motor Bearing: Drive end and opposite end.

- c. Equipment Casing: Top and side.
 - d. Equipment Base: Top and side.
 - e. Building: Floor.
 - f. Piping: To and from equipment after flexible connections.
- I. For equipment with vibration isolation, take floor measurements with the vibration isolation blocked solid to the floor and with the vibration isolation floating. Calculate and report the differences.
 - J. Inspect, measure, and record vibration isolation.
 - 1. Verify that vibration isolation is installed in the required locations.
 - 2. Verify that installation is level and plumb.
 - 3. Verify that isolators are properly anchored.
 - 4. For spring isolators, measure the compressed spring height, the spring OD, and the travel-to-solid distance.
 - 5. Measure the operating clearance between each inertia base and the floor or concrete base below. Verify that there is unobstructed clearance between the bottom of the inertia base and the floor.

3.14 PROCEDURES FOR SOUND-LEVEL MEASUREMENTS

- A. Perform sound-pressure-level measurements with an octave-band analyzer complying with ANSI S1.4 for Type 1 sound-level meters and ANSI S1.11 for octave-band filters. Comply with requirements in ANSI S1.13, unless otherwise indicated.
- B. Calibrate sound meters before each day of testing. Use a calibrator provided with the sound meter complying with ANSI S1.40 and that has NIST certification.
- C. Use a microphone that is suitable for the type of sound levels measured. For areas where air velocities exceed 100 fpm, use a windscreen on the microphone.
- D. Perform sound-level testing after air and water balancing and equipment testing are complete.
- E. Close windows and doors to the space.
- F. Perform measurements when the space is not occupied and when the occupant noise level from other spaces in the building and outside are at a minimum.
- G. Clear the space of temporary sound sources so unrelated disturbances will not be measured. Position testing personnel during measurements to achieve a direct line-of-sight between the sound source and the sound-level meter.
- H. Take sound measurements at a height approximately 48 inches above the floor and at least 36 inches from a wall, column, and other large surface capable of altering the measurements.
- I. Take sound measurements in dBA and in each of the 8 unweighted octave bands in the frequency range of 63 to 8000 Hz.
- J. Take sound measurements with the HVAC systems off to establish the background sound levels

and take sound measurements with the HVAC systems operating.

1. Calculate the difference between measurements. Apply a correction factor depending on the difference and adjust measurements.
- K. Perform sound testing at three (3) locations on Project for each of the following space types. For each space type tested, select a measurement location that has the greatest sound level. If testing multiple locations for each space type, select at least one location that is near and at least one location that is remote from the predominant sound source.
1. Private office.
 2. Open office area.
 3. Conference room.
 4. Auditorium/large meeting room/lecture hall.
 5. Classroom/training room.
 6. Patient room/exam room.
 7. Sound or vibration sensitive laboratory.
 8. Hotel room/apartment.
 9. Each space with a noise criterion of RC or NC 25 or lower.
 10. Each space with an indicated noise criterion of RC or NC 35 and lower that is adjacent to a mechanical equipment room or roof mounted equipment.
 11. Inside each mechanical equipment room.

3.15 PROCEDURES FOR SMOKE-CONTROL SYSTEM TESTING

- A. Before testing smoke-control systems, verify that construction is complete and verify the integrity of each smoke-control zone boundary. Verify that windows and doors are closed and that applicable safing, gasket, and sealants are installed. Report deficiencies and postpone testing until after the reported deficiencies are corrected.
- B. Measure and record wind speed and direction, outside-air temperature, and relative humidity on each test day.
- C. Measure, adjust, and record airflow of each smoke-control system with all fans that are a part of the system operating as intended by the design.
- D. Measure, adjust, and record the airflow of each fan. For ducted systems, measure the fan airflow by duct Pitot-tube traverse.
- E. After air balancing is complete, perform the following pressurization testing for each smoke-control zone in the system:
 1. Verify the boundaries of each smoke-control zone.
 2. With the HVAC systems in their normal mode of operation and smoke control not operating, measure and record the pressure difference across each smoke-control zone. Make measurements after closing doors that separate the zones. Make one measurement across each door. Clearly indicate the high and low pressure side of each door.
 3. With the system operating in the smoke-control mode and with each zone in the smoke-control system activated, perform the following:

- a. Measure and record the pressure difference across each door that separates the smoke zone from adjacent zones. Make measurements with doors that separate the smoke zone from the other zones closed. Clearly indicate the high and low pressure side of the door. Doors that have a tendency to open slightly due to the pressure difference should have one pressure measurement made while held closed and another measurement made with the door open.
- b. Continue to activate each separate zoned smoke-control system and make pressure difference measurements.
- c. After testing a smoke zone's smoke-control system, deactivate the HVAC systems involved and return them to their normal operating mode before activating another zone's smoke-control system.
- d. Verify that controls necessary to prevent excessive pressure differences are functional.

F. Operational Tests:

- 1. Check the proper activation of each zoned smoke-control system in response to all means of activation, both automatic and manual.
- 2. Check automatic activation in response to fire alarm signals received from the building's fire alarm and detection system. Initiate a separate alarm for each means of activation to ensure that the proper operation of the correct zoned smoke-control system occurs.
- 3. Check and record the proper operation of fans, dampers, and related equipment as outlined below for each separate zone of the smoke-control system.
 - a. Fire zone in which a smoke-control system automatically activates.
 - b. Type of signal that activates a smoke-control system, such as pull station, sprinkler water flow, or smoke detector.
 - c. Smoke zone(s) where maximum mechanical exhaust to the outside is implemented and no supply air is provided.
 - d. Positive pressure smoke-control zone(s) where maximum air supply is implemented and no exhaust to the outside is provided.
 - e. Fan(s) "ON" as required to implement the smoke-control system. Multiple- or variable-speed fans should be further noted as "MAX. VOLUME" to verify that the intended control configuration is achieved.
 - f. Fan(s) "OFF" as required to implement the smoke-control system.
 - g. Damper(s) "OPEN" where maximum airflow must be achieved.
 - h. Damper(s) "CLOSED" where no airflow should take place.
 - i. Auxiliary functions to achieve the smoke-control system configuration such as changes or override of normal operating pressure and temperature-control set points.
 - j. If standby power is provided for the smoke-control system, test to verify that the system functions while operating under both normal and standby power.

G. Conduct additional tests required by authorities having jurisdiction. Unless required by authorities having jurisdiction, perform testing without the use of smoke or products that simulate smoke.

H. Prepare a complete report of observations, measurements, and deficiencies.

3.16 PROCEDURES FOR INDOOR-AIR QUALITY MEASUREMENTS (LEED CREDIT 3.2 -

CONSTRUCTION IAQ MANAGEMENT PLAN - BEFORE OCCUPANCY)

- A. After construction is complete (including air balancing and final cleaning) and prior to occupancy, with the HVAC systems operating at indicated conditions conduct baseline IAQ testing using testing protocols consistent with the United States Environmental Protection Agency Compendium of Methods for the Determination of Air Pollutants in Indoor Air and as additionally detailed in the U.S. Green Building Council (USGBC) LEED-NC (Version 2.2) Reference Guide.
- B. Observe and record the following conditions for each HVAC system:
1. The distance between the outside-air intake and the closest exhaust fan discharge, cooling tower, flue termination, or vent termination.
 2. Specified filters are installed. Check for leakage around filters.
 3. Cooling coil drain pans have a positive slope to drain.
 4. Cooling coil condensate drain trap maintains an air seal.
 5. Evidence of water damage.
 6. Insulation in contact with the supply, return, and outside air is dry and clean.
- C. Measure and record the indoor conditions on each floor for each HVAC system serving the floor to satisfy the following:
1. Most remote area.
 2. One location for every 20,000 sq. ft.
 3. Area with the least ventilation
 4. Area with the greatest presumed source strength
- D. Measure and record the following indoor conditions for each location:
1. Temperature.
 2. Relative humidity.
 3. Concentration of carbon dioxide (ppm).
 4. Concentration of carbon monoxide (ppm).
 5. Nitrogen oxides (ppm).
 6. Formaldehyde (ppm)
 7. Particulates
 8. Total Volatile Organic Compounds (TVOC)
 9. 4-Phenylcyclohexene (4-PCH) (This test is only required if carpets and fabrics with styrene butadiene rubber (SBR) latex backing material are installed as part of the base building systems.)
- E. Demonstrate that the contaminant maximum concentrations listed below are not exceeded:
1. Carbon Monoxide (CO): 9 part per million and no greater than 2 parts per million above outdoor levels.
 2. Formaldehyde: 50 parts per billion
 3. Particulates (PM10): 50 micrograms per cubic meter
 4. Total Volatile Organic Compounds (TVOC): 500 micrograms per cubic meter
 5. 4-Phenylcyclohexene (4-PCH): 6.5 micrograms per cubic meter
- F. The air sample testing shall be conducted as follows:

1. All measurements shall be conducted prior to occupancy, but during normal occupied hours, and with the building ventilation system starting at the normal daily start time and operated at the minimum outside air flow rate for the occupied mode throughout the duration of the air testing.
 2. The building shall have all interior finishes installed, including but not limited to millwork, doors, paint, carpet and acoustic tiles. Non-fixed furnishings such as workstations and partitions are encouraged, but not required, to be in place for the testing.
 3. Air samples shall be collected between 3 feet and 6 feet from the floor to represent the breathing zone of occupants, and over a minimum 4-hour period.
- G. For each sampling point where the maximum concentration limits are exceeded, conduct additional flush-out with outside air and retest the specific parameter(s) exceeded to indicate the requirements are achieved. Repeat procedure until all requirements have been met. When retesting non-complying building areas, take samples from the same locations as in the first test.
- H. Submit a copy of the proposed IAQ testing procedures, actual testing locations, and testing results.
- 3.17 PROCEDURES FOR TESTING, ADJUSTING, AND BALANCING EXISTING SYSTEMS
- A. Perform a preconstruction inspection of existing equipment that is to remain and be reused.
1. Measure and record the operating speed, airflow, and static pressure of each fan.
 2. Measure motor voltage and amperage. Compare the values to motor nameplate information.
 3. Check the refrigerant charge.
 4. Check the condition of filters.
 5. Check the condition of coils.
 6. Check the operation of the drain pan and condensate drain trap.
 7. Check bearings and other lubricated parts for proper lubrication.
 8. Report on the operating condition of the equipment and the results of the measurements taken. Report deficiencies.
- B. Before performing testing and balancing of existing systems, inspect existing equipment that is to remain and be reused to verify that existing equipment has been cleaned and refurbished.
1. New filters are installed.
 2. Coils are clean and fins combed.
 3. Drain pans are clean.
 4. Fans are clean.
 5. Bearings and other parts are properly lubricated.
 6. Deficiencies noted in the preconstruction report are corrected.
- C. Perform testing and balancing of existing systems to the extent that existing systems are affected by the renovation work.
1. Compare the indicated airflow of the renovated work to the measured fan airflows and determine the new fan, speed, filter, and coil face velocity.
 2. Verify that the indicated airflows of the renovated work result in filter and coil face velocities and fan speeds that are within the acceptable limits defined by equipment

- manufacturer.
3. If calculations increase or decrease the airflow and water flow rates by more than 5 percent, make equipment adjustments to achieve the calculated airflow and water flow rates. If 5 percent or less, equipment adjustments are not required.
 4. Air balance each air outlet.

3.18 TEMPERATURE-CONTROL VERIFICATION

- A. Verify that controllers are calibrated and commissioned.
- B. Check transmitter and controller locations and note conditions that would adversely affect control functions.
- C. Record controller settings and note variances between set points and actual measurements.
- D. Check the operation of limiting controllers (i.e., high- and low-temperature controllers).
- E. Check free travel and proper operation of control devices such as damper and valve operators.
- F. Check the sequence of operation of control devices. Note air pressures and device positions and correlate with airflow and water-flow measurements. Note the speed of response to input changes.
- G. Check the interaction of electrically operated switch transducers.
- H. Check the interaction of interlock and lockout systems.
- I. Check main control supply-air pressure and observe compressor and dryer operations.
- J. Record voltages of power supply and controller output. Determine whether the system operates on a grounded or nongrounded power supply.
- K. Note operation of electric actuators using spring return for proper fail-safe operations.

3.19 REPORTING

- A. Initial Construction-Phase Report: Based on examination of the Contract Documents as specified in "Examination" Article, prepare a report on the adequacy of design for systems' balancing devices. Recommend changes and additions to systems' balancing devices to facilitate proper performance measuring and balancing. Recommend changes and additions to HVAC systems and general construction to allow access for performance measuring and balancing devices.
- B. Status Reports: As Work progresses, prepare reports to describe completed procedures, procedures in progress, and scheduled procedures. Include a list of deficiencies and problems found in systems being tested and balanced. Prepare a separate report for each system and each building floor for systems serving multiple floors.

3.20 FINAL REPORT

- A. General: Typewritten, or computer printout in letter-quality font, on standard bond paper, in three-ring binder, tabulated and divided into sections by tested and balanced systems.
- B. Include a certification sheet in front of binder signed and sealed by the certified testing and balancing engineer.
 - 1. Include a list of the instruments used for procedures, along with proof of calibration.
- C. Final Report Contents: In addition to the certified field report data, include the following:
 - 1. Pump curves.
 - 2. Fan curves.
 - 3. Manufacturers' test data.
 - 4. Field test reports prepared by system and equipment installers.
 - 5. Other information relative to equipment performance, but do not include Shop Drawings and Product Data.
- D. General Report Data: In addition to the form titles and entries, include the following data in the final report, as applicable:
 - 1. Title page.
 - 2. Name and address of TAB firm.
 - 3. Project name.
 - 4. Project location.
 - 5. Architect's name and address.
 - 6. Engineer's name and address.
 - 7. Contractor's name and address.
 - 8. Report date.
 - 9. Signature of TAB firm who certifies the report.
 - 10. Table of Contents with the total number of pages defined for each section of the report. Number each page in the report.
 - 11. Summary of contents, including the following:
 - a. Indicated versus final performance.
 - b. Notable characteristics of systems.
 - c. Description of system operation sequence if it varies from the Contract Documents.
 - 12. Nomenclature sheets for each item of equipment.
 - 13. Data for terminal units, including manufacturer, type size, and fittings.
 - 14. Notes to explain why certain final data in the body of reports varies from indicated values.
 - 15. Test conditions for fans and pump performance forms, including the following:
 - a. Settings for outside-, return-, and exhaust-air dampers.
 - b. Conditions of filters.
 - c. Cooling coil, wet- and dry-bulb conditions.
 - d. Face and bypass damper settings at coils.
 - e. Fan drive settings, including settings and percentage of maximum pitch diameter.

- f. Inlet vane settings for variable-air-volume systems.
 - g. Settings for supply-air, static-pressure controller.
 - h. Other system operating conditions that affect performance.
- E. System Diagrams: Include schematic layouts of air and hydronic distribution systems. Present each system with single-line diagram and include the following:
- 1. Quantities of outside, supply, return, and exhaust airflows.
 - 2. Water and steam flow rates.
 - 3. Duct, outlet, and inlet sizes.
 - 4. Pipe and valve sizes and locations.
 - 5. Terminal units.
 - 6. Balancing stations.
 - 7. Position of balancing devices.
- F. Air-Handling Unit Test Reports: For air-handling units with coils, include the following:
- 1. Unit Data: Include the following:
 - a. Unit identification.
 - b. Location.
 - c. Make and type.
 - d. Model number and unit size.
 - e. Manufacturer's serial number.
 - f. Unit arrangement and class.
 - g. Discharge arrangement.
 - h. Sheave make, size in inches, and bore.
 - i. Sheave dimensions, center-to-center and amount of adjustments in inches.
 - j. Number of belts, make, and size.
 - k. Number of filters, type, and size.
 - 2. Motor Data:
 - a. Make and frame type and size.
 - b. Horsepower and rpm.
 - c. Volts, phase, and hertz.
 - d. Full-load amperage and service factor.
 - e. Sheave make, size in inches, and bore.
 - f. Sheave dimensions, center-to-center and amount of adjustments in inches.
 - 3. Test Data (Indicated and Actual Values):
 - a. Total airflow rate in cfm.
 - b. Total system static pressure in inches wg.
 - c. Fan rpm.
 - d. Discharge static pressure in inches wg.
 - e. Filter static-pressure differential in inches wg.
 - f. Preheat coil static-pressure differential in inches wg.
 - g. Cooling coil static-pressure differential in inches wg.
 - h. Heating coil static-pressure differential in inches wg.
 - i. Outside airflow in cfm.

- j. Return airflow in cfm.
- k. Outside-air damper position.
- l. Return-air damper position.
- m. Vortex damper position.

G. Apparatus-Coil Test Reports:

1. Coil Data:

- a. System identification.
- b. Location.
- c. Coil type.
- d. Number of rows.
- e. Fin spacing in fins per inch
- f. Make and model number.
- g. Face area in sq. ft..
- h. Tube size in NPS.
- i. Tube and fin materials.
- j. Circuiting arrangement.

2. Test Data: (Indicated and Actual Values):

- a. Airflow rate in cfm.
- b. Average face velocity in fpm.
- c. Air pressure drop in inches wg.
- d. Outside-air, wet- and dry-bulb temperatures in deg F.
- e. Return-air, wet- and dry-bulb temperatures in deg F.
- f. Entering-air, wet- and dry-bulb temperatures in deg F.
- g. Leaving-air, wet- and dry-bulb temperatures in deg F.
- h. Water flow rate in gpm.
- i. Water pressure differential in feet of head or psig.
- j. Entering-water temperature in deg F.
- k. Leaving-water temperature in deg F.
- l. Refrigerant expansion valve and refrigerant types.
- m. Refrigerant suction pressure in psig.
- n. Refrigerant suction temperature in deg F.
- o. Inlet steam pressure in psig.

H. Electric-Coil Test Reports: For electric furnaces, duct coils, and electric coils installed in central-station air-handling units, include the following:

1. Unit Data:

- a. System identification.
- b. Location.
- c. Coil identification.
- d. Capacity in Btuh.
- e. Number of stages
- f. Connected volts, phase, and hertz.
- g. Rated amperage.
- h. Airflow rate in cfm.

- i. Face area in sq. ft..
 - j. Minimum face velocity in fpm.
- 2. Test Data: (Indicated and Actual Values):
 - a. Heat output in Btuh.
 - b. Airflow rate in cfm.
 - c. Air velocity in fpm.
 - d. Entering-air temperature in deg F.
 - e. Leaving-air temperature in deg F.
 - f. Voltage at each connection.
 - g. Amperage for each phase.
- I. Fan Test Reports: For supply, return, and exhaust fans, include the following:
 - 1. Fan Data:
 - a. System identification.
 - b. Location.
 - c. Make and type.
 - d. Model number and size.
 - e. Manufacturer's serial number.
 - f. Arrangement and class.
 - g. Sheave make, size in inches, and bore.
 - h. Sheave dimensions, center-to-center and amount of adjustments in inches.
 - 2. Motor Data:
 - a. Make and frame type and size.
 - b. Horsepower and rpm.
 - c. Volts, phase, and hertz.
 - d. Full-load amperage and service factor.
 - e. Sheave make, size in inches, and bore.
 - f. Sheave dimensions, center-to-center and amount of adjustments in inches.
 - g. Number of belts, make, and size.
 - 3. Test Data: (Indicated and Actual Values):
 - a. Total airflow rate in cfm.
 - b. Total system static pressure in inches wg.
 - c. Fan rpm.
 - d. Discharge static pressure in inches wg.
 - e. Suction static pressure in inches wg.
- J. Round, Flat-Oval, and Rectangular Duct Traverse Reports: Include a diagram with a grid representing the duct cross-section and record the following:
 - 1. Report Data:
 - a. System and air-handling unit number.
 - b. Location and zone.

- c. Traverse air temperature in deg F.
- d. Duct static pressure in inches wg.
- e. Duct size in inches.
- f. Duct area in sq. ft.
- g. Indicated airflow rate in cfm.
- h. Indicated velocity in fpm.
- i. Actual airflow rate in cfm.
- j. Actual average velocity in fpm.
- k. Barometric pressure in psig.

K. Air-Terminal-Device Reports:

1. Unit Data:

- a. System and air-handling unit identification.
- b. Location and zone.
- c. Test apparatus used.
- d. Area served.
- e. Air-terminal-device make.
- f. Air-terminal-device number from system diagram.
- g. Air-terminal-device type and model number.
- h. Air-terminal-device size.
- i. Air-terminal-device effective area in sq. ft..

2. Test Data: (Indicated and actual values):

- a. Airflow rate in cfm.
- b. Air velocity in fpm.
- c. Preliminary airflow rate as needed in cfm.
- d. Preliminary velocity as needed in fpm.
- e. Final airflow rate in cfm.
- f. Final velocity in fpm.
- g. Space temperature in deg F.

L. System-Coil Reports: For reheat coils and water coils of terminal units, include the following:

1. Unit Data:

- a. System and air-handling unit identification.
- b. Location and zone.
- c. Room or riser served.
- d. Coil make and size.
- e. Flowmeter type.

2. Test Data: (Indicated and Actual Values):

- a. Airflow rate in cfm.
- b. Entering-water temperature in deg F.
- c. Leaving-water temperature in deg F.
- d. Water pressure drop in feet of head or psig.
- e. Entering-air temperature in deg F.

- f. Leaving-air temperature in deg F.
- M. Compressor and Condenser Reports: For refrigerant side of unitary systems, stand-alone refrigerant compressors, air-cooled condensing units, or water-cooled condensing units, include the following:
- 1. Unit Data:
 - a. Unit identification.
 - b. Location.
 - c. Unit make and model number.
 - d. Compressor make.
 - e. Compressor model and serial numbers.
 - f. Refrigerant weight in lb.
 - g. Low ambient temperature cutoff in deg F.
 - 2. Test Data: (Indicated and Actual Values):
 - a. Inlet-duct static pressure in inches wg.
 - b. Outlet-duct static pressure in inches wg.
 - c. Entering-air, dry-bulb temperature in deg F.
 - d. Leaving-air, dry-bulb temperature in deg F.
 - e. Condenser entering-water temperature in deg F.
 - f. Condenser leaving-water temperature in deg F.
 - g. Condenser water temperature differential in deg F.
 - h. Condenser entering-water pressure in feet of head or psig.
 - i. Condenser leaving-water pressure in feet of head or psig.
 - j. Condenser water pressure differential in feet of head or psig.
 - k. Control settings.
 - l. Unloader set points.
 - m. Low-pressure-cutout set point in psig.
 - n. High-pressure-cutout set point in psig.
 - o. Suction pressure in psig.
 - p. Suction temperature in deg F.
 - q. Condenser refrigerant pressure in psig.
 - r. Condenser refrigerant temperature in deg F.
 - s. Oil pressure in psig.
 - t. Oil temperature in deg F.
 - u. Voltage at each connection.
 - v. Amperage for each phase.
 - w. Kilowatt input.
 - x. Crankcase heater kilowatt.
 - y. Number of fans.
 - z. Condenser fan rpm.
 - aa. Condenser fan airflow rate in cfm.
 - bb. Condenser fan motor make, frame size, rpm, and horsepower.
 - cc. Condenser fan motor voltage at each connection.
 - dd. Condenser fan motor amperage for each phase.
- N. Pump Test Reports: Calculate impeller size by plotting the shutoff head on pump curves and include the following:

1. Unit Data:
 - a. Unit identification.
 - b. Location.
 - c. Service.
 - d. Make and size.
 - e. Model and serial numbers.
 - f. Water flow rate in gpm.
 - g. Water pressure differential in feet of head or psig.
 - h. Required net positive suction head in feet of head or psig.
 - i. Pump rpm.
 - j. Impeller diameter in inches.
 - k. Motor make and frame size.
 - l. Motor horsepower and rpm.
 - m. Voltage at each connection.
 - n. Amperage for each phase.
 - o. Full-load amperage and service factor.
 - p. Seal type.

2. Test Data: (Indicated and Actual Values):
 - a. Static head in feet of head or psig.
 - b. Pump shutoff pressure in feet of head or psig.
 - c. Actual impeller size in inches.
 - d. Full-open flow rate in gpm.
 - e. Full-open pressure in feet of head or psig.
 - f. Final discharge pressure in feet of head or psig.
 - g. Final suction pressure in feet of head or psig.
 - h. Final total pressure in feet of head or psig.
 - i. Final water flow rate in gpm.
 - j. Voltage at each connection.
 - k. Amperage for each phase.

O. Air-to-Air Heat-Recovery Unit Reports:

1. Unit Data:
 - a. Unit identification.
 - b. Location.
 - c. Service.
 - d. Make and type.
 - e. Model and serial numbers.
2. Motor Data:
 - a. Make and frame type and size.
 - b. Horsepower and rpm.
 - c. Volts, phase, and hertz.
 - d. Full load amperage and service factor.
 - e. Sheave make, size in inches, and bore.
 - f. Sheave dimensions, center-to-center, and amount of adjustments in inches.

3. If fans are an integral part of the unit, include the following for each fan:
 - a. Make and type.
 - b. Arrangement and size.
 - c. Sheave make, size in inches, and bore.
 - d. Sheave dimensions, center-to-center, and amount of adjustments in inches.
4. Test Data (Indicated and Actual Values):
 - a. Total exhaust airflow rate in cfm.
 - b. Purge exhaust airflow rate in cfm.
 - c. Outside airflow rate in cfm.
 - d. Total exhaust fan static pressure in inches wg.
 - e. Total outside-air fan static pressure in inches wg.
 - f. Pressure drop on each side of recovery wheel in inches wg.
 - g. Exhaust air temperature entering in deg F.
 - h. Exhaust air temperature leaving in deg F.
 - i. Outside-air temperature entering in deg F.
 - j. Outside-air temperature leaving in deg F.
 - k. Calculate sensible and total heat capacity of each airstream in MBh.

P. Domestic Hot Water Circulation Systems:

1. Schematic drawings/diagrams: Include plans and diagrams showing locations of all equipment included in the report.
2. Listings of balancing manufacturer and model, balancing valve settings, and differential pressure readings across the balancing valve.

Q. Vibration Measurement Reports:

1. Date and time of test.
2. Vibration meter manufacturer, model number, and serial number.
3. Equipment designation, location, equipment, speed, motor speed, and motor horsepower.
4. Diagram of equipment showing the vibration measurement locations.
5. Measurement readings for each measurement location.
6. Calculate isolator efficiency using measurements taken.
7. Description of predominant vibration source.

R. Sound Measurement Reports: Record sound measurements on octave band and dBA test forms and on an NC or RC chart indicating the decibel level measured in each frequency band for both "background" and "HVAC system operating" readings. Record each tested location on a separate NC or RC chart. Record the following on the forms:

1. Date and time of test. Record each tested location on its own NC curve.
2. Sound meter manufacturer, model number, and serial number.
3. Space location within the building including floor level and room number.
4. Diagram or color photograph of the space showing the measurement location.
5. Time weighting of measurements, either fast or slow.
6. Description of the measured sound: steady, transient, or tonal.
7. Description of predominant sound source.

S. Indoor-Air Quality Measurement Reports for Each HVAC System:

1. HVAC system designation.
2. Date and time of test.
3. Outdoor temperature, relative humidity, wind speed, and wind direction at start of test.
4. Room number or similar description for each location.
5. Measurements at each location.
6. Observed deficiencies.

T. Instrument Calibration Reports:

1. Report Data:
 - a. Instrument type and make.
 - b. Serial number.
 - c. Application.
 - d. Dates of use.
 - e. Dates of calibration.

3.21 INSPECTIONS

A. Initial Inspection:

1. After testing and balancing are complete, operate each system and randomly check measurements to verify that the system is operating according to the final test and balance readings documented in the Final Report.
2. Randomly check the following for each system:
 - a. Measure airflow of at least 10 percent of air outlets.
 - b. Measure water flow of at least 5 percent of terminals.
 - c. Measure room temperature at each thermostat/temperature sensor. Compare the reading to the set point.
 - d. Measure sound levels at two locations.
 - e. Measure space pressure of at least 10 percent of locations.
 - f. Verify that balancing devices are marked with final balance position.
 - g. Note deviations to the Contract Documents in the Final Report.

B. Final Inspection:

1. After initial inspection is complete and evidence by random checks verifies that testing and balancing are complete and accurately documented in the final report, request that a final inspection be made by Architect.
2. TAB firm test and balance engineer shall conduct the inspection in the presence of Architect.
3. Architect shall randomly select measurements documented in the final report to be rechecked. The rechecking shall be limited to either 10 percent of the total measurements recorded, or the extent of measurements that can be accomplished in a normal 8-hour business day.
4. If the rechecks yield measurements that differ from the measurements documented in the final report by more than the tolerances allowed, the measurements shall be noted as

"FAILED."

5. If the number of "FAILED" measurements is greater than 10 percent of the total measurements checked during the final inspection, the testing and balancing shall be considered incomplete and shall be rejected.
6. TAB firm shall recheck all measurements and make adjustments. Revise the final report and balancing device settings to include all changes and resubmit the final report.
7. Request a second final inspection. If the second final inspection also fails, Owner shall contract the services of another TAB firm to complete the testing and balancing in accordance with the Contract Documents and deduct the cost of the services from the final payment.

3.22 ADDITIONAL TESTS

- A. Within 90 days of completing TAB, perform additional testing and balancing to verify that balanced conditions are being maintained throughout and to correct unusual conditions.
- B. Seasonal Periods: If initial TAB procedures were not performed during near-peak summer and winter conditions, perform additional testing, inspections, and adjusting during near-peak summer and winter conditions.

END OF SECTION 230593

SECTION 230700 - MECHANICAL SYSTEMS INSULATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. The drawings and general provisions of the Contract, including General and Supplementary Conditions, General Requirements and all other Specification Sections apply to the work specified in this section. In the event of conflict between specific requirements of the various documents, the more restrictive, the more extensive (i.e.: more expensive) requirement shall govern.

1.2 SCOPE

- A. Work included in this section is the thermal insulating done in the field, on the Division 22 and 23 systems as specified herein.
- B. Work excluded in this Section are the following:
 - 1. Thermal building insulation.
 - 2. Sound absorbing duct lining.
- C. The requirements of Division 23, Section "Mechanical and Electrical General Provisions" shall apply to the work specified under this Section.

1.3 DEFINITIONS

- A. The k factor means the number of British thermal units of heat transmitted per (sq. ft.) (Fahrenheit temperature difference) through a material with flat, parallel sides one (1) inch apart. The material shall be tested and rated according to ASTM Test Method C-177.
- B. Unless otherwise specified, the term "concealed", as used in this specification, shall include all items hidden from normal sight. This includes items within furred spaces, pipe and duct shafts, above suspended ceilings and within return air plenums.
- C. Unless otherwise specified, the work "exposed" shall refer to all work other than "concealed" work.
- D. Unless otherwise specified, the term "exterior", as used in this specification, shall include all items being or situated outside. Items located within a crawl space shall be considered exterior.
- E. Unless otherwise specified, the term "conditioned", as used in this specification, shall be a heated or cooled space, or both, within a building and, where required, provided with humidification or dehumidification means, so as to be capable of maintaining a space condition falling within the comfort envelope set forth in ASHRAE 55.

1.4 SUBMITTALS

- A. Provide shop drawings in accordance with Division 23, Sections “Mechanical and Electrical General Provisions” and the General Requirements which shall include all insulation, jackets, finishes, corner beads, pump covers, etc. Shop drawings shall additionally describe each system or component to be insulated, insulation type and thickness, and method of installation.
- B. Product Data: For each type of product indicated. Include thermal conductivity, water-vapor permeance thickness, and jackets (both factory and field applied if any).
- C. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
 - 1. Detail application of protective shields, saddles, and inserts at hangers for each type of insulation and hanger.
 - 2. Detail attachment and covering of heat tracing inside insulation.
 - 3. Detail insulation application at pipe expansion joints for each type of insulation.
 - 4. Detail insulation application at elbows, fittings, flanges, valves, and specialties for each type of insulation.
 - 5. Detail removable insulation at piping specialties.
 - 6. Detail application of field-applied jackets.
 - 7. Detail application at linkages of control devices.

1.5 MOCK-UPS

- A. Mockups: Before installing insulation of any type, build mockups for each type of insulation and finish listed below to demonstrate quality of insulation application and finishes. Build mockups according to the following requirements, using materials indicated for the completed Work:
 - 1. Include the following mockups:
 - a. One 10-foot section of 2” straight pipe and duct run.
 - b. One 90-degree pipe and duct elbow.
 - c. One pipe and duct tee fitting.
 - d. One 2” valve.
 - e. Four support hangers, including hanger shield and insert.
 - 2. Build mockups with cutaway sections to allow observation of application details for insulation materials, mastics, attachments, and jackets.
 - 3. Build mockups in the location indicated or, if not indicated, as directed by Architect.
 - 4. Notify Architect seven (7) days in advance of dates and times when mockups will be constructed.
 - 5. Obtain Architect’s approval of mockups before starting insulation application.
 - 6. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
 - 7. Demolish and remove mockups when directed.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: Skilled mechanics who have successfully completed an apprenticeship program or another craft training program certified by the Department of Labor, Bureau of Apprenticeship and Training.
- B. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products according to ASTM E 84, by a testing and inspecting agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing agency.
 - 1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.
 - 2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.

1.7 COORDINATION

- A. Coordinate sizes and locations of supports, hangers, and insulation shields.
- B. Coordinate clearance requirements with piping Installer for piping insulation application. Before preparing piping Shop Drawings, establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.
- C. Coordinate installation and testing of heat tracing.

1.8 SCHEDULING

- A. Schedule insulation application after pressure testing systems and, where required, after installing and testing heat tracing. Insulation application may begin on segments that have satisfactory test results.
- B. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

PART 2 - PRODUCTS

2.1 GENERAL

- A. All insulating materials, including adhesives, jackets and coatings, to be used on the project must be delivered to the building in the manufacturer's unopened container and must bear the manufacturer's stamp or label giving name of manufacturer, brand and description of material.
- B. After the necessary tests have been conducted to prove the water and air systems tight, all piping, ductwork and equipment to be insulated shall be thoroughly cleaned and then covered. Insulation materials shall be the product of Owens Corning, CSG, Schuller or Armacell equal to

the products specified herein.

- C. All Insulation shall have ASTM E84 flame spread/smoke developed indices of $\leq 25/50$ for use in air plenums of commercial buildings.

2.2 TYPES OF INSULATION

A. Type I - Pipe Insulation:

- 1. Provide heavy density fiberglass pipe insulation with vapor barrier jacket. The k factor shall not be more than 0.23 at seventy-five (75) degrees Fahrenheit mean temperature. Insulation shall be equal to Johns Manville Micro-Lok meeting ASTM C 547 with FSK jacket.

B. Type II - Pipe Insulation:

- 1. Provide closed cell elastomeric tubular insulation with built-in vapor barrier. The k factor shall not be more than 0.25 at seventy-five (75) degrees Fahrenheit mean temperature. Insulation shall be equal to Armacell AP Armaflex or AP Armaflex SS. The use of polyethylene, polyolefin or engineered polymer insulation is prohibited.

C. Type IV - Duct Insulation:

- 1. Provide blanket type lightweight fiberglass duct insulation with vapor barrier facing. The compressed k-factor shall not exceed 0.27 at seventy-five (75) degrees Fahrenheit mean temperature and a minimum installed R-Value of 6.0 (hr•ft²•°F)/Btu. Insulation shall be equal to Johns Manville flexible fiberglass blanket Microlite XG Formaldehyde-free Type 100 meeting ASTM C 553 with factory-applied FSK facing.

D. Type V - Duct and Equipment Insulation:

- 1. Provide board type fiberglass insulation with vapor barrier facing. The k factor shall not exceed 0.22 at seventy-five (75) degrees Fahrenheit mean temperature, and the density shall not be less than 6.0 pounds per cubic foot (pcf). Insulation shall be equal to Johns Manville 817 Spin-Glas meeting ASTM C 612 with FSK facing.

E. Type VI - Equipment Insulation:

- 1. Provide board type fiberglass insulation, unfaced. The k factor shall not exceed 0.23 at seventy-five (75) degrees Fahrenheit mean temperature and the density shall not be less than 3.0 pounds per cubic foot (pcf). Insulation shall be equal to Johns Manville 814 Series Spin-Glas meeting ASTM C 612.

F. Type VII - Equipment or Exterior Duct Insulation:

- 1. Provide flexible elastomeric thermal sheet insulation with built-in vapor barrier. The k factor shall not exceed 0.27 at seventy-five (75) degrees Fahrenheit mean temperature. Insulation shall be equal to Armacell AP Armaflex or AP Armaflex SA.

G. Type IX - Equipment Insulation:

1. Provide flexible board type fiberglass insulation, unfaced. The k factor shall not exceed 0.28 at 150 degrees Fahrenheit mean temperature. Insulation shall be equal to Johns Manville pipe and tank insulation.

H. Type XI – Fire Barrier Insulation

1. Provide patented inorganic blanket encapsulated with scrim reinforced foil insulation with k-factor of 0.21. Wrap shall be rated as a shaft alternative per UL 1978. Insulation shall be equal to 3M Fire Barrier Insulation 15A.

I. Type XII – Piping Insulation

1. Provide rigid closed-cell polyisocyanurate thermal insulation with vapor retarder over pipe insulation and 0.030 inch thick PVC (polyvinylchloride) rolled jacketing. The insulation shall have a density of 2 lb/ft³, the k factor shall not be more than 0.18 (aged 6-months) at seventy-five (75) degrees Fahrenheit mean temperature and the minimum R-value of 5.6 hr*ft²*F/BTU (aged 6-months). Polyisocyanurate pipe insulation shall be manufactured by Dyplast, Dow Chemical Company, Elliott Company, or Duna USA equal to Dyplast dP-ISO-C1.

2.3 ADHESIVES, SEALERS AND COATINGS

- A. The vapor barrier on all insulation systems shall be maintained at all times. Any penetration into the vapor barrier shall be sealed vapor tight. All joints, fittings etc shall be sealed vapor tight.
- B. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated unless otherwise indicated. They shall not corrode, soften or otherwise attach such material in either the wet or dry state and must be suitable for the service temperatures.
- C. Any cement, sealer or coating used shall be resistant to vermin and mold and shall be durable. It shall not discolor on aging; and where applied on the final surface of the insulation, it shall be light in color and be capable of being painted.
- D. For indoor applications:
1. Use adhesive that has a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 2. Use sealants that have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- E. Adhesives, coatings and compounds shall be equal to the following:
1. Vapor barrier adhesive for sealing joints on pipe and duct insulation - Foster 85-75.
 2. Adhesive for installing canvas jackets - Foster 30-36.
 3. Adhesive for installing duct insulation - Foster 85-20 and 81-91.
 4. Adhesive for installing cellular-glass insulation - Foster Brand 81-84.
 5. Adhesive for installing elastomeric insulation - Foster Brand 85-75, Armaflex 520.
 6. Adhesive for installing mineral-fiber insulation - Foster Brand 85-60/85-70, Childers CP-

127.

7. Adhesive for ASJ, FSK and PVDC jackets - Foster Brand 85-50, Childers CP-82.
8. Joint sealants for cellular-glass insulation - Foster Brand 30-45, Childers CP-76.
9. FSK and metal jacket flashing sealants - Foster Brand 95-44, Childers CP-76.
10. ASJ, vinyl, PVDC, and PVC jacket flashing sealants - Childers Brand CP-76
11. Two coats of WB Armaflex finish or glass mesh with mastic for all Armaflex located outside.

2.4 FABRIC JACKETS

- A. All exposed piping, ductwork, and equipment in addition to the insulation jackets specified, shall be covered with an additional UL listed jacket of eight (8) ounce canvas. This shall be in addition to the insulation jackets specified.

2.5 PAINTING

- A. All piping and insulation in the mechanical rooms shall be painted. Refer to Division 23 Section "Basic Materials and Methods" and Division 9 for more information.

2.6 FITTING AND VALVE COVERS

- A. Pipe fittings and valves shall be insulated with one (1) piece pre-molded high impact PVC insulated fitting covers with factory pre-cut insulation inserts and accessories. Fittings shall have edges of one (1) piece cover sealed with vapor barrier pressure sensitive tape. Fitting covers shall be 25/50 rated to meet fire and smoke safety requirements of federal, state and local building codes. Manufacturers shall be Knauf (Proto), Johns Manville (Zeston), Thomas Insulation or equal to Proto Fitting Cover System.

2.7 METALLIC COMPONENTS

- A. Staples shall be outward clinching type of 304 or 316 stainless steel.
- B. Bands shall be galvanized steel, aluminum, brass, or nickel-copper alloy, of 3/4 inch nominal width. The band thickness, exclusive of coating, shall be not less than 0.005 inch for steel and nickel copper alloy, 0.007 inch for aluminum, and 0.01 inch for brass.
- C. Wire shall be fourteen (14) gauge, nickel-copper alloy or copper clad steel, or sixteen (16) gauge, soft annealed, galvanized steel.
- D. Wire netting used for exposed surfaces of insulation that is to be cement finished shall be twenty-two (22) gauge, one (1) inch galvanized mesh, with continuous twenty-six (26) gauge galvanized steel corner beads having 2-1/2 inch wings.
- E. Protect external corners on insulation of ducts and equipment exposed in occupied spaces by corner beads two (2) inches by two (2) inches, .016 inch thick aluminum adhered to heavy duty Kraft paper.
- F. All exterior piping and ductwork shall be additionally covered with a sixteen (16) mil embossed

aluminum weatherproof jacket. Jacketing shall be ITW's Lock-On (Childers) type with an integrally bonded polysurlyn moisture retarder over the entire surface in contact with the insulation. Jackets are to be fabricated with continuous modified Pittsburg Z-lock on the longitudinal seam and each butted section of jacketing shall be joined and sealed with factory fabricated butt strap and sealant. Fittings shall be insulated and weatherproofed using similar materials.

2.8 INSULATION SCHEDULE:

- A. Insulation materials furnished must meet the minimum thickness requirements of National Voluntary Consensus Standard 90.1 (current accepted edition), "Energy Efficient Design of New Buildings" of the American Society of Heating, Refrigeration, and Air Conditioning Engineers (ASHRAE).

Service	Type	Thickness
	I	1"
B. Domestic Water Pipe (Hot, Cold, Tempered, & Recirc.,) Optional sizes 1" and smaller	I	½"
	II	½"
C. Domestic Water Piping Concealed in Walls and Cabinet Enclosures		
	I	1"
D. Storm Water Pipe (Horizontal Pipe Only)	IX	2"
E. Roof Drain Bodies Optional	VII	1"
	I	1"
F. Air Conditioning Condensate Optional	II	½"
G. Air Conditioning Supply and Outdoor Air Ductwork		
1. Concealed	IV	2"
	V	2"
2. Exposed or in Shafts		
	V	1"
3. Air Device Bodies		
H. Air Conditioning Return Ductwork		
1. Concealed (shafts only)	IV	2"
	V	1"
2. Exposed		
I. Refrigerant Piping	II	1"
J. Handicapped Lavatory Water and Sanitary Piping	II	½"

PART 3 - EXECUTION

3.1 GENERAL:

- A. All insulation shall be installed by skilled workmen regularly engaged in this type of work.
- B. Insulation shall be continuous at all hangers, hanger rods, supports, sleeves and openings. Continuous vapor barrier must be provided for all cold surfaces. Insulation shall be sealed where it terminates because of a valve, union, flange, etc.
- C. Provide continuous insulation and jacketing when passing thru interior wall, floor, and ceiling construction.
 - 1. At Through Penetration Firestops: Coordinate insulation densities with the requirements of approved firestop system being installed.
 - 2. Insulation densities required by approved firestop system may vary with the densities specified in this Section. When this occurs use the higher density insulation.
- D. Do not intermix different insulation materials on individual runs of piping or ductwork.
- E. Arrange to permit expansion and contraction without causing damage to insulation or surface.
- F. Actual insulation thickness must be at least equal to the minimum specified in the schedule at all locations including supports in contact with cold surfaces. Where the manufacturer's rated or nominal thickness is less than the minimum specified, a thicker material or more layers will be requested so that the stated minimum thickness will be attained or exceeded.
- G. Install insulation materials in a first class manner with smooth and even surfaces. Scrap pieces of insulation shall not be used where a full length section will fit.
- H. Unless otherwise specified herein, the application of all insulation materials, accessories and finishes shall be in accordance with the manufacturer's published recommendations.
- I. Insulation materials shall not be applied until all surfaces to be covered are clean and dry; all foreign material, such as rust, scale, dirt, etc., has been removed, and where specified, surfaces have been painted. Insulation shall be clean and dry when installed and during the application of any finish. The insulation on pipe fittings, valves and pipe joints shall not be installed before the piping is tested and approved.
- J. Omit insulation of the following unless directed otherwise.
 - 1. Brass or copper pipe specified to be chrome plated.
 - 2. Traps and pressure reducing valves, relief piping from safety valves, and unions, flanges and expansion joints on heating water system.
 - 3. All fire protection piping.
 - 4. Existing adjacent insulation.
 - 5. ASME stamps, manufacturer's nameplates.
 - 6. Access plates on fan housings.
 - 7. Cleanouts or handholes.
 - 8. Components within factory preinsulated HVAC equipment.

- 9. Factory - preinsulated flexible ductwork and HVAC equipment.
- 10. Vibration - isolating connections.

- K. Replace and repair insulation disturbed by testing and balancing procedures required under Division 23, Section "Testing and Balancing".
- L. Repair existing insulation on piping, ductwork, and equipment, that is damaged by the contractor's work with a material similar to the existing insulation. Insulation vapor barrier and appearance shall be returned to its original condition.

3.2 PIPE INSULATION

- A. High density pipe saddles shall be provided at all points of support as hereinbefore specified.
- B. Insulate all valves and strainers. Use premolded covers and factory precut insulation where applicable. Unions and flanges shall not be insulated except on cold services.
- C. Insulate valves up to and including bonnets, except for cold water valves which shall be insulated over packing nuts in a manner to permit removal for adjustment and repacking.
- D. Insulate strainers in a manner to permit removal of the basket without disturbing the insulation of the strainer. Obtain Architect's approval of installation method.
- E. Insulate all exposed piping under lavatories and sinks with a white, fitted/molded antimicrobial undersink pipe cover equal to Truebro Lav Guard 2. Cover shall have internal, E-Z Tear-To-Fit trim feature for square, clean trimming (internal ribs) and built-in, concealed E-Z Grip fasteners (no cable-tie fasteners allowed).
- F. Application - Type I Insulation:
 - 1. Insulate all pipes in a neat and workmanlike manner. Seal all longitudinal laps of jackets and staple every six (6) inches. Where the piping operates below ambient temperature, the staples shall be coated with vapor barrier adhesive. All butt joints shall be wrapped with a three (3) inch minimum wide strip of jacketing material securely sealed in place.
 - 2. Insulate valves and fittings with pre-cut blanket type fiberglass insulation and PVC covers as specified. Insulation shall be of the same thickness as that on adjoining pipe. The ends of the insulation shall be tucked snugly into the throat of the fitting and the edges adjacent to the pipe covering tufted and tucked, fully insulating the pipe fitting. The one (1) piece PVC fitting cover shall then be secured by stapling, tack fastening, banding or taping the ends to the adjacent pipe covering. Chilled water supply and return piping and cold water systems piping shall be insulated as above and have all seam edges of the cover sealed with ZESTON vapor barrier adhesive mastic. The circumferential edges of cover shall be wrapped with ZESTON vapor barrier pressure sensitive color matching tape. The tape shall extend over the adjacent pipe insulation and overlap itself at least two (2) inches on the downward side.
 - 3. Where fittings are operating above ambient they may, in lieu of the proceeding paragraph, be covered with a three (3) hour, hydraulic setting, combination insulating and finishing cement having k factor not greater than 0.87 at a mean temperature of 200 degrees Fahrenheit. The thickness of this cement shall be such that the surface is substantially flush with the pipe covering. Where the insulation terminates at a fitting that

is not covered, the end of the insulation shall be beveled off with this same cement. All fittings insulated in this manner shall be covered by a fabric jacket as specified, which shall be cemented down with lagging adhesive.

4. Where expansion joints are required to be insulated, they shall be covered with readily removable sections of insulation of same composition and thickness as provided for adjacent piping.

G. Application - Type II Insulation:

1. The material shall be slit lengthwise to permit installation or slipped over pipe before connections are made. Self-seal insulation may also be installed.
2. All joints and seams must be thoroughly bonded, both mechanically and hermetically, by the adhesive recommended by the insulation manufacturer. Also, the manufacturer's recommendations shall be followed as to the adhesive to use where the insulation needs bonding to metal or other material used for any surface treatment where a finish coat of paint is required.
3. All penetrations of the insulation must be thoroughly sealed so that the insulation itself will form a complete vapor barrier. Insulation shall run continuous at hangers and supports to form a complete vapor barrier. Wherever the insulation terminates, the edges shall be sealed to the metal.
4. Insulation shall be extended to stop valves under plumbing fixtures and/or within cabinets. Water and waste lines serving handicap plumbing fixtures shall be insulated and painted to match adjacent surface.

H. Application -Type XII Insulation:

1. Insulation shall be fabricated in required shapes from bun stock in accordance with ASTM C-450 "Standard Practice for Prefabrication and Field Fabrication of Thermal Insulating Fitting Covers for NPS Piping, Vessel Lagging, and Dished Head Segments" and C-585 "Standard Practice for Inner and Outer Diameters of Rigid Thermal Insulation for Nominal Sizes of Pipe and Tubing (NPS System)". Insulation shall be factory fabricated by a qualified fabricator from bun stock.
2. Fittings, such as valves, valve stations, flanges, 90° and 45° elbows, and tees shall be two piece flycut or routed as the preferred fabrication method. For diameters too large for flycutting or routing, the pieces shall be fabricated in two halves with each half made up of mitered sections. Both methods shall be in accordance with ASTM C-450 and ASTM C-585.
3. Adhesives, Joint Sealers and Mastics
 - a. Solvent based adhesives, joint sealers and mastics may be used in contact with ISO-C1 insulation. Mastics shall remain flexible at the lowest expected ambient temperature.
 - b. Joint sealers for sealing joints of insulation shall be vapor retarder type, moisture and water resistant, non hardening, and flexible with a service temperature range from -275°F to +200°F.
 - c. A vapor retarder type joint sealer shall be applied on insulation longitudinal joints and butt joints to prevent moisture and moisture vapor infiltration. Such joint sealers are Fosters 95-50 sealer or approved equal. Please consult joint sealer manufacturer for recommended products
 - d. Solvent or water adhesives may be used to attach the vapor barrier to the outer surface of the ISO-C1. Refer to the vapor barrier installation guidelines. Consult

adhesive manufacturer's literature for instructions on handling adhesives including required operating temperatures. Potential adhesives for use in this application include:

- 1) Childers CP 88 adhesive (solvent based)
- 2) Foster 81-05 adhesive (solvent based)
- 3) Foster 85-50 adhesive (water based)
- 4) Foster 85-60 adhesive (water based)

4. Vapor Retarder

- a. The Vapor Retarder be factory or field applied to the outer surface of the pipe insulation. A double layer vapor retarder design shall be used for cryogenic and LNG applications, with the secondary vapor retarder applied between the outer most foam insulation layer and the next inner layer of foam insulation. Refer to Figure 2 in Appendix B for details.
- b. Vapor retarder shall have a maximum permeance of 0.01 perm and shall be equivalent to Venture Wrap or Venture Clad products or Insulrap 50 Laminated Vapor Retarder for Pipe Insulation. Refer to ASTM standards C-755 and C-1136 for information on selection and specification of vapor retarders. Refer to product literature and installation guidelines from the vapor retarder manufacturer for recommended application instructions.
- c. Elbows and fittings shall be wrapped with vapor retarder tape with a 50% overlap.
- d. For other laminated membrane type vapor retarders, consult manufacturer's literature and installation guidelines.

5. Installation

- a. Dyplast recommends insulation shall be fabricated with shiplap or tongue and groove longitudinal joints and shiplap ends.
- b. Install pre-fabricated insulation fittings on elbows, tees, and valves. Insulation shall be the same thickness as pipe sections and fabricated with shiplap ends and shiplap or tongue and groove longitudinal joints.
- c. Insulation shall be secured to the pipe with 3/4" wide fiber reinforced tape.
- d. Insulation shall be secured with fiber reinforced tape prior to installation of the vapor retarder material when vapor retarder is field applied.
- e. Outer layer insulation and vapor retarder shall be secured with fiber reinforced tape. Use a 25% circumferential overlap on 12" centers when vapor retarder is factory applied to insulation. Fiber tape shall be applied to the exterior of the insulation/vapor retarder system.
- f. All insulation shall be tightly butted and free of voids and gaps at all joints. Vapor retarder must be continuous. All fasteners and bands shall be neatly aligned and overall work must be of high quality appearance and workmanship.
- g. Vapor stops shall be used on either side of valves frequently removed for servicing, valve stations left exposed, or odd fittings, elbows, tees, etc. where the chance of moisture infiltration is high.
- h. The vapor retarder shall have a maximum permeance of 0.01 perm and shall be equivalent to Venture wrap or Venture Clad products or Insulrap 50 Laminated Vapor Retarder.
- i. Vapor Retarder Film should be cut to length longitudinally and wrapped around the circumference of the pipe with lap joint and installed facing downward

avoiding the placement of the joint at the top or bottom of the pipe. Lap joint to be sealed using liquid adhesive. Butt joints shall be covered with Vapor Retarder Tape. Spiral wrap configuration can be used in lieu of the above installation. Spiral wrapping will require adhesive placed on one edge of the vapor retarder as it is wrapped over the previous layer.

- j. Elbows and fittings shall be wrapped with Vapor Retarder Tape or covered with a mastic type vapor retarder product. Vapor Retarder Tape is to be wrapped in a spiral configuration. If using mastic type vapor retarder at fittings and elbows, form mastic so that fitting covers can be applied true and tight.
- k. On factory applied Vapor Retarder Film, lap joint to be sealed with SSL tape. All vapor retarder surfaces should be cleaned and free of dust, grease, oil, etc before application of the SSL tape to ensure good adhesion between the tape and vapor retarder. Refer to Figure 7 in Appendix. For other types of factory applied vapor retarders, consult manufacturer's recommendations on installation.
- l. Before jacketing can be installed on a portion of the piping, the vapor retarder system on that portion must be complete and continuous.

3.3 DUCT INSULATION

- A. Provide accessories as required to prevent distortion and sagging of duct insulation. Provide welded pins, adhesive clips and wire ties as recommended by the manufacturer and directed by the Architect.
- B. Insulation shall cover all standing seams and metal surfaces. Provide corner beading on all exposed ducts.
- C. Staples shall be sealed to maintain vapor barrier.
- D. Neatly cut insulation at dampers, temperature control sensors, and controllers. Butter exposed edges with approved mastic coating.
- E. Use 24" minimum length Type V board type insulation , of specified thickness, on the bottoms of ducts at each trapeze hanger location.
- F. Application - Type IV Insulation:
 - 1. Insulation shall be cut slightly longer than perimeter of duct to insure full thickness at corners. All insulation shall be applied with edges tightly stitched with staples. Provide vapor barrier mastic sealer at seam. The insulation shall be additionally secured to the bottom of all square ducts eighteen (18) inches or wider by means of welded pins and speed clips. The protruding ends of the pins shall be cut off flush after the speed clips have been applied. The vapor barrier facing shall be thoroughly sealed where the pins have pierced through with a tape of the same material by applying a vapor barrier adhesive to both surfaces as recommended by the manufacturer.
 - 2. All hanger rods, support members, joints and penetrations of the vapor barrier shall be sealed with full thickness insulation and vapor barrier mastic sealer. All cuts or tears shall be sealed with strips of the aluminum foil tape and vapor barrier adhesive.
- G. Application - Type V Insulation:

1. All insulation shall be applied with edges tightly butted. Insulation shall be impaled on pins welded to the duct and secured with speed clips. Spacing of pins shall be as required to hold insulation firmly in place but not less than one (1) pin per square foot, and pins shall be placed within three (3) inches of each corner of insulation. All joints and penetrations of the vapor barrier shall be sealed with a three (3) inch wide strip of the same material, applied with Foster 85-75, or to both surfaces as recommended by the adhesive and vapor barrier mastic sealer manufacturer.
2. If, through space or size restriction or other causes, the welded pin method is impossible, the insulation shall be secured to the duct with adhesive such as Foster 81-91 or equal. The adhesive shall cover the entire surface of the sheet metal when applied to underside of horizontal duct but may be applied in strips or spots for application to top and sides with a minimum of fifty (50) percent coverage.

3.4 EQUIPMENT INSULATION

- A. Cut or score insulation to fit shape and contour of equipment. Stagger all joints.
- B. Provide permanently fastened angles or plates, where required to support insulation.
- C. Apply insulation on access openings and cover plates as separate sections with insulation cut back for access to bolt heads and other fasteners.
- D. Do not cover nameplates. Cut back the insulation and line edges with twenty-six (26) gauge galvanized steel.
- E. Application – Type VI & IX Insulation:
 1. Insulation shall be applied with staggered joints firmly butted and joined. The insulation shall be held in place by steel bands. Bands shall be placed on not over twelve (12) inchcenters. All joints and voids shall be filled with cement, well trowled into openings. Apply over the insulation surface one (1) inch galvanized wire netting laced together at all edges and wired to the steel bands with sixteen (16) gauge soft annealed wire. Over this shall be applied 2-inch thick layer of insulating cement, applied in two (2) layers. Install metal corner beads at all corners and edges to provide a permanent installation.
- F. Application – Type VII Insulation:
 1. Apply a brush coat of manufacturer's recommended adhesive to dry, clean metal surface, covering an area equal to the size of one (1) sheet. Apply a brush coat of adhesive to the back of the sheet, except for a 2 inch wide border around the edges. After adhesive on metal surface and sheet has dried to a non-tacky state, position sheet so that the edges overlap the previously installed sheets by 1/8 inch. Apply light pressure to adhere a spot in the center of the sheet only and compress butt edges into place. Spread joints and coat with adhesive.
- G. Application – Type VIII Insulation:
 1. Apply a brush coat of manufacturer's recommended adhesive to dry, clean 3/4 inch high V-rib, stand-off expanded metal lath to provide an air space between the covered surface and insulation, covering an area equal to the size of one (1) sheet, except for a 2 inch

wide border around the edges. After adhesive on metal ribs and sheet has dried to a non-tacky state, position sheet so that the edges overlap the previously installed sheets by 1/8 inch. Apply light pressure to adhere a spot in the center of the sheet only and compress butt edges into place. Spread joints and coat with adhesive.

3.5 FABRIC JACKET

- A. Apply jacket to insulated breeching and equipment. Onto the dry cement surface apply a brush coat of Foster Sealfas 30-36 at the rate of sixty (60) to seventy (70) square feet per gallon. Embed into wet coating the canvas jacket, smoothed out to avoid wrinkles and overlap all seams a minimum of two (2) inches. Apply a second brush coat of Sealfas 30-36 to the entire surface at the rate of sixty (60) to seventy (70) square feet per gallon.
- B. Where jacket is to be installed on piping, apply Foster 30-36 adhesive to the canvas jacket by dipping to completely wet and saturate the canvas. While wet, position on the pipe insulation and pull tight, bond, lap and smooth out all wrinkles. Finish with a sealer coat of adhesive.

END OF SECTION 230700

SECTION 233110 - AIR DISTRIBUTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. The drawings and general provisions of the Contract, including General and Supplementary Conditions, General Requirements and all other Specification Sections apply to the work specified in this section. In the event of conflict between specific requirements of the various documents, the more restrictive, the more extensive (i.e.: more expensive) requirement shall govern.

1.2 SCOPE

- A. This section includes the air distribution systems including those devices distributing the air to the spaces, and those items which collect, filter, control, and convey air.
- B. Fans which are not an integral part of a factory fabricated air handling unit are included under this section.
- C. The requirements of Division 23, Section "Mechanical and Electrical General Provisions" shall apply to the work specified under this section.
- D. Except for duct pressure tests, all testing and balancing of the air distribution systems shall be performed under Division 23, Section "Testing and Balancing" of the Specifications.

PART 2 - PRODUCTS

2.1 AIR DEVICES

- A. Provide air devices of the minimum sizes and quantities indicated and of the types specified. Contractor shall carefully study the drawings and the field conditions to ascertain the air device requirements as to suitability, location, air capacity, required accessories, border and finish. Devices shall be selected to provide draft-free air distribution over entire area served and sound rating shall not exceed Noise Criteria (NC) 25.
- B. Border types shall be compatible with Architectural ceiling type for the room for which the air device is located. All devices shall have plaster frames when installed in plaster or drywall construction.
- C. Margins shall be as indicated or directed to suit field conditions.
- D. Provide Titus, Kreuger, Price, Metalaire, Nailor or Tuttle & Bailey air devices in accordance with the schedule below and on the drawings.
- E. Air Device Schedule:

Device	Type	Finish	Basis of Design
Ceiling Supply Diffuser	A	#26 white	Titus/TDCA
Ceiling Supply Diffuser	B	#26 white	Titus/TDC-AA
Return Register	C	#26 white	Titus/PAR
Return/Exhaust Grille	D	#26 white	Titus/PAR
Exhaust Grille	E	#26 white	Titus/PAR-AA
Return/Exhaust Grille	F	#26 white	Titus/350-FL
Linear Slot Diffuser	G	#26 white	Titus/ML-TZ
Sidewall Supply Diffuser	H	#26 white	Titus/300-RS
Supply Slot Diffuser	J	#26 white	Titus/FL-10-JT
Return Slot Diffuser	K	#26 white	Titus/FL-30-JT

1. Type A: Ceiling diffusers shall be Titus Model TDCA (steel) or prior approved equal for adjustable discharge pattern. These diffusers shall consist of an outer frame assembly of the sizes and mounting types shown on the plans and outlet schedule. A square or rectangular inlet shall be an integral part of the frame assembly and a transition piece shall be available to facilitate attachment of round duct. An inner core assembly consisting of fixed deflection louvers shall be available in one-, two-, three- or four-way horizontal discharge patterns. Diffuser shall include adjustable vanes to provide full vertical projection as well as horizontal projection. The inner core assembly must be removable in the field without tools for easy installation, cleaning or damper adjustment.
 - a. The finish shall be #26 white. The finish shall be an anodic acrylic paint, baked at 315°F for 30 minutes. The pencil hardness must be HB to H. The paint must pass a 100-hour ASTM B117 Corrosive Environments Salt Spray Test without creepage, blistering, or deterioration of film. The paint must pass a 250-hour ASTM D870 Water Immersion Test. The paint must also pass the ASTM D2794 Reverse Impact Cracking Test with a 50-inch pound force applied.
 - b. Opposed blade volume damper shall not be provided. Throw Reducing Vanes (TRV) must be available to deflect a horizontal discharge airstream from each side of the TDC diffuser into diverging airstreams.
 - c. The manufacturer shall provide published performance data for the diffuser. The diffuser shall be tested in accordance with ANSI/ASHRAE Standard 70-1991.

2. Type B: Ceiling diffusers shall be Titus Model TDC-AA (aluminum) or prior approved equal for fixed, horizontal discharge pattern. These diffusers shall consist of an outer frame assembly of the sizes and mounting types shown on the plans and outlet schedule. A square or rectangular inlet shall be an integral part of the frame assembly and a transition piece shall be available to facilitate attachment of round duct. An inner core assembly consisting of fixed deflection louvers shall be available in one-, two-, three- or four-way horizontal discharge patterns. The inner core assembly must be removable in the field without tools for easy installation, cleaning or damper adjustment.
 - a. The finish shall be #26 white. The finish shall be an anodic acrylic paint, baked at 315°F for 30 minutes. The pencil hardness must be HB to H. The paint must pass a 100-hour ASTM B117 Corrosive Environments Salt Spray Test without creepage, blistering, or deterioration of film. The paint must pass a 250-hour ASTM D870 Water Immersion Test. The paint must also pass the ASTM D2794 Reverse Impact Cracking Test with a 50-inch pound force applied.
 - b. Opposed blade volume damper shall not be provided. Throw Reducing Vanes

- (TRV) must be available to deflect a horizontal discharge airstream from each side of the TDC diffuser into diverging airstreams.
- c. The manufacturer shall provide published performance data for the diffuser. The diffuser shall be tested in accordance with ANSI/ASHRAE Standard 70-1991.
3. Type C: Perforated ceiling diffusers shall be Titus Model PAR (steel, flush face) or approved equal for return. Diffusers shall have a perforated face with 3/16-inch diameter holes on 1/4-inch staggered centers and no less than 51 percent free area. Perforated face shall be steel. The backpan shall be one piece stamped heavy gauge steel of the sizes and mounting types shown on the plans and outlet schedule. The diffuser neck shall have 1 1/8-inch depth for easy duct connection. Diffusers must discharge a uniform horizontal blanket of air into the room and protect ceiling against smudging. Pattern controllers in the supply models shall be mounted on the back of the perforated face and must be field adjustable to allow the discharged air to enter the room in either vertical or one-, two-, three- or four-way horizontal jets. The perforated face must be easily unlatchable from the backpan to facilitate option of the face for pattern controller adjustment.
 - a. The finish shall be #26 white. The finish shall be an anodic acrylic paint, baked at 315°F for 30 minutes. The pencil hardness must be HB to H. The paint must pass a 100-hour ASTM B117 Corrosive Environments Salt Spray Test without creepage, blistering or deterioration of film. The paint must pass a 250-hour ASTM D870 Water Immersion Test. The paint must also pass the ASTM D2794 Reverse Impact Cracking Test with a 50-inch pound force applied.
 - b. Opposed blade volume damper shall not be provided.
 - c. The manufacturer shall provide published performance data for the perforated diffuser. The diffuser shall be tested in accordance with ANSI/ASHRAE Standard 70-1991.
 4. Type D: Perforated ceiling diffusers shall be Titus Model PAR (steel, flush face) or approved equal for return. Diffusers shall have a perforated face with 3/16-inch diameter holes on 1/4-inch staggered centers and no less than 51 percent free area. Perforated face shall be steel. The backpan shall be one piece stamped heavy gauge steel of the sizes and mounting types shown on the plans and outlet schedule. The diffuser neck shall have 1 1/8-inch depth for easy duct connection. Diffusers must discharge a uniform horizontal blanket of air into the room and protect ceiling against smudging. Pattern controllers in the supply models shall be mounted on the back of the perforated face and must be field adjustable to allow the discharged air to enter the room in either vertical or one-, two-, three- or four-way horizontal jets. The perforated face must be easily unlatchable from the backpan to facilitate option of the face for pattern controller adjustment.
 - a. The finish shall be #26 white. The finish shall be an anodic acrylic paint, baked at 315°F for 30 minutes. The pencil hardness must be HB to H. The paint must pass a 100-hour ASTM B117 Corrosive Environments Salt Spray Test without creepage, blistering or deterioration of film. The paint must pass a 250-hour ASTM D870 Water Immersion Test. The paint must also pass the ASTM D2794 Reverse Impact Cracking Test with a 50-inch pound force applied.
 - b. Opposed blade volume damper shall not be provided.
 - c. The manufacturer shall provide published performance data for the perforated diffuser. The diffuser shall be tested in accordance with ANSI/ASHRAE Standard 70-1991.

5. Type E: Perforated ceiling diffusers shall be Titus Model PAR-AA (aluminum, flush face) or approved equal for exhaust. Diffusers shall have a perforated face with 3/16-inch diameter holes on 1/4-inch staggered centers and no less than 51 percent free area. Perforated face shall be aluminum. The backpan shall be one piece stamped heavy gauge steel of the sizes and mounting types shown on the plans and outlet schedule. The diffuser neck shall have 1 1/8-inch depth for easy duct connection. Diffusers must discharge a uniform horizontal blanket of air into the room and protect ceiling against smudging. Pattern controllers in the supply models shall be mounted on the back of the perforated face and must be field adjustable to allow the discharged air to enter the room in either vertical or one-, two-, three- or four-way horizontal jets. The perforated face must be easily unlatchable from the backpan to facilitate option of the face for pattern controller adjustment.
 - a. The finish shall be #26 white. The finish shall be an anodic acrylic paint, baked at 315°F for 30 minutes. The pencil hardness must be HB to H. The paint must pass a 100-hour ASTM B117 Corrosive Environments Salt Spray Test without creepage, blistering or deterioration of film. The paint must pass a 250-hour ASTM D870 Water Immersion Test. The paint must also pass the ASTM D2794 Reverse Impact Cracking Test with a 50-inch pound force applied.
 - b. Opposed blade volume damper shall not be provided.
 - c. The manufacturer shall provide published performance data for the perforated diffuser. The diffuser shall be tested in accordance with ANSI/ASHRAE Standard 70-1991.

6. Type F: Aluminum return/exhaust grilles shall be Titus Model 350FL (3/4-inch blade spacing) of the sizes and mounting types shown on the plans and outlet schedule. The fixed deflection blades shall be available parallel to the long dimension of the grille. Construction shall be of extruded aluminum with a 1/4-inch wide border on all sides. Minimum border thickness shall be 0.040-0.050 inch. Sizes 24 x 24 inches and smaller shall be constructed using a roll-formed frame. Corners shall be welded with full penetration resistance welds. Sizes larger than 24 x 24 inches shall be constructed by using heavy aluminum extrusions and shall be interlocked at the four corners and mechanically staked to form a rigid frame. Screw holes shall be counter-sunk for a neat appearance. Deflection blades shall be contoured to a specifically designed and tested cross-section to meet published test performance data. Blades shall be firmly held in place by mullions from behind the grille and fixed in place by crimping or welding. Blade deflection angle shall be available at 35°.
 - a. Optional opposed blade volume damper shall not be provided.
 - b. The grille finish shall be #26 white. The finish shall be an anodic acrylic paint, baked at 315° F for 30 minutes. The pencil hardness must be HB to H. The paint must pass a 100-hour ASTM B117 Corrosive Environments Salt Spray Test without creepage, blistering or deterioration of film. The paint must pass a 250-hour ASTM D870 Water Immersion Test. The paint must also pass the ASTM D2794 Reverse Impact Cracking Test with a 50-inch pound force applied.
 - c. The manufacturer shall provide published performance data for the grille. The grille shall be tested in accordance with ANSI/ASHRAE Standard 70-1991.

7. Type G: Modulinear diffusers shall be Titus model ML-TZ (supply) TechZone Series linear slot diffusers with 3/4- inch slot spacing of the sizes and mounting types shown on the plans and air device schedule, for installation in Armstrong TechZone ceiling system.

Linear slot diffusers shall be available in standard one piece lengths up to 6 feet and 1 to 8 discharge slots. Diffuser lengths greater than 6 feet shall be furnished in multiple sections and will be joined together end-to-end with alignment pins to form a continuous slot appearance. All alignment components to be provided by the manufacturer. The return models shall be constructed the same as supply diffusers without the pattern controllers. The frame and support bars shall be constructed of heavy gauge extruded aluminum. The pattern controller shall be an aerodynamically curved “ice-tong” shaped steel deflector capable of 180° pattern adjustment from the face of the diffuser and shall allow dampering if required. Maximum pattern controller length shall be 3 feet, for diffusers longer than 3 feet pattern controllers shall be furnished in multiple sections.

- a. The finish shall be #26 white on the face and #84 black on the pattern controllers. The finish shall be an anodic acrylic paint, baked at 315°F for 30 minutes. The pencil hardness must be HB to H. The paint must pass a 100-hour ASTM B117 Corrosive Environments Salt Spray Test without creepage, blistering or deterioration of film. The paint must pass a 250-hour ASTM D870 Water Immersion Test.
 - b. The paint must also pass the ASTM D2794 Reverse Impact Cracking Test with a 50-inch pound force applied. Heavy gauge extruded aluminum end borders, end caps and mitered corners shall be available to close off the ends of the diffusers. Plenums shall be manufactured by the same manufacturer of the linear slot diffusers. Optional diffuser curving to a 6-foot minimum radius with fixed deflection shall be available as required.
 - c. The manufacturer shall provide published performance data for the linear slot diffuser. The diffuser shall be tested in accordance with ANSI/ASHRAE Standard 70-2006.
8. Type H: Steel supply grilles shall be Titus Model 300R (double deflection) of the sizes and mounting types shown on the plans and outlet schedule. The deflection blades shall be available parallel to the short dimension of the grille. Construction shall be of steel with a 1¼-inch wide border on all sides. Screw holes shall be countersunk for a neat appearance. Corners shall be welded with full penetration resistance welds. Deflection blades shall be contoured to a specifically designed and tested cross-section to meet published test performance data. Blades shall be spaced on ¾-inch centers. Blades shall have steel friction pivots on both ends to allow individual blade adjustment without loosening or rattling. Plastic blade pivots are not acceptable.
- a. Optional opposed-blade volume damper shall not be provided.
 - b. The grille finish shall be #26 white. The finish shall be an anodic acrylic paint, baked at 315°F for 30 minutes. The pencil hardness must be HB to H. The paint must pass a 100-hour ASTM B117 Corrosive Environments Salt Spray Test without creepage, blistering or deterioration of film. The paint must pass a 250-hour ASTM D870 Water Immersion Test. The paint must also pass the ASTM D2794 Reverse Impact Cracking Test with a 50-inch pound force applied.
 - c. The manufacturer shall provide published performance data for the grille. The grille shall be tested in accordance with ANSI/ASHRAE Standard 70-1991.
9. Type J: Aluminum linear and modular slot air diffusers shall be Titus Model FL-10-JT of the sizes and mounting types shown on the plans and outlet schedule. Provide all materials and equipment required for a complete installation of all linear and modular slot air distribution systems as shown on the architectural and mechanical drawings and/or

indicated in the architectural or mechanical specifications. The slot diffusers shall integrate into the ceiling or wall system. The systems shall be complete in every respect and shall include all required appurtenances. Mechanical contractor shall furnish and install all plenums, hoods, blank-offs and associated sheet metal components including all duct connections thereto.

- a. The linear slot diffusers shall have a single slot unless shown otherwise and shall be capable of being used for supply air, return air, exhaust air or any combination thereof.
- b. Linear diffusers supported by screws in the flanges or from air plenums are unacceptable. For lay-in ceiling, provide hanger wire support clips that are integral with the linear slot diffusers allowing the linear slot diffusers to be supported from the building structure with ceiling wire. For hard ceilings or walls, provide clips that are integral with the linear slot diffusers allowing the diffusers to be secured directly to the ceiling/wall framing without the requirement for hanger supports. Provide spline clips to secure joints and ceiling tees to the diffusers.
- c. Provide ends and corners as required. Ends shall be butt type, field installed, or mitered picture frame type factory installed, as indicated herein or shown on the drawings. Corners shall be mitered one piece unit.
- d. Pattern controllers shall be one piece extruded aluminum, 24 inches long maximum, positioned between spring loaded spacers. Pattern controllers shall allow the airstream to be directed flat against the ceiling in either direction or downward as well as allowing throw reduction every two feet along the entire length of the linear slot diffusers. The airstream shall be maintained at the ceiling plane and shall not dump when volume is reduced. Only extruded aluminum pattern controllers are acceptable. Where shown or noted pattern controllers shall be designed to allow the airstream to be jetted into the occupied space and be adjustable to vector the airstream as required.
- e. Material shall be minimum wall thickness 0.062 inches extruded aluminum. Spring steel retainers shall be used under the spacers to hold the slot diffusers assembly tightly together and allow the slot diffusers to be disassembled easily for field trimming. Materials other than extruded aluminum and spring steel will not be accepted.
- f. Flanges exposed to view shall be painted factory standard white. All other surfaces shall be painted flat black.
- g. All slot diffusers shall be manufactured by the same manufacturer of the plenums and hoods. No exceptions will be allowed. Plenum lengths and entry collar sizes shall be as indicated on the plan schedules.
- h. Plenums shall be minimum 24-gauge galvanized steel and externally insulated with fiberglass insulation. Hoods shall be 51 percent free area and constructed of 24-gauge perforated sheet metal painted flat black.
- i. Optional opposed-blade volume damper shall not be provided.
- j. All slot diffusers shall be performance tested with air plenums as a composite assembly in full accordance with ASHRAE, and/or ARI standards.
- k. Diffusers shall be selected to achieve a throw to room length ratio which meets the requirements of the ASHRAE 2001 Fundamentals Handbook, Chapter 32, Table 4, at both maximum design flow rate, and for VAV systems, at the minimum flow rate expected during partial occupancy. Diffusers shall be selected to achieve a minimum of 70 percent ADPI over the range of expected loads in the space. The diffusers' reported performance shall be based on tests conducted in accordance with ASHRAE Standard 70-91. ADPI performance on at least one unit size of the

selected diffuser shall have been tested in accordance with ASHRAE Standard 113–90, to validate conformance and applicability to the ASHRAE table.

10. Type K: Aluminum linear and modular slot air diffusers shall be Titus Model FL-30-JT of the sizes and mounting types shown on the plans and outlet schedule. Provide all materials and equipment required for a complete installation of all linear and modular slot air distribution systems as shown on the architectural and mechanical drawings and/or indicated in the architectural or mechanical specifications. The slot diffusers shall integrate into the ceiling or wall system. The systems shall be complete in every respect and shall include all required appurtenances. Mechanical contractor shall furnish and install all plenums, hoods, blank-offs and associated sheet metal components including all duct connections thereto
 - a. The linear slot diffusers shall have a single slot unless shown otherwise and shall be capable of being used for supply air, return air, exhaust air or any combination thereof.
 - b. Linear diffusers supported by screws in the flanges or from air plenums are unacceptable. For lay-in ceiling, provide hanger wire support clips that are integral with the linear slot diffusers allowing the linear slot diffusers to be supported from the building structure with ceiling wire. For hard ceilings or walls, provide clips that are integral with the linear slot diffusers allowing the diffusers to be secured directly to the ceiling/wall framing without the requirement for hanger supports. Provide spline clips to secure joints and ceiling tees to the diffusers.
 - c. Provide ends and corners as required. Ends shall be butt type, field installed, or mitered picture frame type factory installed, as indicated herein or shown on the drawings. Corners shall be mitered one piece unit.
 - d. Pattern controllers shall be one piece extruded aluminum, 24 inches long maximum, positioned between spring loaded spacers. Pattern controllers shall allow the airstream to be directed flat against the ceiling in either direction or downward as well as allowing throw reduction every two feet along the entire length of the linear slot diffusers. The airstream shall be maintained at the ceiling plane and shall not dump when volume is reduced. Only extruded aluminum pattern controllers are acceptable. Where shown or noted pattern controllers shall be designed to allow the airstream to be jetted into the occupied space and be adjustable to vector the airstream as required.
 - e. Material shall be minimum wall thickness 0.062 inches extruded aluminum. Spring steel retainers shall be used under the spacers to hold the slot diffusers assembly tightly together and allow the slot diffusers to be disassembled easily for field trimming. Materials other than extruded aluminum and spring steel will not be accepted.
 - f. Flanges exposed to view shall be painted factory standard white. All other surfaces shall be painted flat black.
 - g. All slot diffusers shall be manufactured by the same manufacturer of the plenums and hoods. No exceptions will be allowed. Plenum lengths and entry collar sizes shall be as indicated on the plan schedules.
 - h. Plenums shall be minimum 24-gauge galvanized steel and externally insulated with fiberglass insulation. Hoods shall be 51 percent free area and constructed of 24-gauge perforated sheet metal painted flat black.
 - i. Optional opposed-blade volume damper shall not be provided.
 - j. All slot diffusers shall be performance tested with air plenums as a composite assembly in full accordance with ASHRAE, and/or ARI standards.

- k. Diffusers shall be selected to achieve a throw to room length ratio which meets the requirements of the ASHRAE 2001 Fundamentals Handbook, Chapter 32, Table 4, at both maximum design flow rate, and for VAV systems, at the minimum flow rate expected during partial occupancy. Diffusers shall be selected to achieve a minimum of 70 percent ADPI over the range of expected loads in the space. The diffusers' reported performance shall be based on tests conducted in accordance with ASHRAE Standard 70-91. ADPI performance on at least one unit size of the selected diffuser shall have been tested in accordance with ASHRAE Standard 113-90, to validate conformance and applicability to the ASHRAE table.
11. Paint the ductwork behind registers with flat black enamel so that bright surface cannot be seen. Properly prime galvanized surface prior to painting.
 12. The position of the pattern controllers for linear supply diffusers shall be verified and optimally adjusted by the contractor during Division 23, Section "Testing and Balancing".
 13. Provide integral EXTERNALLY insulated plenums for all linear slot supply diffusers. Plenums shall not be internally lined.

2.2 DUCTWORK

A. General:

1. The Duct Manual as herein referenced shall mean the "HVAC Duct Construction Standards – Metal & Flexible", 3rd Edition, 2005 as published by the Sheet Metal and Air Conditioning Contractors National Association, Inc.
2. Unless noted otherwise, ductwork shall be constructed of prime, first quality galvanized steel of gauges as called for in the Duct Manual. Reinforce all ducts to prevent buckling, breathing, vibrations, or unnecessary noise. Such reinforcing shall be as recommended in Duct Manual, plus any additional reinforcing as required to meet job conditions. Longitudinal and cross joints, elbows, transitions, etc., shall be furnished as specified in Duct Manual, including recommended duct supports to suit job conditions.
3. All uninsulated rectangular ductwork shall be crossbroken on all four (4) sides of each panel section. All vertical and horizontal sheet metal barriers, duct offsets and elbows, as well as the panels of straight sections of ducts, shall be crossbroken. Crossbreaking shall be applied between the standing seams or reinforcing angles. The center of the crossbreak shall be of the required height to assure each panel section being rigid, to prevent vibrations and "breathing".
4. Ductwork and ductwork fittings for acid fume hood exhaust system shall be acid resistant fiberglass reinforced plastic ductwork.
5. Ductwork and ductwork fittings for fume hood, radio isotope, BL-3, glasswash, and tunnel/cagewash exhaust systems shall be fully welded type 304 stainless steel of gauges as called for in the Duct Manual.
6. Ductwork from kitchen exhaust hood to perimeter of kitchen shall be constructed of minimum 18 gauge stainless steel or 16 gauge black iron all welded construction with fully welded joints, and installed in accordance with the South Carolina State Health Department and the State Fire Marshals requirements. Kitchen hood exhaust ductwork from perimeter of kitchen to the exhaust fan shall be preengineered UL listed kitchen hood exhaust ductwork system with integral two (2) hour fire rating as specified herein. Provide access doors and fire rating around ductwork as required by code.
7. Dryer exhaust ductwork for clothes dryers shall terminate on the outside of the building

with a hooded wall vent with integral backdraft damper. Screens shall not be installed at the duct termination. Ducts shall not be connected or installed with sheet metal screws or other fasteners that will obstruct flow. Dryer exhaust shall be provided in accordance with the dryer manufacturers written instructions.

8. Supply air ductwork from air handling units to the air terminal units shall be "medium pressure" ductwork. Supply ductwork from air terminal units to air devices shall be "low pressure" ductwork.
9. Laboratory exhaust air ductwork shall be "medium pressure" ductwork.
10. Outdoor air, ventilation air, return air, relief air and non-laboratory exhaust air ductwork shall be low pressure ductwork.
11. Exposed circular low pressure supply ductwork shall be provided with grip finish and painted. Refer to Division 9 specifications. Color shall be by Architect.
12. Duct cleaning and acceptable level of contaminants allowed in the HVAC system, otherwise known as the Duct Cleanliness Level, shall be equal to Level C - Advanced in accordance with SMACNA Duct Cleanliness for New Construction, 2000 Edition.

B. Low Pressure Ductwork (0" to 2" Water Gauge):

1. Ductwork shall conform to requirements and details, unless specified or indicated otherwise in the SMACNA "HVAC Duct Construction Standards – Metal & Flexible", 3rd Edition, 2005. A copy of the duct manual shall be secured by the Contractor and shall be kept at the project for convenient reference.
2. Concealed circular low pressure supply and exhaust ductwork shall be United McGill low pressure spiral ductwork and fittings, equal to United Uni-seal spiral lockseam duct.
3. Exposed circular low pressure supply ductwork shall be acoustically insulated double-wall spiral ductwork and fittings. Double wall duct shall be constructed of a paintable outer shell, a 1" thick layer of fiberglass insulation and an inner metal liner. Insulation shall have a thermal conductivity "K" factor of .27 BTU/hr/sq. ft./°F or less. Double-wall spiral ductwork shall be United ACOUSTI-k27 spiral lockseam duct, Semco Industries SL95P, Lindab Safe, United Sheet Metal spiral pipe, or approved equal.
4. Flexible duct connections where indicated shall be "Ventglass" duct fabric as manufactured by Ventfabrics, Inc.
5. Low pressure ductwork shall conform to the requirements and details contained in the Duct Manual and shall be constructed to the requirements for two (2) inches water gauge. Construction shall conform to the following:
 - a. Material gauges (galvanized steel) & general construction - Tables 1-5, 1-10 thru 1-13 Seal Class B
 - b. Longitudinal seams - Fig. #1-5, Types L-1, L-3 & L-4
 - c. Corner Closures - Fig. #1-13 & # 1-14
 - d. Hangers - Fig. #4-1 & 4-4 & Tables 4-1 & 4-2
 - e. Radius Elbows - Fig. #2-2, Type RE-1 and RE-3
 - f. Vaned Elbows (Applied to Square elbows) - Fig. #2-2 Type Re-2 & Figs. #2-3 & #2-4, double thickness vanes only
 - g. Transitions & Offsets - Fig #2-9

- h. Branch connections - Fig. #2-8, 45° only
 - i. Volume dampers, up to 12" deep - Fig. #2-14, Figs. A&B w/Ventlok #555 quadrant
 - j. Volume dampers, over 12" deep - Fig. #2-15, Fig. A w/Ventlok #555 quadrant
 - k. Access doors - Cesco #HADF-10 hinged one (1) side w/Ventlok #100 latch, insulated, one (1) inch thick
6. Duct sizes indicated on the drawings are air side sizes. Where duct lining is indicated, increase sheet metal sizes accordingly to compensate for thickness of lining.
 7. Seal all transverse joints in all low pressure supply ductwork with mineral impregnated woven fiber tape as manufactured by Hardcast, Inc.
 8. Provide stand-offs on volume dampers installed in all insulated ductwork.
 9. Flexible ductwork for connection to air devices shall be Casco Silent Flex II or FlexMaster Type 6B. Flexible duct shall have a minimum R-6 insulation, comply with NFPA Standard 90A and shall be U.L. listed as Class 1 Air Duct & Connector, Standard 181.
 10. Volume dampers located above gypsum board or other non-accessible ceilings shall be the remote operator type. Dampers shall use bowden cable controls with the adjuster located inside the diffuser being controlled.

2.3 DUCT LINING

- A. Armacell AP Coilflex conformable duct liner
- B. Duct lining shall be provided where indicated and as herein specified. Duct lining shall be Solcoustic flexible polyimide foam coated duct liner, thickness at 1-inch unless otherwise indicated. Adhere liner, with coated side toward air stream, to all interior sides of duct with 100 percent coverage of manufacture approved fire-resistant insulation binding adhesive meeting ASTM C 916. Adhesive shall completely cover the sheet metal at each end of each section of ductwork. Where duct width exceeds twelve (12) inches, or height exceeds sixteen (16) inches further secure the liner to these surfaces with welded pin type mechanical fasteners as shown in the SMACNA duct manual. Pin length should be such as to limit compression of liner to 1/8 inch. Additionally, point all joints in liner and butter the edges of the liner where sections of ductwork will be jointed with adhesive meeting ASTM C 916. Provide leading edge protection as indicated in Duct Manual. Take every precaution to protect surface of liner as damaged liner will be rejected.
- C. Duct lining shall have air surface coated with acrylic coating formulated with immobilized EPA registered anti-microbial agent and been tested to Industry Standards, UL 181 mold growth and humidity test, ASTM C1071 fungi resistance test, and ASTM G21 and G22 and have proven not to support microbial growth. When tested at two and one-half times (12,500 feet per minute) the maximum recommended service velocity, the duct liner shall meet the erosion requirements of UL 181. Approval labels shall be supplied with all liner material. All raw edges and tears shall be repaired in an EPA registered anti-microbial coating such as Johns-

Manville Superseal or approved equal.

- D. Linacoustic RC duct liner shall have temperature limit up to 250 degrees Fahrenheit and have fire hazard classification 25/50 per ASTM E84 and UL 723. Thermal conductance of insulation material shall be 0.24 BTU/HR Sq. Ft. Degrees Fahrenheit at seventy-five (75) degrees Fahrenheit mean temperature and one (1) inch thickness. Acoustical performance shall be tested in accordance with ASTM C423-90a and ASTM E795-83 and meet or exceed the following sound absorption coefficients:

Thickness (Inches)	Frequency (Hz)						NRC
	125	250	500	1000	2000	4000	
0.50	0.07	0.20	0.44	0.66	0.84	0.93	0.55
1.00	0.08	0.31	0.64	0.84	0.97	1.03	0.70

- E. Solcoustic duct liner shall have temperature limit up to 250 degrees Fahrenheit and have fire hazard classification 25/50 per ASTM E84 and UL 723. Thermal conductance of insulation material shall be 0.30 BTU/HR Sq. Ft. Degrees Fahrenheit at seventy-five (75) degrees Fahrenheit mean temperature and one (1) inch thickness. Acoustical performance shall be tested in accordance with ASTM C423-90a and ASTM E795-83 and meet or exceed the following sound absorption coefficients:

Thickness (Inches)	Frequency (Hz)						NRC
	125	250	500	1000	2000	4000	
1.00	0.11	0.30	0.73	1.02	0.73	0.66	0.70

2.4 FANS

A. General:

1. Provide fans having a certified rating based on tests performed in accordance with AMCA Bulletins Number 210, 211A and 300. See AMCA Standard 99 "Standard Handbook" for definitions of fan terminology. Arrangement, size and capacity of fans are scheduled on the drawings.
2. All fans shall be statically and dynamically balanced by the manufacturer and shall be provided with field mounted vibration isolation units as hereinbefore specified.
3. Diffuser cones and inlet bells are not permitted in rating a fan unless they are an integral part of the fan design.
4. Provide inlets and outlets of fans not duct connected, including fans in plenum chamber or open to the weather, with heavy guard screens to protect personnel. Construct guard screens in a manner that will not impair fan performance, and when bolted to equipment will permit their removal for fan service and cleaning.
5. Provide lubrication facilities, such as oil reservoirs, sight glasses, grease and relief fittings, fill and drain plugs, pipe connections, etc. Place in a readily and safely accessible location so that after installation they will perform required function without requiring the dismantling of any parts or stopping equipment.
6. All parts of fans shall be protected against corrosion prior to operation of the fan.
7. Certified performance data including acoustical data shall be submitted for each fan at

design conditions. Data shall include published sound power levels based on actual test on the fan sizes being furnished, and conducted in accordance with current AMCA standards. Such data is to define Sound Power Levels (PWL), re: 10-12 watts for each of the eight (8) frequency bands. Sound Power Levels shall not exceed those scheduled. Should additional attenuation be required to achieve the levels specified, it shall be included by the fan manufacturer. Any cost of field modifications necessitated by additional attenuation shall also be included by the fan manufacturer. Fan curves shall be submitted which will depict static pressure, total pressure, brake horsepower, and mechanical efficiency plotted against air volume. Data submitted in tabular form is not acceptable.

8. Motors, drives, curbs, and bases shall be furnished by the fan manufacturer in accordance with the requirements of Division 23, Sections "Mechanical and Electrical General Provisions" and "Motors". Motors and drives exposed to the weather shall be suitably protected as specified herein.

B. Type "A" Fan:

1. Fan shall be Twin City, Trane, Greenheck, Buffalo, or Loren Cook, equal to Twin City EPQN quiet efficient plenum, direct drive, centrifugal fan. Each fan shall be direct drive in AMCA arrangement 4.
2. Fans shall have a sharply rising pressure characteristic extending through the operating range and continuing to rise beyond the peak efficiency to ensure quiet and stable operation. Fans shall have a non-overloading design with self-limiting horsepower characteristics and shall reach a peak in the normal selection area. All fans shall be capable of operating over the minimum pressure class limits as specified in AMCA's Standard 2408-69.
3. Fans shall be designed without a scroll type housing and shall incorporate a non-overloading type backward inclined airfoil blade wheel, heavy-gauge reinforced steel inlet plate, structural steel frame, and shaft and bearings.
4. Inlet panels shall be of heavy-gauge reinforced steel construction. The inlet panel incorporates a removable spun inlet cone designed for smooth airflow into the accompanying inlet retaining ring of the fan wheel. A square, formed lip suitable for attachment of a boot connector shall surround the unit.
5. Wheels shall have a spun non-tapered style blade retaining ring on the inlet side to allow higher efficiencies over the performance range of the fan. All wheels on direct drive arrangement 4 fans shall have airfoil-shaped extruded aluminum blades. All hollow blade wheels shall be continuously welded around all edges. Wheels shall have twelve blades for better sound quality. All wheels shall be statically and dynamically balanced on precision electronic balancers to a Balance Quality Grade G6.3 per ANSI/AMCA 204 or better.
6. Shafts shall be AISI 1040 or 1045 hot rolled steel, accurately turned, ground, polished, and ring gauged for verification. Shafts shall be sized for the first critical speed of at least 1.43 times the maximum speed.
7. All shafts must be dial indicated for straightness after the keyways are cut and straightened as required. Structural steel bases to be designed and manufactured by the fan supplier to ensure proper alignment of the fan and motor and structural integrity of the base to prevent vibration
8. Bearings shall be heavy duty, grease lubricated, spherical roller or adapter mounted antifriction ball, self-aligning, pillow block type and selected for a minimum bearing life (AFBMA L-10) in excess of 80,000 hours at the maximum fan RPM. All bearings shall be equipped with greasable zerk fittings and, where necessary, extended lube lines for

- easy access for lubrication.
9. The entire fan assembly, excluding the shaft, shall be thoroughly degreased and deburred before application of a rust-preventative primer. After the fan is completely assembled, a finish coat of paint shall be applied to the entire assembly. The fan shaft shall be coated with a petroleum-based rust protectant. Aluminum components shall be unpainted.
 10. All fans prior to shipment shall be completely assembled and test run as a unit at the specified operating speed or maximum RPM allowed for the particular construction type. Maximum vibration shall be within the limits of ANSI/AMCA 204 Fan Application Category BV-3. Balance readings shall be taken by electronic type equipment in the axial, vertical, and horizontal directions on each of the bearings. Records shall be maintained and a written copy shall be available upon request.
 11. The manufacturer shall guarantee the workmanship and materials for at least one (1) year from startup or eighteen (18) months from shipment, whichever occurs first.

C. Type "B" Fan:

1. Fan shall be Trane, Twin City, Greenheck or Loren Cook equal to Twin City Model BAF-DW belt drive air foil centrifugal fan with double width, double inlet.
2. The fan shall be designed with centrifugal backward inclined air foil blade wheel and steel scroll. Housings are to be of heavy gauge, continuously welded construction. In Class I and II construction sizes twelve (12) inches thru twenty-seven (27) inches shall have twelve (12) gauge sides and fourteen (14) gauge scrolls, while sizes thirty (30) inches thru sixty-six (66) inches shall have ten (10) gauge sides and twelve (12) gauge scrolls. All fan housings are equipped with flanged discharge, and removable spun inlet cones designed for smooth airflow into the accompanying venturi shaped inlet cone for the fan wheel. Sizes twelve (12) inches thru thirty-three (33) inches shall be of the rotatable design, convertible to eight (8) standard discharge configurations. Housings with lock seams are not acceptable. Provide inlet collars of heavy gauge, round or rectangular design.
3. All fan wheels shall have spun inlet cones providing a minimum separation in airflow. Blades shall be plate type or die formed airfoil shaped. Sizes eighteen (18) inches and larger shall have nine (9) airfoil blades. Where plate type blades are used, sizes twenty-seven (27) inches and larger shall have twelve (12) blades, while 24-1/2 inches and smaller shall have ten (10) blades. All blades shall be welded to the inlet cones as well as the backplate. No partial welding will be acceptable on airfoil blades. Class III and IV blades shall be made of high strength alloy steel having a minimum yield strength of 50,000 pounds per square inch. Class III and IV wheels shall have steel hubs in place of cast iron. All wheels shall be "true" lined, statically and dynamically balanced on precision electronic balancers. Each wheel shall be designed for critical speeds of at least 1.25 times the maximum class speed.
4. All fan sizes are to have shafts of solid AISI 1040, or 1045 hot rolled steel accurately turned, ground, polished, and ring gauged for accuracy. Close tolerances are to be maintained where the shaft makes contact with the bearings. All shafts must be dial indicated for straightness after the keyways are cut. Shaft diameters shall have first critical speed at least 1.35 times the maximum class speed of the fan.
5. All fans are to have heavy duty, grease lubricated, precision anti-friction ball or roller, self-aligning, pillow block type bearings. Bearings are to be selected for minimum average bearing life (AFBMA L-50) in excess of 200,000 hours when operating at maximum cataloged class conditions. All bearings shall be equipped with re-greaseable zerk fittings and where necessary, extended lube lines for easy access for re-lubrication. All Class III fans and Class II fans with bearings larger than 2-2/16 inch shall have

- double row spherical split-housed roller bearings, Dodge SAF-XT.
6. All fans shall be furnished with scroll access door (raised for insulation where required), drain fittings and belt guards per OSHA Requirements. Guards shall have tachometer openings at fan and motor shafts.
 7. Each fan component shall be thoroughly degreased and deburred before the application of a rust-preventative primer. After complete assembly, a second coat of primer shall be applied to the complete assembly. Fans for laboratory and chemical exhaust shall have heresite-plastic 3055 baked phenolic, five (5) to seven (7) mil thick coating on all internal surfaces and corrosion resistant enamel coating on all exterior surfaces.
 8. All fan ratings shall be based on tests made in accordance with the ASHRAE Standard 51/AMCA Standard 210-74 and shall be licensed to bear the AMCA Seal. All fans shall be capable of operating over the minimum pressure class limits, as specified in AMCA's Standard 2048-69. Each fan shall be run fully assembled at the factory, prior to shipment, at the operating rotations per minute or maximum class rotations per minute. All wheels shall be statically and dynamically balanced on precision electronic balancers to a Balance Quality Grade G6.3 per ANSI/AMCA 204 or better.

D. Type "C" Fan:

1. Fan shall be Loren Cook, Greenheck or Twin City equal to Loren Cook Model ACRU-D direct drive roof mounted, upblast centrifugal exhaust fan.
2. Fan shall be of bolted and welded construction utilizing corrosion resistant fasteners. The spun aluminum structural components shall be constructed of minimum 16 gauge marine alloy aluminum, bolted to a rigid aluminum support structure. The aluminum base shall have a one piece inlet spinning and continuously welded curb cap corners for maximum leak protection. The windband shall have a rolled bead for added strength. An integral conduit chase shall be provided into the motor compartment to facilitate wiring connections. The motor shall be enclosed in a weather-tight compartment, separated from the exhaust airstream. Unit shall bear an engraved aluminum nameplate. Nameplate shall indicate design CFM and static pressure. Unit shall be shipped in ISTA certified transit tested packaging.
3. Wheel shall be centrifugal backward inclined, constructed of 100% aluminum, including a precision machined cast aluminum hub. An aerodynamic aluminum inlet cone shall be provided for maximum performance and efficiency. Wheel shall be balanced in accordance with AMCA Standard 204-96, Balance Quality and Vibration Levels for Fans.
4. Motor shall be heavy duty type with permanently lubricated sealed bearings and furnished at the specified voltage, phase and enclosure.
5. Fan shall be manufactured at an ISO 9001 certified facility. Fan shall be listed by Underwriters Laboratories (UL 705) and UL listed for Canada (cUL 705). Fan shall bear the AMCA certified ratings seal for sound and air performance.
6. Fan shall be provided with a factory fabricated insulated roof curb engineered to support the equipment and a wire mesh bird screen.

E. Type "D" Fan:

1. Fan shall be Loren Cook, Greenheck or Twin City equal to Loren Cook Model SQN-D duct mounted, direct driven centrifugal square inline exhaust fan.
2. The fan shall be of bolted construction utilizing corrosion resistant fasteners. Housing shall be minimum 18 gauge galvanized steel with integral duct collars. Bolted access doors shall be provided on three sides, sealed with closed cell neoprene gasketing.

Housing shall be pre-drilled to accommodate universal mounting feet for vertical or horizontal installation. Unit shall bear an engraved aluminum nameplate. Nameplate shall indicate design CFM and static pressure. Unit shall be shipped in ISTA certified transit tested packaging.

3. Wheel shall be centrifugal backward inclined, constructed of 100% aluminum, including a precision machined cast aluminum hub. Wheel inlet shall overlap an aerodynamic aluminum inlet cone to provide maximum performance and efficiency. Wheel shall be balanced in accordance with AMCA standard 204-96, balance quality and vibration levels for fans.
4. Motor shall be heavy duty type with permanently lubricated sealed bearings and furnished at the specified voltage, phase and enclosure.
5. Fan shall be manufactured at an ISO 9001 certified facility. Fan shall be listed by Underwriters Laboratories (UL 705) and UL listed for Canada (cUL 705). Fan shall bear the AMCA certified ratings seal for sound and air performance.

F. Type "E" Fan:

1. Fan shall be Loren Cook, Greenheck or Twin City equal to Loren Cook Model GC ceiling mounted, direct driven, centrifugal exhaust fan.
2. Fan shall be manufactured at an ISO 9001 certified facility. Fan shall be listed by Underwriters Laboratories (UL 705) and UL listed for Canada (cUL 705). Fan shall bear the AMCA Certified Ratings Seal for Sound and Air Performance. Construction: The fan wheel housing and integral outlet duct shall be injection molded from a specially engineered resin exceeding UL requirements for smoke and heat generation. The outlet duct shall have provision for an aluminum backdraft damper with continuous aluminum hinge rod. The inlet box shall be minimum 22 gauge galvanized steel. Motor shall be isolation mounted to a one piece galvanized stamped steel integral motor mount/inlet. A field wiring compartment with disconnect receptacle shall be standard. To accommodate different ceiling thickness, an adjustable prepunched mounting bracket shall be provided. A white, non-yellowing, high impact styrene injection molded grill shall be provided as standard. Unit shall be designed with provision for field conversion from ceiling to in-line. Unit shall be shipped in ISTA Certified Transit Tested Packaging.
3. Wheel shall be centrifugal forward curved type, injection molded of polypropylene resin. Wheel shall be balanced in accordance with AMCA Standard 204-96, Balance Quality and Vibration Levels for Fans.
4. Motor shall be open drip proof type with permanently lubricated bearings and include impedance or thermal overload protection and disconnect plug. Motor shall be furnished at the specified voltage.

G. Type "F" Fan:

1. Fan shall be Loren Cook, Greenheck or Twin City equal to Greenheck Model Vektor H, Fume Hood Exhaust.
2. Base fan performance at standard conditions (density 0.075 Lb./ft³). Fans selected shall be capable of accommodating static pressure and flow variations of +/-15% of scheduled values. Each fan shall be belt driven. Each fan to be equipped with 316 stainless steel lifting lugs for corrosion resistance. Fasteners exposed to corrosive exhaust shall be stainless steel. Fan assembly shall be designed for a minimum of 125 MPH wind loading, without the use of guy wires.
3. All fan and system components (fan, nozzle, windband and plenum) shall be corrosion resistant coated with a two part electrostatically applied and baked, sustainable, corrosion

resistant coating system. Standard finish color to be gray. All parts shall be cleaned and chemically prepared for coating using a multi-stage wash system which includes acid pickling that removes oxide, increases surface area, and improves coating bond to the substrate. The first powder coat applied over the prepared surface shall be a zinc rich epoxy primer (no less than 70% zinc) and heated to a gelatinous consistency (partial cure) at which the second powder coat of polyester resin shall be electrostatically applied and simultaneously be cured at a uniform temperature of 400°F. The coating system, a total thickness of up to 6 mils, is not affected by the UV component of sunlight (does not chalk), and has superior corrosion resistance to acid, alkali, and solvents. Coating system shall exceed 4000 hour ASTM B117 Salt Spray Resistance.

4. Fan housing to be aerodynamically designed with high-efficiency inlet, engineered to reduce incoming air turbulence. Fan housing shall be welded steel and meet specification section 2.15 for corrosion resistant coating. No uncoated metal fan parts shall be acceptable. Fan housings that are fabricated of polypropylene or fiberglass that have lower mechanical properties than steel, have rough interior surfaces in which corrosive, hazardous compounds can collect, and / or which chalk and structurally degrade due to the UV component of the sunlight shall not be acceptable. A high velocity conical discharge nozzle shall be supplied by the fan manufacturer and be designed to efficiently handle an outlet velocity of up to 6000 FPM. Discharge stack caps or hinged covers, impeding exhaust flow shall not be permitted. Provide housing drain for removal of rain and condensation. A bolted and gasketed access door shall be supplied in the fan housing allowing for impeller inspection or removal of impeller, shaft and bearings without removal of the fan housing. Standard finish color to be gray.
5. Fan impeller shall be centrifugal, backward inclined, with non-stall characteristics. The impeller shall be electronically balanced both statically and dynamically per AMCA Standard 204. Fan impeller shall be manufactured of aluminum (AMCA type B spark resistant), fully welded and have a corrosion resistant coating.
6. For constant volume systems, the fan shall be connected directly to the exhaust duct without the need of a bypass air plenum. Fans mounted directly to roof curbs shall be provided with a damper tray located in the roof curb for mounting of the gravity isolation damper. For variable volume systems, a bypass air plenum shall be provided as shown on drawings. The plenum shall be equipped with a bypass air damper and intake air hood with bird screen for introducing outside air at roof level upstream of the fan. The plenum shall be constructed of fully welded steel, have a corrosion resistant coating, and mount on roof curb as shown on the project drawings. Plenums that are fabricated of plastics or resins that are combustible and have mechanical properties less than steel shall not be acceptable. The bypass air plenum shall be mounted on factory fabricated roof curb provided by the fan manufacturer. Fan designs that use inlet flexible connectors that can leak causing loss of lab exhaust shall not be accepted. Bypass air dampers shall be opposed-blade design, and coated with up to 4 mils of Hi-Pro Polyester resin, electrostatically applied and baked. A fan isolation damper, either gravity backdraft or two position actuated, fabricated of steel or aluminum and coated with minimum 4 mils of Hi-Pro Polyester resin, electrostatically applied and baked, shall be provided as shown on the project documents. Blower/Plenum vibration isolation shall be limited to neoprene vibration pads.
7. Exhaust system manufacturer shall supply a structural support curb for the plenum, of specified height, as shown on the drawings. Curb shall be fabricated of a minimum of 14 gauge corrosion resistant coated steel and structurally reinforced. Seismic certification requires a minimum of 12 gauge corrosion resistant coated steel and structurally reinforced roof curb be provided. Curbs shall be insulated. When properly anchored to the roof structure, the standard curb / plenum / blower assembly shall withstand wind

- loads of up to 125 mph without additional structural support.
8. Motors shall be premium efficiency, standard NEMA frame, 1800 or 3600 RPM, TEFC with a 1.15 service factor. A factory-mounted NEMA 3R disconnect switch shall be provided for each fan. Motor maintenance shall be accomplished without fan impeller removal or requiring maintenance personnel to access the contaminated exhaust components. Drive belts and sheaves shall be sized for 200% of the motor horsepower, and shall be readily and easily accessible for service, if required. Drive shall consist of a minimum of two belts under all circumstances. Fan shaft to be turned and polished of 1040 steel material (optional 316 stainless steel) as standard, coated with corrosion resistant coating. Fan shaft bearings shall be Air Handling Quality, ball or roller pillow block type and be sized for an L-10 life of no less than 100,000 hours. Bearings shall be fixed to the fan shaft using concentric mounting locking collars, which reduce vibration, increase service life, and improve serviceability. Bearings that use set screws shall not be allowed. All shaft bearings shall have extended lube lines with zerkl fittings.

PART 3 - EXECUTION

3.1 AIR DEVICES

- A. Install air devices in accordance with the manufacturer's latest published installation instruction to insure against incorrect air pattern, drafts, and dirt smudging.
- B. Construct, and install sheet metal duct or plenum connections to air devices in accordance with terminal manufacturer's recommendations.
- C. Make modifications to the duct systems as required to accommodate actual sizes of air devices furnished, e.g., transformations and collar sizes without additional cost.
- D. Make joints between each devices and its components, connecting duct, or the mounting surface airtight, using gasket or its equivalent.
- E. Align exposed butt edges of linear diffusers using slots and keys strips or with other concealed means.

3.2 FILTERS

- A. Protect filter elements and media against contamination from dirt during construction. Thoroughly clean system prior to placing filters in operation.
- B. After all adjustments and tests are completed and immediately before the filters are accepted for regular operation, restore filter media to "new" condition status.
- C. Install static pressure pitot tips in duct upstream and downstream of the filter and connect to the draft gauge with tubing. Provide suitable cocks in tubing in a manner that will permit calibrating the draft gauge. Carefully level and adjust gauges. Three (3) draft gauges shall be approved for Type "C" filter housing.

3.3 DUCTWORK

- A. Install hangers, supports, and their attachments, generally in conformance with SMACNA standard referred to in this section of the specifications and applicable portions of article "Piping, Conduit and Supports", of Division 23, Section "Mechanical and Electrical General Provisions".
- B. Furnish hangers capable of withstanding five (5) times the weight of the load imposed on them without damage to duct or any adjacent construction.
- C. Neatly erect ducts and plenums of sizes and arrangements shown and detailed and as required to carry out intent of specifications and drawings. Work must meet approval of the Architect in all its parts and details.
- D. Sizes shown are air side sizes. Where ducts are shown as lined, dimensions shall be increased to reflect that thickness of the lining.
- E. Install ductwork in such a manner as to meet the recommendations of NFPA Standard 90A.
- F. Provide each air outlet with a collar adequately stiffened, fastened, and made suitable for securing air device thereto. Make field changes in ductwork, such as those required to accommodate the sizes of factory fabricated equipment actually furnished, i.e., coils, air filters, fans, damper and air terminal units and similar items, without additional cost. Provide duct flanges to match those of connecting factory fabricated equipment. When necessary, relocate and modify ductwork to avoid obstructions such as structural members, piping and conduit, in a manner acceptable to the (Architect/Engineer).
- G. Construct and install all ductwork in accordance with the SMACNA Standards specified. Coordinate the installation of all duct systems with all other trades including plumbing, electrical, sprinkler, ceiling systems, etc.
- H. All open end return air ducts shall be provided with 1/2" galvanized wire mesh screen.
- I. Leak Testing of Ductwork:
 - 1. When deemed necessary by the Architect, test low pressure ductwork for leaks by sealing openings and pressurizing system to that static pressure which the system will operate. Use test methods approved by SMACNA and Architect. Seal all joints. Leakage shall not exceed three (3) percent of air flow specified at the system's nominal static pressure.
 - 2. Medium pressure ductwork shall be pressure tested as hereinbefore defined.
- J. Duct smoke detectors shall be installed where indicated on the electrical drawings. Duct smoke detectors shall be installed upstream of the associated smoke damper and within 6'-0" of the damper in as straight a section of ductwork as possible.

END OF SECTION 233110

SECTION 237433 - DEDICATED OUTDOOR-AIR 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 factory-packaged units capable of supplying up to 100 percent dehumidified and conditioned outdoor air.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product. Include rated capacities, operating characteristics, and furnished specialties and accessories.
- B. Shop Drawings:
 - 1. Include plans, elevations, sections, and attachment details.
 - 2. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
 - 3. Prepare the following by or under the supervision of a qualified professional engineer:
 - a. Mounting Details: For securing and flashing roof curb to roof structure. Indicate coordinating requirements with roof membrane system.
 - b. Include diagrams for power, signal, and control wiring.

1.4 INFORMATIONAL SUBMITTALS

- A. Seismic Qualification Certificates: For dedicated outdoor-air 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.
- B. Startup service reports.
- C. Sample Warranty: For special warranty.

1.5 CLOSEOUT SUBMITTALS

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

1.6 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Fan Belts: Two sets for each belt-driven fan.
 - 2. Filters: Two sets for each unit.

1.7 QUALITY ASSURANCE

- A. The system shall be factory tested prior to shipment. Testing shall include, but shall not be limited to: system and component operational and functional testing; electrical “HiPot” insulation test; refrigerant piping circuit pressuring testing per UL 1995 Safety Standard for Heating and Cooling Equipment.

1.8 WARRANTY

- A. Special Warranty: Manufacturer agrees to replace components (parts and labor) of units that fail in materials or workmanship within specified warranty period.
 - 1. Warranty Period for Compressors: Five years from date of Substantial Completion.
 - 2. Warranty Period for Heat Exchangers: Five years from date of Substantial Completion.

1.9 UNIT DESCRIPTION

- A. Unit(s) furnished and installed shall be packaged units with integral hot gas reheat as scheduled on contract documents and within these specifications. Unit(s) shall consist of insulated weather tight casing with compressor(s), hot gas reheat coil, modulating face and by-pass dampers for hot gas reheat control, air cooled condenser coil, condenser fans, evaporator coil, return air filters, supply motors and drives, and factory mounted DDC microprocessor controls. Field mounted controls and electromechanical controls are not acceptable.
- B. All accessories mentioned above, including the total energy wheel and DDC controls shall be provided as factory mounted and shall be an integral part of the packaged unit. Field assembly is not acceptable. Packaged units shall be manufactured with a single point power connection. Disconnects shall be provided per Division 16 Section “Electrical.”
- C. Cooling performance shall be rated in accordance with ARI testing procedures and must be ARI 210/240 or ARI 340/360 certified. All units must meet ASHRAE 90.1, minimum efficiency requirements. All units shall be factory assembled, internally wired, fully charged with R-22, and 100% run-tested before leaving the factory. Wiring internal to the unit shall be colored and numbered for simplified identification. Units shall be UL listed and labeled in accordance with UL 1995/CAS/CSA No. 236-M90.

- D. The DDC controller must control and modulate Face and By-pass dampers to maintain discharge air temperature and humidity per the schedule.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Basis-of-Design Product: Subject to compliance with requirements, provide Trane Model MORAE or comparable product by one of the following:
 - 1. AAON.
 - 2. Desert Aire
 - 3. DesChamps
 - 4. Annexaire
 - 5. Munters Corporation, Dehumidification Division; Des Champs Products.
- B. Unit Casing
 - 1. Unit casing shall be constructed of zinc coated, heavy gauge, galvanized steel. Exterior surfaces shall be cleaned, phosphatized, and finished with a weather-resistant baked enamel finish with removable access panels. All exposed vertical panels and top covers in the indoor wet section shall be insulated with a cleanable foil faced, fire-retardant permanent, odorless glass fiber insulation. Cabinet surface shall be tested 1000 hours in salt spray test in compliance with ASTM B117.
 - 2. The base of the unit shall be insulated with 1/2 inch, 1 pound density foil-faced, closed-cell material. All insulation edges shall be either captured or sealed. The unit's base pan shall have no penetrations within the perimeter of the curb other than the raised 1 1/8 inch high downflow supply-return openings.
 - 3. Cabinet construction shall incorporate removable panels to access the filter/evaporator, indoor fan/heat exchanger, and the compressor.
 - 4. Factory installed hail guards shall be provided for condenser coil protection.
 - 5. Cabinet top cover shall be one piece construction or where seams exist, it shall be double-hemmed and gasket sealed.
 - 6. Insulation: Provide 1/2 inch thick fiberglass insulation with matt-face on all exterior panels in contact with the return and conditioned air stream. All edges must be captured so that there is no insulation exposed in the air stream.
 - 7. Drain Connections: Threaded nipple both sides of drain pan.
 - 8. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.
- C. Air Filters
 - 1. Two inch pleated media filters shall mount integral within the unit and shall be accessible through access doors.
- D. Evaporator Fan
 - 1. Provide belt driven, FC centrifugal fans with fixed-pitch sheave drive assemblies. Fan

assembly shall have an adjustment idler-arm assembly for quick-adjustment to fan belts and motor sheaves. All motors shall be thermally protected. All indoor fan motors shall meet the U.S. Energy Policy Act of 1992 (EPACT).

2. Fans shall be provided with self-aligning, grease lubricated, ball or sleeve bearings with permanent lubrication fittings.
3. Mount fan motor(s) and fan on a common base assembly and isolated from unit with double deflection rubber-in-shear isolators. Provide thrust restraint isolation on the fan housing/fan board to assure smooth fan startup transition and operation.
4. Dynamically balance all fans and the unit's running fan assembly to assure smooth operation of the fan and it's associated assembly. Balancing of the fan only shall not be acceptable.

E. ELECTRIC HEATERS

1. Electric heater elements shall be constructed of heavy-duty nickel chromium elements internally wired. Electric heater package shall have automatically reset high limit control operating through heating element contactors. All heaters shall be individually fused from the factory, where required, and shall meet all NEC and CEC requirements.
2. Electric heat modules shall be U.L. listed or CSA certified.
3. Silicon controlled rectifiers (SCR's) must be provided to ensure full-modulation of heater.
4. Electric heat shall be controlled by the DDC panel which monitors outdoor air and determines heat stages by calculating the delta T provided by each stage and determines how many should be activated. The activated set point shall co-ordinate with the discharge air temperature sensor to maintain space temperature (fully programmable).

F. EVAPORATOR AND HOT GAS REHEAT SECTION

1. Internally finned, 5/16" copper tubes, mechanically bonded to a configured aluminum plate fin shall be standard. Coils shall be leak tested at the factory to ensure pressure integrity. The evaporator coil shall be leak tested to 200 psig and pressure tested to 450 psig. The evaporator coil shall be located in the draw-thru position.
2. Formed sections of stainless-steel sheet, a minimum of 2 inches deep and complying with ASHRAE 62.1. A removable, reversible, double-sloped condensate drain pan shall be provided.
3. Provide separate, independent hot gas reheat coil located 18 inches downstream of the supply fan. Hot gas reheat coil shall be completely separate and detached from the cooling and located downstream of the supply fan.
4. Fully modulating reheat capacity control shall be provided by face and by-pass dampers to provide discharge air temperature and humidity control.
5. Hot gas reheat coil must be piped in series to condenser coil. Parallel piping is unacceptable. Controlling reheat with refrigerant modulating control valves and/or solenoid valves is unacceptable.

G. COMPRESSORS AND REFRIGERATION SYSTEM

1. Compressor(s): Units shall have dual independent refrigerant circuits with direct-drive, hermetic, scroll type compressors, and centrifugal type oil pumps. Provide suction gas cooled motor with over temperature and over current protection. Internal overloads shall be provided with the scroll compressors, as well as inlet dirt separator, rolling element bearings, crankcase heater, in completely enclosed compression chamber with no leakage paths.

2. Each refrigerant circuit shall be provided with a thermal expansion valve for optimum refrigerant capacity control. Service pressure ports, and refrigerant line filter driers shall be factory-installed. An area shall be provided for replacement suction line driers. Fixed orifice metering devices are not acceptable.
3. Compressor(s) shall be manufactured by the HVAC unit manufacturer.
4. Units shall have cooling capabilities down to 0 degree F.

H. CONDENSER SECTION

1. Internally finned, 5/16" copper tubes, mechanically bonded to a configured aluminum plate fin shall be standard. Coils shall be leak tested at the factory to ensure pressure integrity. The condenser coil shall be leak tested to 200 psig and pressure tested to 450 psig.
2. The outdoor fans shall be direct-drive, statically and dynamically balanced, draw-through in the vertical discharge position. The fan motor shall be permanently lubricated and shall have built-in thermal overload protection in a weather tight casing.
3. Integrated head pressure control shall be provided and monitored via the unit controller.
4. Provide factory-installed louvered steel coil guards around perimeter of condensing section to protect the condenser coils, refrigerant piping and control components. Louvered panels shall be fabricated from minimum 20 ga. galvanized steel and be rigid enough to provide permanent protection for shipping and pre-/post- installation. Wire mesh is not an acceptable material for coil guards.

I. FACTORY MOUNTED UNIT DDC CONTROLS

1. Unit control shall be provided by the manufacturer's unit mounted DDC control module with clear language display that shall make all unit decisions in order to satisfy the space temperature and humidity). The packaged unit manufacturer shall bear all cost and responsibility, to provide, factory install, wire, mount, and pre-program the unit manufacturer's DDC programmable controller. Subcontracting the BAS controls contractor is not acceptable. Electromechanical controls are not acceptable.
2. Unit shall be capable of independent, standalone control and operation without intervention or modification by the HVAC control subcontractor. Field mounted controls are not acceptable. Factory mounted control module shall provide a link that is compatible with the Building Automation Temperature Control System via BacNet. At a minimum, the control module shall include the following:
3. Interface the following points with the Building Management System and these points must also be readable at the unit control module's LCD Clear Language Display
 - a. Analog Input: Space Temperature Set Point
 - b. Analog Input: Relative Humidity Set Point
 - c. Analog Output: Mixed Air Temperature
 - d. Analog Output: Face/Bypass Damper
 - e. Analog Output: Evaporator Discharge Air Temperature
 - f. Binary Output: Evaporator Fan
 - g. Binary Output: Compressor 1
 - h. Binary Output: Compressor 2
 - i. Binary Output Aux Electric Heat
 - j. Digital Input: Start/Stop (occupied/unoccupied)
 - k. Digital Output: Alarm Status (unit failure)

4. In addition to the above points, the following points must also be readable at the unit control module's LCD Clear Language display:
 - a. Unit Supply Air Temperature
 - b. Mode (occupied/unoccupied)
 - c. Mixed Air Temperature
 - d. Evaporator Discharge Air Temperature
 - e. Evaporator Discharge Air Temperature Set Point
 - f. Reheat Status (face and bypass damper position)
 - g. Electric Heat Stage (SCR)
 - h. Compressor Status
 - i. Condenser Fan Status
 - j. Suction Line Temperature
 - k. Liquid Line Temperature

5. Pre-Programmed Sequence of Operation:
 - a. Provide microprocessor unit mounted control which when used with an electronic discharge air sensor and other sensors as described below, provides proportional integral space temperature control. This UCM shall perform all unit functions by making all heating, cooling and ventilating decisions through resident software logic. The microprocessor shall include multiple temperature functions. All functions of the microprocessor shall be fully programmable and have the capability to be monitored and adjusted thru a laptop computer. In the occupied mode the fan shall run continuously, as described below.
 - b. Control of the Hot Gas Re Heat DX unit shall be accomplished through a dedicated standalone programmable control module. One programmable control module shall be installed per unit. This controller utilizes multiple temperature sensors. The function of this controller is to maintain a programmed space air temperature and humidity. Fan proving switch shall also indicate proof of air flow.
 - c. The DX Supply sensor is mounted after the DX evaporator coil. This temperature sensor shall be used by the programmable controller to control the compressors to maintain a 53 degree (programmable-adjustable) dry bulb temperature set point in the cooling mode. On multiple compressor applications the first compressor is energized at 51 degrees and the second at 55 degrees. The second compressor is shut off at 49 degrees and the first at 44 degrees. These settings are adjustable.
 - d. The zone temperature and humidity sensor is field mounted in the space and will be used by the programmable controller to enable the cooling, dehumidification, or heating mode. In the cooling mode the DX Supply sensor is active and staging compressors as per the above paragraph. Once temperature set point is reached, an analog signal is sent to the face-n-bypass damper actuator to modulate condenser heat into the air stream to maintain the space temperature set point. The space temperature set point is adjustable based on the sensor set point dial input. After a 3 degree dead band, heating is enabled.
 - e. Suction line temperature sensors are utilized to measure suction line temperature. These sensors will disable cooling circuits when the temperature when the temperature drops below a specified safe operating temperature and enabled in the safe zone. Liquid line temperature sensors are utilized to measure liquid line temperature. These sensors will enable control of the condenser fans when the liquid line temperature exceeds the optimum operating head pressure. The outdoor air temperature sensor monitors outdoor air temperature and is factored into the staging of

- condenser fans.
- f. When the heating mode is called for based on the zone temperature sensor, the unit will go into the heating mode and the heat stages will be brought on as required to maintain space heating set point (adjustable)
- g. Unoccupied mode: The supply fan shall be off and the cooling and heating stages will be off. An unoccupied set point can be programmed in the unit controller to bring on the supply fan and cooling and/or heating to a setback temperature. The outside air damper shall be closed.

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 the Work.
- B. Examine roughing-in for piping, ducts, and electrical systems to verify actual locations of connections before equipment installation.
- C. Examine roof curbs and equipment supports for suitable conditions where units will be installed.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Comply with manufacturer's rigging and installation instructions for unloading units and moving to final locations.
- B. Unit Support: Install unit level on structural curbs. Coordinate wall penetrations and flashing with wall construction. Secure RTUs to structural support with anchor bolts.
- C. Install wind and seismic restraints according to manufacturer's written instructions. Wind and seismically restrained vibration isolation rails are specified in Section 230548 "Vibration and Seismic Controls for HVAC Piping and Equipment."
- D. Install wall- and duct-mounted sensors furnished by manufacturer for field installation. Install control wiring and make final connections to control devices and unit control panel.
- E. Install separate devices furnished by manufacturer and not factory installed.
- F. Install new filters at completion of equipment installation and before testing, adjusting, and balancing.
- G. Electrical Connections: Comply with requirements for power wiring, switches, and motor controls in electrical Sections.
 - 1. Install electrical devices furnished by unit manufacturer but not factory mounted.

3.3 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. Inspect units for visible damage to furnace combustion chamber.
 - 3. Inspect units for visible damage to refrigerant compressor, condenser and evaporator coils, and fans.
 - 4. Start refrigeration system when outdoor-air temperature is within normal operating limits and measure and record the following:
 - a. Cooling coil leaving-air, dry- and wet-bulb temperatures.
 - b. Cooling coil entering-air, dry- and wet-bulb temperatures.
 - c. Condenser coil entering-air dry-bulb temperature.
 - d. Condenser coil leaving-air dry-bulb temperature.
 - 5. Simulate maximum cooling demand and inspect the following:
 - a. Compressor refrigerant suction and hot-gas pressures.
 - b. Short-circuiting of air through outside coil or from outside coil to outdoor-air intake.
 - 6. Inspect casing insulation for integrity, moisture content, and adhesion.
 - 7. Verify that clearances have been provided for servicing.
 - 8. Verify that controls are connected and operable.
 - 9. Verify that filters are installed.
 - 10. Clean coils and inspect for construction debris.
 - 11. Clean furnace flue and inspect for construction debris.
 - 12. Inspect operation of power vents.
 - 13. Purge gas line
 - 14. Inspect and adjust vibration isolators and seismic restraints.
 - 15. Verify bearing lubrication.
 - 16. Clean fans and inspect fan-wheel rotation for movement in correct direction without vibration and binding.
 - 17. Adjust fan belts to proper alignment and tension.
 - 18. Start unit.
 - 19. Inspect and record performance of interlocks and protective devices including response to smoke detectors by fan controls and fire alarm.
 - 20. Operate unit for run-in period.
 - 21. Calibrate controls.
 - 22. Adjust and inspect high-temperature limits.
 - 23. Inspect outdoor-air dampers for proper stroke[and interlock with return-air dampers].
 - 24. Verify operational sequence of controls.
 - 25. Measure and record the following airflows. Plot fan volumes on fan curve.
 - a. Supply-air volume.
 - b. Outdoor-air flow.
- B. After startup, change filters, verify bearing lubrication, and adjust belt tension.
- C. Remove and replace components that do not properly operate and repeat startup procedures as

specified above.

- D. Prepare written report of the results of startup services.

3.4 ADJUSTING

- A. Adjust initial temperature and humidity set points.
- B. Set field-adjustable switches and circuit-breaker trip ranges as indicated.
- C. Occupancy Adjustments: When requested within 12 months from date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to two visits to Project during other-than-normal occupancy hours for this purpose.

3.5 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain units.

END OF SECTION 237330

SECTION 238126 - HEATING AND AIR CONDITIONING EQUIPMENT

PART 1 - GENERAL

1.1 Related Documents

- A. The drawings and general provisions of the Contract, including General and Supplementary Conditions, General Requirements and all other Specification Sections apply to the work specified in this section. In the event of conflict between specific requirements of the various documents, the more restrictive, the more extensive (i.e.: more expensive) requirement shall govern.

1.2 Scope

- A. This section includes all heating and air conditioning equipment as indicated on the drawings and described herein.
- B. The requirements of Division 23500, Section "Mechanical and Electrical General Provisions" shall apply to the work specified under this section.

1.3 Quality Assurance

- A. The units shall be listed by Electrical Testing Laboratories (ETL) and bear the ETL label.
- B. All wiring shall be in accordance with the National Electrical Code (N.E.C.).
- C. The units shall be manufactured in a facility registered to ISO 9001 and ISO14001 which is a set of standards applying to environmental protection set by the International Standard Organization (ISO).
- D. All units must meet or exceed the 2010 Federal minimum efficiency requirements and the proposed ASHRAE 90.1. Efficiency shall be published in accordance with the DOE alternative test procedure, which is based on the Air-Conditioning, Heating, and Refrigeration Institute (AHRI) Standards 340/360, 1230 and ISO Standard 13256-1.
- E. A full charge of R-410A for the system shall be provided.

1.4 SUBMITTALS

- A. Submit unit performance data including: capacity, nominal and operating performance.
- B. Submit Mechanical Specifications for unit and accessories describing construction, components and options.
- C. Submit shop drawings indicating overall dimensions as well as installation, operation and service clearances. Indicate lift points and recommendations and center of gravity. Indicate unit shipping, installation and operating weights including dimensions.

- D. Submit data on electrical requirements and connection points. Include recommended wire and fuse sizes or MCA, sequence of operation, safety and start-up instructions.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Comply with manufacturer's installation instructions for rigging, unloading, and transporting units.
- B. Store in clean dry place and protect from weather and construction traffic. Handle carefully to avoid damage to components, enclosures, and finish.

1.6 ENVIRONMENTAL REQUIREMENTS

- A. Do not operate units for any purpose, temporary or permanent, until ductwork is clean, filters are in place, bearings lubricated, and fan has been test run under observation.

1.7 WARRANTY

- A. Provide 5 year parts and labor warranty.

1.8 COORDINATION

- A. The installing contractor for any equipment shall coordinate the following items with applicable trades:
 1. Structural supports, curbs, and/or housekeeping pads required for all equipment.
 2. Piping size and connection/header locations. Locations shall be indicated on the installation and coordination shop drawings and final coordination shall be done on site.
 3. Ductwork connection sizes and locations. Locations shall be indicated on the installation and coordination shop drawings and final coordination shall be done on site.
 4. Electrical power requirements and wire/conduit and over-current protection sizes. Sizes shall be indicated on the installation and coordination shop drawings and final coordination shall be done on site.

PART 2 - PRODUCTS

2.1 SUMMARY

- A. The contractor shall furnish and install air handling units(s) as shown as scheduled on the contract documents. The unit(s) shall be installed in accordance with this specification and perform at the specified conditions as scheduled.
- B. **APPROVED MANUFACTURERS:** Trane is basis of design. Split System manufacturers shall comply with all specifications, performance data, efficiency, dimensional requirements, and warranty, as they apply to all manufacturers. All building heating and air conditioning systems shall meet the scheduled performance as documented and meet the efficiency as scheduled.

2.2 GENERAL

- A. Provide indoor-mounted, draw-thru, air handling unit(s). Unit(s) shall be factory-assembled including direct-expansion evaporator coil, expansion valve(s), check valves, condensate drain pan, centrifugal fan assembly with fan motor(s) and mounting bracket sheaves, drives and belts, filters, and electrical controls. Units shall be suitable for either horizontal or vertical airflow configuration and be used with or without ductwork.

2.3 CASING

- A. Unit casing shall be constructed of zinc-coated, heavy gauge, galvanized steel. Exterior surfaces shall be cleaned, phosphatized and finished with a baked enamel finish.
- B. Unit casing shall be completely insulated with fire-retardant, permanent, foil-faced, odorless glass fiber material.

2.4 FANS

- A. Provide fan section with forward curved, double width, double inlet, centrifugal type fan.
- B. Provide self-aligning, grease lubricated, ball or roller bearings with permanent lubrication fittings.
- C. Factory mount motor on slide rails. Provide access to motor, drive, and bearings through removable casing panels.
- D. Provide shafts constructed of solid hot rolled steel, ground and polished, with key-way, and protectively coated with lubricating oil.
- E. Provide cast iron or steel variable and adjustable pitched sheaves, dynamically balanced, bored to fit shafts and keyed.

2.5 COILS

- A. Provide configured aluminum fin surface mechanically bonded to copper tubing coil. Enclose coils with headers and return bends fully contained within casing. Coil shall have factory installed expansion valves and factory pressure and leak tested at 375 psig.
- B. Provide double sloped condensate drain pan constructed of PVC with external connections on either side of unit. The drain pan shall be removable for cleaning.

2.6 FILTERS

- A. Provide two inch MERV 13 filters, factory installed. Units shall have filter access from either side panel.

2.7 HEAT PUMP CONDENSING UNIT

- A. Outdoor unit shall be fabricated with Zinc Coated, heavy gauge, galvanized steel. Panels shall be weather resistant baked enamel finish that meets 672 salt spray test. Panels shall be removable from a single side for maintenance access with lifting handles. Unit base shall have provisions for forklift.
- B. Provide dual independent refrigerant circuits. Refrigeration circuit shall have integral sub-cooling circuit with direct drive hermetic scroll compressors. Compressors shall be suction gas cooled w/ + 10% voltage utilization range of unit nameplate voltage.
- C. Unit shall be provided with crankcase heaters, internal temperature and current sensitive motor overloads, factory installed liquid line filter drier, phase loss/reverse rotation monitor, liquid line service valve with gauge port, suction line service valve with gauge port, external high pressure cut out device, external low pressure cut out device, evaporator defrost control, and loss of charge protection.
- D. Condensing unit shall come equipped with low ambient head pressure control via variable frequency drive to modulate condenser fan for load operation of system.
- E. Condenser coil shall be 3/8" internally enhanced copper tube mechanically bonded to lanced aluminum plate fins and factory pressure/leak tested to 660 psig. Provide perforated steel hail guards for condenser coil protection. Micro-channel aluminum tubes are not acceptable.
- F. Condenser fans shall be statically and dynamically balanced. Condenser fan motors are permanently lubricated totally enclosed construction with built in current and thermal overloads. Utilize ball or sleeve bearing type motors.

2.8 CONTROLS

- A. Provide factory installed and wired controls including fan contactor, low voltage terminal strip and single point power entry.
- B. Provide a thermostat with temperature and humidity control, seven day schedule and lockout.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Installation
 - 1. All required installation, fabrication and connection drawings shall be submitted and approved prior to the start of work detailed on these drawings.
 - 2. Equipment shall be installed in accordance with manufacturer's recommendations. Installation drawings shall be in accordance with referenced standards in this section.
 - 3. Repair damaged galvanized areas with paint. Repair painted units by touch up of all scratches with finish paint material.
- B. Operation and Maintenance

1. Contractor shall submit Operation and Maintenance Manuals complete with descriptive literature, model, and serial number of all equipment, performance data, manufacturer's instructions for operating and maintenance, lubrication recommendation and schedule.

END OF SECTION 238120

SECTION 260500 – COMMON WORK RESULTS FOR ELECTRICAL

PART 1 - GENERAL

1.1 SUMMARY

- A. Provide complete, tested and fully functional electrical systems as shown on the Drawings and as specified herein.
- B. Electrical equipment and installed systems shall be suitable for the intended application, shall be safe for the intended use, shall be fully rated for the available fault current, and shall conform to local building codes and statutory requirements.

1.2 RELATED DOCUMENTS

- A. The Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section. In the event of conflict between specific requirements of the various documents, the more restrictive, the more extensive (i.e.: more expensive) requirement shall govern.
- B. Electrical requirements specified in this Section apply to electrical equipment and materials described in other Sections of Division 26.

1.3 SCOPE OF WORK

- A. The work includes, but is not limited to, the following:
 - 1. Basic electrical materials and methods
 - 2. Electrical Service
 - 3. Grounding System
 - 4. Power Distribution System
 - 5. Surge Protection Devices
 - 6. Switchboard
 - 7. Panelboards
 - 8. Dry-Type Transformers
 - 9. Engine Generator
 - 10. Electrical identification
 - 11. Wire and cable
 - 12. Raceways, boxes, and fittings
 - 13. Cable Tray
 - 14. Enclosed switches and circuit breakers
 - 15. Lighting Controls
 - 16. Receptacles and Equipment Connections
 - 17. Interior Lighting
 - 18. Exterior Lighting
 - 19. Fire Alarm System
 - 20. Seismic Restraints for Electrical
 - 21. Building expansion/seismic joint accommodation equipment

22. Fire Rated Penetration Systems
23. Low Voltage Systems Raceway Distribution System
24. Coordination Drawings
25. Thorough cleaning of all equipment prior to energization
26. Acceptance testing of all equipment installed under this Section
27. Protection of all equipment under this Division until the final acceptance of the job

- B. Coordinate Division 26 requirements with work in other Divisions.
- C. Submit preconstruction submittals, shop drawings, product data, samples, design data, test reports, certificates, manufacturer's instructions, manufacturer's field reports, operation and maintenance data, closeout submittals and other specified documents to the Engineer for review and approval as described in Division 1, in this Section, and in other Sections of Division 26.
- D. Perform electrical acceptance tests described in other Division 26 Sections (Part 3).
- E. The following principal items of work will be performed under other Sections unless otherwise noted:
1. Finish painting of all exposed raceways, boxes, hangers, apparatus, etc., except as otherwise specifically mentioned herein.
 2. Cutting and patching referred to in Division 1.

1.4 PROJECT CONDITIONS

- A. Ambient temperature, humidity, and elevation ranges: Equipment other than transformers shall be rated for continuous operation at full rated load without derating, under the following conditions:
1. Ambient Temperature: 0 to 40 deg C.
 2. Humidity: Less than 90 percent (non-condensing).
 3. Altitude: Not exceeding 3300 feet (1000 m).
- B. Product Selection for Restricted Space: Drawings show allowable space to scale for anticipated equipment sizes. Comply with NEC requirements for working clearances and with manufacturer's recommendations for access for maintenance. Notify the Engineer if insufficient space is available for available products.

1.5 DEFINITIONS

- A. In addition to the Definitions in Specification Division 1, the following definitions apply to Division 26:
1. AHJ: The statutory Authority Having Jurisdiction as defined in NEC Article 100 for enforcement of legally required compliance to local codes, standards, and ordinances.
 2. ANSI: American National Standards Institute
 3. AEIC: Association of Edison Illuminating Companies
 4. ASQ: American Society for Quality
 5. AWG: American Wire Gauge
 6. CFR: Code of Federal Regulations

7. Cable: an assembly of insulated conductors
8. Control panel: an electrical enclosure housing control logic devices and an operator control interface
9. Commissioning: the process of testing system performance after the sequential steps of installation, testing, energization, startup (including initial adjustment and de-bugging) and functional testing of individual pieces of equipment have all been completed
10. Contract: as used in the Electrical Specification, includes all Contract documents including Specifications and Appendices, Drawings, Addenda, and Change Orders
11. ICEA: Insulated Cable Engineers Association
12. Equipment: a general term including materials, fittings, devices, appliances, fixtures, apparatus, and the like, used as part of, or in connection with, an electrical installation (OSHA Section 29 CFR 1910.399(46) definition)
13. FM: Factory Mutual, Inc.
14. Field wiring: on-site installation of raceways & conductors to connect equipment in accordance with approved drawings
15. Field test: electrical test carried out on-site
16. Fail-safe: selection of control devices and contacts in a manner which results in safe shutdown of the equipment whenever one of the following events occurs:
 - a. Loss of remote control RUN command (normal configuration: contacts close to run equipment)
 - b. Intentional and unintentional disconnection of device (normal configuration: contacts open to shut down equipment)
 - c. High contact resistance or high resistance connection
 - d. Loss of 4-20mADC signal
 - e. Definite-time sequence takes too long, e.g., reduced voltage motor starter fails to make transition from START mode to RUN mode after a reasonable time
 - f. Defined sequence does not occur, e.g., there is no flow from a motor driven pump within a reasonable time after the motor starter contactor is energized.
17. Furnish and install: same as "Provide" below.
18. Functional testing: verification of the satisfactory performance of control logic, with due attention to equipment protective devices, for example, overload relays, temperature switches, pressure switches, flow switches, and similar devices, under actual operating conditions
19. HV: high voltage, operating voltage over 600V (NEC definition)
20. IEEE: Institute of Electrical and Electronics Engineers, Inc.
21. ISO: International Standards Organization
22. Lineup: with respect to switchgear, switchboards, and motor control centers, a contiguous group of vertical sections with common main busbars, and including bus tie breaker sections and control sections
23. LV: low voltage, operating voltage under 600V (NEC definition)
24. Megger: insulation tester with megohm scale
25. NEC: NFPA 70, the National Electrical Code
26. NETA: InterNational Electrical Testing Association, Inc.
27. NICET: National Institute for Certification in Engineering Technologies
28. NFPA: National Fire Protection Association
29. NRTL: Nationally recognized testing laboratory as defined in 29 CFR 1910.7 as it applies to testing and inspecting for safety in the workplace (OSHA definition)
30. Nonconformity: The nonfulfillment of a specified requirement (ASQ definition)

31. “Or approved equal”: proposed “equal” product shall be in conformance with all specified requirements, shall be equivalent in materials of construction to specified manufacturers’ products, shall have equal or superior performance in the conditions anticipated for use of the product in this project, and shall be approved by the Engineer
32. OSHA: Occupational Safety and Health Act
33. Panel: with respect to circuit breaker and fuse power distribution centers, panel is equivalent to “distribution board”, e.g., lighting panel; with respect to control panels, refers either to the entire control panel itself or to a steel plate used for mounting devices inside the control panel
34. Provide: Throughout the Specification, use of this term includes project administration, quality assurance, human resources, tools & equipment, logistics and scheduling, submittals of shop drawings & samples for approval, managing suppliers, purchasing, manufacturing, factory testing, release for shipment, packing, delivery, storage, submittal of coordinated & dimensioned installation drawings for approval, installation, surface preparation & finishes, site testing, startup & commissioning, on-site supervision by equipment manufacturers’ representatives, spare parts & tools, Operations and Maintenance (O&M) Manuals, training, guarantees and warranties, other work described in individual Sections of the Specification, and the Contractor’s duties, responsibilities, risks, and liabilities under the Contract.
35. Punch list: document containing detailed descriptions of non-conformities
36. Quality: conformance to specified requirements.
37. RMS: root mean square
38. Raceways: cable ladder and tray, conduit, duct, wireway, and associated boxes and fittings which enclose, support, and protect wires and cables
39. Shop drawings: a complete package of manufacturer’s equipment drawings, bill of materials, catalog data sheets, performance curves, calculations, and other data provided to demonstrate conformance to the equipment specification
40. Substitution: an alternative, nonconforming product proposed by the Contractor in lieu of a specified, conforming product
41. Substantial Completion: an electrical system may be considered substantially complete when the equipment has passed the specified tests required prior to energization, has been energized, has passed the Electrical Acceptance Tests, and all related Specification requirements have been met except for well-defined minor items which, in the opinion of the Engineer, may be repaired or replaced prior to Final Acceptance without adversely affecting process performance.
42. Terminal box: an electrical enclosure containing labeled terminal blocks for connection of wiring
43. UL: Underwriters Laboratories, Inc.
44. VFC: variable frequency controller
45. VFD: variable frequency drive, the combination of VFC and inverter-duty motor that drive mechanical loads using the principle of variable frequency motor control
46. Wiring: conductors and connections to equipment terminals. ‘Wiring’ and ‘cabling’ shall be considered equivalent terms. Fiber optic cables shall be included in the scope of electrical wiring.

1.6 REFERENCE STANDARDS

- A. Notwithstanding revision dates shown in this and other Sections of Division 26, the codes and standards applicable to this project shall be those in effect at the time of bid submittal, except for NFPA 70 NEC, which shall be the version acceptable to the AHJ.

1.7 QUALITY ASSURANCE

- A. In consultation with the equipment and materials Suppliers, the Contractor shall prepare and submit a Compliance Statement as described in “SUBMITTALS” below with each submittal requiring approval.
- B. The Engineer’s approval of a submittal shall not relieve the Contractor of any Contractor responsibilities under the Contract. Approval of a submittal that is incomplete, or one that has nonconformities that are not described in the Compliance Statement that is specified to be included with each submittal, followed by the discovery of unapproved nonconformities, will result in replacement of the non-conforming items at no additional cost to the Owner. Substitutions require the approval of the Engineer.
- C. Manufacturers of electrical equipment shall have quality certification to ISO 9000:2000 or an equivalent Quality Management System acceptable to the Engineer.
- D. Equipment, materials, and installation shall conform to NEC requirements and shall be NRTL-listed and labeled.
- E. On-site testing prior to energization and electrical acceptance testing shall be performed as specified in other Sections.
- F. Manufacturers, manufacturer’s representatives, subcontractors, supervisors, installers, and testing agencies shall have qualifications and experience as described in other Sections of the Specification. Qualifications and experience submittals for firms and individuals shall be submitted, re-submitted, or updated whenever requested by the Owner’s Representative.

1.8 SAFETY IN THE WORKPLACE

- A. Electrical equipment and materials, and the Contractor’s installation practices, shall conform to the following:
 - 1. Current edition of OSHA sections of the Code of Federal Regulations (CFR): Part 29 CFR 1910 for General Industry and Part 19 CFR 1926 for Construction Activities
 - 2. NFPA 70, the National Electrical Code
 - 3. Current edition of NFPA 70E, Standard for Electrical Safety Requirements for Employee Workplaces
- B. These regulations and standards impose obligations on equipment manufacturers to obtain NRTL certification, listing, and labeling to comply with OSHA (Occupational Safety and Health Act) and Department of Labor regulations.
- C. All electrical equipment for which NRTL test procedures have been established shall be certified, listed, and labeled, or otherwise determined to be safe for its intended use, by a NRTL. The absence of a specific reference to NRTL-listing in other Sections shall not relieve the Contractor of the requirement to provide NRTL-listed equipment, and to obtain certification as required by the AHJ in cases where NRTL listing and labeling is not a manufacturer’s standard offering for a particular product.
- D. Equipment shall not be modified in any manner adversely affecting safety for the intended use, nor shall any equipment be modified on-site without the approval of the manufacturer.

- E. Equipment sound levels shall not exceed limits established by reference standards and local regulations. In the absence of reference standards and local regulatory requirements, sound pressure levels shall not exceed 85 dB (A) measured three feet from the equipment.
- F. Equipment with moving parts shall be fully guarded in compliance with OSHA rules and regulations.

1.9 INSPECTIONS BY THE AHJ

- A. The Contractor shall make arrangements for electrical inspection of the project by the AHJ. Upon completion of the work, final certificate of approval documents shall be submitted to the Engineer for forwarding to the Owner. This certificate shall be submitted prior to request for final payment. The Contractor shall pay all fees required for inspection.

1.10 WORKMANSHIP AND MATERIALS

- A. Materials and equipment shall be new and undamaged, shall be marked by the manufacturer, and shall be delivered to the construction site in the original factory packaging.
- B. Materials and equipment shall be installed in accordance with the Drawings, the Specification, and the manufacturer's installation, operation, and maintenance instructions. In the event of apparent conflicts or discrepancies, the Engineer shall be informed of the apparent conflict or discrepancy in writing, and will instruct the Contractor how to proceed.

1.11 RESOURCES AND CONSTRUCTION SCHEDULE

- A. The Contractor shall provide sufficient resources, including qualified and experienced project managers, electrical engineers, superintendents, technicians, supervisors, electricians, tools and construction equipment to complete the electrical work in accordance with the activity durations and sequences shown on the Construction Schedule for this project.
- B. The construction schedule shall include the following activities and milestones, in realistic sequence, for each transformer, circuit breaker panelboard and exterior lighting:
 - 1. Review of shop drawings
 - 2. Approval of shop drawings (milestone)
 - 3. Factory testing
 - 4. Request for release of shipment documentation
 - 5. Shipping
 - 6. Delivery to site (milestone)
 - 7. Formwork ready for sleeves, openings, and inserts
 - 8. Equipment installation (including "remote" sites)
 - 9. Tests on completion of installation (prior to energization)
 - 10. Energization (milestone)
 - 11. Functional testing
 - 12. Acceptance testing
 - 13. Installation, testing, and commissioning complete (milestone)
- C. The construction schedule shall include the following activities and milestones, in the following sequence, for electrical raceways and wiring in each building and structure:

1. Review of Contractor's dimensioned layout and coordination drawings
2. Approval of Contractor's dimensioned layout and coordination drawings (milestone)
3. Materials delivery to site (milestone)
4. Foundations ready for grounding electrode installation
5. Imbedded raceway installation
6. Room ceiling, wall, and floor finishing complete (ready for exposed raceway installation)
7. Surface raceway installation
8. Wire & cable installation
9. Tests on completion of installation (prior to energization)
10. Wire and cable testing complete (milestone)

1.12 CONTRACT DRAWINGS AND SPECIFICATIONS

- A. The Electrical Drawings provide scaled layouts of representative equipment and key building dimensions, for example, structural gridlines, but do not include "approved for construction" dimensions for equipment.
- B. All electrical systems, mounting hardware, labor and other items indicated on the Electrical Drawings, schedules and/or specifications shall be included in the Contractor's bid, unless specifically indicated otherwise. The specifications, schedules, diagrams, details and plans are complementary and what is indicated on any is as binding as if indicated on all. Where conflict exists between what is shown and what is specified, the more stringent shall govern.
- C. The drawings are diagrammatic and are not intended to show each and every conductor, fitting, device, conduit, or complete detail of all the work to be performed, but are for the purpose of illustrating the type system and special conditions necessary for the experienced electrician to take off their material and lay out the work. The Contractor shall be responsible for making such measurements as may be necessary at the Project and adapting the work to project conditions.
- D. Drawings shall not be scaled. Refer to architectural and structural drawings for building construction and dimensions and to room finish schedule or architectural drawings for material, finish and construction method of walls, floor and ceiling in order to insure proper rough-in and installation of work.

1.13 COORDINATION OF WORK

- A. Work under this Division shall be performed in conjunction with the work of other trades. Coordinate electrical installation work with the overall construction schedule. Examine the plans and specifications prior to commencement of work and become familiar with all phases of work involved prior to commencing installation work.
- B. The Contractor shall be responsible for coordinating dimensions of equipment and working clearances in accordance with NEC, and in all cases bring to the attention of the Engineer any discrepancies on the plans and in the specifications prior to installation. Any work that installed without proper coordination shall be removed and reinstalled at the Contractor's expense. The layout for sleeves, chases, openings, etc., must be arranged prior to construction in order to prevent unnecessary cutting. Examine Architectural drawings for doors swings, countertop heights, built-in furniture and casework, and other factors affecting electrical outlet locations prior to roughing-in raceways, boxes, fittings, and outlets.

1.14 COORDINATION WITH FOOD SERVICE CONTRACTOR (FSC)

- A. Coordinate work with the requirements of the food service drawings and specifications.
- B. All final connections to equipment shall be done under this Division.
- C. All electrical lines shall be extended from rough-in connection point or points on the fixture under this Division, furnishing all labor and materials.
- D. All rough-ins shall be concealed in walls or columns wherever possible.
- E. All fabricated equipment shall be completely wired internally, and all electrical outlets and receptacles mounted on or in fabricated equipment shall be furnished and installed by the Food Service Contractor who shall run all lines to suitable terminal boxes or subpanels; starters or disconnect switches and final connection under this Division. Where equipment wiring terminates in a junction box, switch or terminal box, the Contractor shall make all connections between the branch circuit and the equipment wiring. Where terminal is a receptacle, connect branch circuit to receptacle. Where terminal is a sub panel, connect branch circuit to the main of the sub-panel. All receptacles shall be furnished under this Division, except those which are built into an item of equipment.
- F. All plug-in equipment receptacles shall be polarized. The Contractor shall provide the appropriate grounding type receptacle for all wall- and floor-mounted outlets to be used for plug-in equipment as noted on the drawings, with characteristics as noted. All plug-in equipment shall have the appropriate cord and plug set furnished and installed by the Food Service Contractor. The Food Service Contractor and the Contractor under this Division of work shall coordinate their work so that the receptacles provided will match the specific plugs installed as part of the plug-in equipment, and any changes in cords and plugs or receptacles required in the field will be done at no cost to the Owner.
- G. The Contractor shall interwire equipment components where required, such as, ventilator control panels to ventilators, fans and detergent systems, solenoid valves, and disposal control panels to disposer motors and solenoids.
- H. Electric switches with thermal overload protection will be mounted on the dishwashing machine by FSC or dishmachine manufacturer. Machine may be shipped to the job site in one or more sections. After machine is assembled by the FSC, the Contractor shall interconnect machine sections and provide final connections under this Division.
- I. The FSC shall supply, on each motor-driven appliance or electric heating unit, a suitable control switch or starter of the proper type in accordance with Underwriters Laboratory requirements wherever such switch or starter is not furnished integrally with the equipment by its manufacturer. All other line switches; safety cutouts; disconnect switches; control panels; fuse boxes; other controls; fittings, and connections, when not an integral part of the unit, shall be furnished and installed under this Division.
- J. All conduit, junction boxes, and other fittings for equipment which is freestanding, or open tubular construction, exposed to public view, shall be galvanized steel.
- K. The Contractor under this Division shall supply power and interconnecting services and all final connections to walk-in refrigeration and freezer compressor/condensers and evaporators

solenoid valves and switches required for a complete operating system. Furnish and install a disconnect switch for each compressor. Walk-in refrigerator lights shall be furnished by the FSC and installed and fully connected under this Division of work. Exposed conduit inside the walk-in compartment is unacceptable.

- L. "Sealtite" type flexible conduit shall be used for all flexible conduit installation, depending on code requirements. Junction boxes for equipment requiring flexible conduit should be mounted on rigid conduit at elevations which limit the total length of flexible conduit to 24 inches overall.
- M. Sleeve collars shall extend 2 inches above top of the finished floor. Openings between collar and conduit shall be sealed watertight.
- N. The Contractor under this Division shall connect electrical supply from rough-in location to the disposer control panel and then to the disposer motor and solenoids. Control panel contains overload and under-voltage protection and fused disconnect switch.
- O. The FSC shall provide microswitches as part of the fire suppression system, which, when wired to, will allow for the interruption of power to all electrically operated equipment as required in case of fire. Power source for the fire suppression system shall be interwired to an emergency generator under this Division so that the fire system will remain energized in the event of a power failure. The Contractor shall provide adequate contactors, shunt-trips, or other equipment to interrupt power as required by code and interwire with system as supplied by FSC.
- P. The Contractor shall interwire ventilator exhaust system per directions of FSC.
- Q. Light fixtures in foodservice areas shall be enclosed with a non-breakable diffuser. Lights furnished in exhaust hoods are factory installed; Contractor to provide final connection to power source and switch.

1.15 CODES AND STANDARDS

- A. All equipment and materials shall be manufactured, tested, and installed in accordance with the National Electrical Code (NEC) and all applicable portions of local codes, in accordance with the requirements of the AHJ.
- B. In addition, work shall be in accordance with the versions of the following referenced standards in effect at the time of bid opening:
 - 1. American Association for Laboratory Accreditation (A2LA)
 - 2. American Society for Testing and Materials (ASTM)
 - 3. American National Standards Institute (ANSI)
 - 4. Americans with Disabilities Act (ADA)
 - 5. Code of Federal Regulations (29 CFR 1903, 1910, and 1926)
 - 6. Factory Mutual Engineering & Research (FME&R)
 - 7. Illuminating Engineering Society of North America (IESNA)
 - 8. Insulated Cable Engineers Association (ICEA)
 - 9. International Organization for Standardization (ISO)
 - 10. National Electrical Manufacturers Associates (NEMA)
 - 11. Institute of Electrical and Electronic Engineers (IEEE)
 - 12. National Fire Protection Association (NFPA)

13. Occupational Safety and Health Act (OSHA)
14. Underwriters Laboratory, Inc. (UL) and other NRTL standards and test procedures

1.16 SUBMITTALS

- A. Submittals shall conform to requirements described in Division 1 Section “Submittal Procedures”.
- B. Compliance Statement: with each submittal, include a Compliance Statement listing each Specification Section, and Part 1, 2, and 3 Sub-Sections, stating, paragraph-by-paragraph, compliance with the Specification, each minor nonconformity that is within the intent of the Specification, and proposed nonconformities. Provide short description of minor nonconformities, and detailed explanation of other nonconformities.
- C. Submittal Format
 1. Each submittal shall be accompanied by a transmittal letter showing the submittal category and Specification Section reference number(s). Submittals shall be 3-hole punched and neatly bound.
 2. Submittals shall have a complete Table of Contents with tabs corresponding to the Table of Contents headings.
 3. Submittal transmittal letters shall clearly identify the reason for submittal, e.g., for approval, as manufactured, or as-built / record.
 4. Each page of each submittal shall be numbered. Page numbers shall be listed on the Table of Contents. Content shall be printed on 8½ x 11 inch paper, or 11 x 17 paper (folded). Larger size drawings shall be folded and placed in labeled individual clear plastic pockets.
 5. Product Data shall be clearly marked to show which items are proposed for this project. Information that does not apply to this project shall be crossed out.
- D. Submittal Categories
 1. Preconstruction Submittals, including proposed substitutions, supplier and manufacturer qualifications and experience, construction scheduling, preliminary harmonics analysis for variable frequency controllers
 2. Shop Drawings, including equipment drawings, seismic bracing details, and Coordination Drawings
 3. Product Data, marked to indicate precisely which items are proposed for this project
 4. Samples, labeled by name, Specification Section and sub-clause, and mounted on sample boards
 5. Design Data, including manufacturer’s design calculations
 6. Test Reports, including prototype tests, factory tests, field tests, acceptance tests, and functional tests
 7. Certificates, including seismic qualification certification, welding certificates, factory training certificates for manufacturer’s representatives
 8. Manufacturer’s Instructions, including unloading, hoisting, rigging, short term storage, long term storage, method of field assembly, and installation instructions
 9. Manufacturer’s Field Reports, including inspections and training records
 10. Operation and Maintenance Manuals, including manufacturer’s standard published literature and specially prepared descriptions of operation

11. Closeout Submittals, including black line paper copy of Record Drawings marked in red illustrating changes during construction
 12. Spare Parts and Special Tools List
- E. In the absence of contradictory instructions in Division 1 Section “Submittal Procedures”, Shop Drawings and Coordination Drawings shall be marked with revision blocks to indicate status as follows:
1. FOR APPROVAL
 2. AS MANUFACTURED (incorporates Engineer’s comments)
 3. AS BUILT / RECORD (incorporates on-site modifications)
- F. Product Data Sheets: Submit a list of manufacturers with catalog numbers and product data sheets for the following materials miscellaneous equipment, and obtain approval before the items in question are ordered or installed.
1. Switchboards
 2. Panelboards
 3. Dry-Type Transformers
 4. Engine Generator
 5. Grounding Systems
 6. Raceways, Boxes, and Fittings
 7. Wire and Cable (600 V and less)
 8. Fire Rated Penetration Systems
 9. Electrical Identification
 10. Hangers and Supports
 11. Seismic Restraints
 12. Cable Tray
 13. Surge Protection Devices
 14. Disconnect Switches and Enclosed Circuit Breakers
 15. Lighting Control Devices
 16. Wiring Devices
 17. Lighting Fixtures
 18. Fire Alarm System
- G. Record Drawings: Maintain a full size paper set of “black-line” working drawings throughout the project, and shall carefully record in red ink the actual locations including dimensions to locate each piece of electrical equipment, raceways, boxes, & fittings, and electrical outlets. Upon Substantial Completion of the work, deliver the marked-up set of prints to the Engineer. The Engineer reserves the right to withhold final payment until "As-Built" drawings are received.
- H. Operation and Maintenance Manuals: Prior to acceptance of the finished project, provide copies of electrical Operation and Maintenance Manuals in conformance with Division 1 Section “Operation and Maintenance Data”. O&M Manuals shall be organized according to Division 26 Section numbers. Each copy shall be bound in a durable, 3-ring hardback binder, with data sheets individually punched and reinforced to prevent tearout. Data sheets shall be grouped, and binder dividers shall be provided to match the Table of Contents. Each Manual shall have an identifying label on the spine and front cover and shall include the following:
1. List of all O&M Manuals in the front of each manual.

2. Table of Contents for each manual and each binder
3. Copy of each of the following:
 - a. Preconstruction Submittals
 - b. Shop Drawings
 - c. Product Data
 - d. Design Data
 - e. Test Reports
 - f. Certificates
 - g. Manufacturer's Instructions
 - h. Manufacturer's Field Reports
 - i. Operation and Maintenance Data
 - j. Closeout Submittals
 - k. Panelboard directories (as-built)

1.17 OUTAGES

- A. Electrical outages: Do not interrupt electrical service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary electrical service if required by the Specification.
 1. Notify the Owner a minimum of 14 days in advance of proposed interruption of electrical service.
 2. Submit step-by-step sequence and schedule for proposed interruption, and if required, proposed method of providing temporary electrical service, to the Owner for approval.
 3. Confirm approved interruption of electrical service one week in advance of Owner-approved date.
 4. All work requiring an outage shall be done at night, from after the last plane arrival until 4am.
 5. Do not proceed with interruption of electrical service without written permission from the Owner.

1.18 TEMPORARY LIGHTING AND POWER

- A. Refer to Division 1.
- B. The Contractor shall provide all temporary electric service for power and lighting including panels, feeders, lighting, outlets, branch circuits, etc.
- C. The Owner's electrical power shall not be used without permission of the Owner.
- D. All temporary work shall be in accordance with the NEC, OSHA, and NFPA safety requirements and shall be completely removed upon completion of the project.

PART 2 - PRODUCTS AND EXECUTION

2.1 EQUIPMENT AND MATERIALS

- A. Provide equipment and materials in compliance with other Sections of Division 26. The requirements in this Section apply to all Sections in Division 26.

2.2 ELECTRICAL IDENTIFICATION

- A. Electrical equipment, raceways, boxes, fittings, wires and cables shall be marked in the field in accordance with Division 26 Section "Electrical Identification".

2.3 ELECTRICAL ENCLOSURES

- A. In the absence of other specified NEMA enclosure ratings in other Sections of the Specification, electrical enclosures shall have degree of protection ratings suitable for the intended application (e.g., watertight, dust-tight, explosion-proof) and environmental conditions. Electrical equipment enclosures shall have the following NEMA 250 ratings:
 1. NEMA 3R: Electrical enclosures located outdoors in non-corrosive areas shall be NEMA 3R painted steel.
 2. NEMA 4X: Outdoor enclosures in corrosive areas, including areas exposed to cooling tower mist, shall be NEMA 4X stainless steel.

2.4 ELECTROMAGNETIC INTERFERENCE

- A. Power conversion equipment, including variable frequency controllers, battery-powered inverters, computer power supplies, frequency converters, and Uninterruptible Power Supplies, shall be fitted with EMI (electromagnetic interference), RFI (radio frequency interference) and telephone interference filters to limit interference effects on other equipment in the area in accordance with IEEE standards and recommendations applicable to the equipment.

2.5 DISSIMILAR METALS

- A. Dissimilar metals shall not be connected, spliced, or joined except where specifically approved in writing by the Engineer. Copper busbars, aluminum busbars, and copper-to-aluminum busbar connections shall be tin-plated at joints and at cable lugs. Bolted electrical conductor connections shall be made with silicone-bronze bolts, nuts, and washers. Belleville washers & tin-plated flat washers shall be used at aluminum-to-copper and aluminum-to-aluminum busbar joints.

2.6 FIRE RATED PENETRATION SYSTEMS

- A. Provide UL Listed fire penetration systems in openings in rated floors, walls, and other elements of construction. Provide UL listed fire penetration systems at all new and existing pipe penetrations of new and existing rated construction within the area of work. Coordinate work of this section with all other trades necessary for the proper installation of the fire rated penetration systems.

- B. Submit shop drawings showing each condition requiring penetration seals in dictating proposed UL systems materials, anchorage, methods of installation, and actual adjacent construction. Submit a copy of UL illustration of each proposed system indicating manufacturer approved modifications. Submit copies of manufacturer's specifications, recommendations, inspection requirements, installation instructions, and maintenance data for each type of material required. Include letter indicating that each material complies with the requirements and is recommended for the applications shown.
- C. All fire penetration systems shall reference ASTM E814/UL 1479 - Fire Test of Through - Penetration Fire Stops.
- D. All systems shall be UL tested and listed in the UL Fire Resistance Directory.
- E. Submit copies of written guarantee agreeing to repair or replace joint sealers which fail in joint adhesion, cohesion, abrasion resistance, weather resistance, extrusion resistance, migration resistance, stain resistance, general durability or appear to deteriorate in any other manner not clearly specified by submitted manufacturer's data as an inherent quality of the material for the exposure indicated. The guarantee period shall be one (1) year from date of substantial completion.
- F. 3M products have been specified as the penetration fire stop basis of design. Other manufacturer's systems are acceptable providing they meet the requirements set forth in this specification. The fire rated penetration systems shall be the products of one manufacturer to the maximum extent possible. The products of more than one manufacturer shall not be used as a combined seal.
- G. Provide materials classified by UL to provide fire stopping equal to time rating, both "F" and "T" ratings, of construction being penetrated. Provide asbestos free materials that comply with applicable codes and have been tested under positive pressure in accordance with UL 1479 or ASTM E814. Systems shall be smoke and air tight.
- H. Deliver material undamaged in manufacturer's clearly labeled, unopened containers identified with brand, type, grade, and UL label where applicable. Coordinate delivery with scheduled installation date to allow minimum storage time at site. Store material in clean, dry ventilated location. Protect from soiling, abuse, and moisture. Follow manufacturer's instruction.
- I. Verify existing conditions and substrates before starting work. Correct unsatisfactory conditions before proceeding. Proceed with installation only after penetrations of the substrate and supporting brackets have been installed.
- J. Furnish adequate ventilation if using solvent. Furnish forced air ventilation during installation if required by manufacturer. Keep flammable materials away from sparks or flame. Provide masking and drop cloths to prevent contamination of adjacent surfaces by fire stopping resistance.
- K. Clean surfaces to be in contact with penetration seal materials, of dirt, grease, oil, loose, materials, rust, or other substances that may affect proper fitting, adhesion of the required fire resistance.
- L. Install penetration seal materials in accordance with printed instructions of the UL Fire Resistance Directory and in accordance with manufacturer's instructions. Seal holes or voids made

by penetrations to ensure an effective smoke barrier. Where floor openings without penetrating items are more than four (4) inches in width and subject to traffic or loading, install fire stopping materials capable of supporting same loading as floor. Protect materials from damages on surfaces subject to traffic.

- M. Clean up spills of liquid components. Neatly cut and trim materials as required. Remove equipment, materials, and debris, leaving area in undamaged, clean condition.
- N. Examine penetration sealed areas to ensure proper installation before concealing or enclosing areas. Keep areas of work accessible until inspection by applicable code authorities. Perform under this section patching and repairing of fire stopping caused by cutting or penetration by local inspectors and other trades.
- O. Fire Rated Pathway for Low Voltage Systems: All data, video and communications cable bundles shall utilize an enclosed fire-rated pathway device wherever cables penetrate rated area separation walls. The fire-rated pathway shall contain a built-in fire sealing system sufficient to maintain the hourly fire rating of the barrier being penetrated. The self-contained sealing system shall automatically adjust to the installed cable loading and shall permit cables to be installed, removed, or retrofitted without the need to remove or reinstall firestop materials. The fire rated pathways shall consist of three inch square chases gangable up to three pathways at any location. The pathway shall be UL classified and/or FM systems approved and tested to the requirements of ASTM E814 (UL 1479). Specified Technologies, Inc. EZ-Path. Refer to architectural drawings for location of the rated area separation walls.

2.7 WARRANTIES

- A. Warranties for equipment and materials shall conform to Division 2 “Product Requirements”.
- B. Provide an on-site parts and labor warranty for a minimum period of one year after Substantial Completion for all equipment and materials. In cases where the manufacturer offers a longer warranty period, the longer warranty period shall apply as described by the manufacturer.
- C. All components of electrical systems that are not fully functional at the time of Substantial Completion shall have warranties extended to provide minimum one year coverage of fully operational equipment unless otherwise approved by the Owner’s Representative.

PART 3 - EXECUTION

3.1 DELIVERY AND HANDLING

- A. Equipment delivered to site shall be handled in accordance with manufacturer’s recommendations by experienced riggers, crane operators, and fork lift truck operators.

3.2 STORAGE AND PROTECTION OF EQUIPMENT

- A. All electrical equipment to be used in construction shall be properly stored and protected against the elements. General construction materials shall be stored in covered trailers. Switchgear, unit substations, motor controllers, panelboards, emergency lighting, solid state equipment, engine generator shall be stored in a clean, dry, indoor location, under cover, until the building

is weathertight and the area where the equipment is to be installed has been completed to the satisfaction of the Engineer, including completion of overhead work by other trades.

- B. Equipment enclosures exposed to construction damage such as paint spots, spackling, waterproofing, insulation etc. shall be covered and protected against damage.

3.3 INSPECTIONS PRIOR TO COVERING-UP

- A. Raceways embedded in concrete or otherwise concealed shall be inspected in the presence of the Engineer's Representative prior to placement of concrete. Sufficient time shall be allowed to make corrections if required.

3.4 ON-SITE INSPECTIONS AND NONCONFORMITIES

- A. Equipment shall be inspected on delivery to site for physical damage and for compliance with the Specification and approved equipment shop drawings.
- B. Installed equipment, raceways, and wiring shall be inspected on completion of installation for compliance with the Specification and approved installation drawings.
- C. A Punch List will be prepared by the Owner's Representative during inspections and testing, and issued to the Contractor for corrective action.
- D. Conform to Division 1 Section "Contract Closeout".
- E. Repairs, replacement, and other corrective action that requires de-energizing any part of the Electrical Power Distribution and Control System shall be completed prior to the scheduled date for substantial completion of the project.

3.5 CUTTING AND PATCHING

- A. Conform to Division 1 Section "Cutting and Patching".

3.6 PENETRATIONS AND SEALING

- A. Sleeves and rectangular openings shall be provided for raceways provided under this Contract, and for raceways for future equipment where future equipment is shown on the Drawings. Sleeves and rectangular openings for the passage of raceways and conductors shall be sealed after the raceways and conductors have been installed. Spare sleeves and rectangular openings shall also be sealed.
- B. Penetration of Waterproof Construction: Coordinate the work to minimize penetration of waterproof construction, including roofs and exterior walls. Where penetrations are necessary, provide sleeves and sealing fittings to make each penetration watertight. Conduit sleeves and openings shall be sealed watertight with mechanical seals. Watertightness shall not rely on caulking.

3.7 ELECTRICAL SAFETY AND TEST EQUIPMENT

- A. Maintain the following test instruments and calibration certificates less than 12 months old on-site as a minimum:
 - 1. True RMS digital volt-ohm meter with resistance scale
 - 2. Clip-on ammeter with range from 1 to 600 amps
 - 3. 500V DC battery-powered megger insulation tester
- B. Provide electrical safety equipment, including personal protective equipment, hot sticks, HV gloves, electrical blankets, test instruments, lighting, ventilation, and instructions in the use of safety equipment, and perform the work under this Contract in accordance with applicable safety rules and regulations. The Contractor's attention is directed to safety issues related to confined spaces as defined in OSHA regulations.

3.8 CLEANING AND PAINTING

- A. Conform to Division 1 Section "Closeout Procedures".
- B. After installation and wiring work is completed, all dust and debris shall be removed from the interior and exterior of each electrical equipment enclosure and motor by vacuum-cleaning with circuits de-energized. Do not use compressed air for cleaning. Vacuum cleaner wands and brushes shall be non-conducting. Anti-static protection shall be provided for static-sensitive devices.
- C. Clean and remove all rust, scale, oil, grease, and dirt from panelboard enclosures, conduits, pull, junction and terminal boxes, fittings and hangers, leaving surfaces in condition for final surface preparation and painting under Division 9.
- D. All ferrous materials that are concealed, or exposed in unfinished areas, including fittings, hangers, junction, pull and terminal boxes, that are not plated or painted with a factory-applied finish, shall be painted under this Section with one coat of zinc-chromate primer and one (1) finish coat of enamel paint approved by the Engineer. Nonferrous materials shall be cleaned only and left unpainted.
- E. Equipment furnished with a factory finish coat shall have finish carefully touched-up where it is scratched or otherwise damaged. Touch-up work shall be match the color and type of the original finish.

3.9 INSPECTION AND TESTING ON-SITE

- A. The Contractor shall hire a NETA-certified or NICET-certified specialist electrical testing firm to perform on-site inspection and electrical testing.
- B. Perform Electrical Acceptance Tests in accordance with NETA Acceptance Testing Standards as described in individual Division 26 Sections, Part 3.
- C. Submit manufacturer-endorsed field test data sheets & procedures for approval, test equipment and materials on-site prior to site visit by manufacturer's factory-trained representative, test equipment on-site under the supervision of the Engineer and the equipment manufacturer's

factory-trained representative(s), and submit manufacturer's statement of acceptance of installation prior to energization of equipment. Invite the Engineer's and Owner's representatives to witness field testing.

- D. Electrical equipment shall not be energized without the approval of the Engineer.
- E. A complete certified electrical test report shall be compiled by the electrical testing firm, checked for completeness, and submitted for the record.
- F. The Contractor shall notify all parties whose presence is necessary for the test; and in all cases, the Engineer shall be notified at least one week prior to the actual test.

3.10 LOAD BALANCING

- A. Single phase circuits in single and three-phase fuse and circuit breaker distribution boards and lighting panels shall be balanced initially based on the load calculations. Load currents shall be measured under actual operating conditions, and under conditions described by the Engineer. Circuiting shall be re-arranged as necessary to obtain current balancing within 10% on each busbar.

END OF SECTION 260500

SECTION 260519 - LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

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. Building wires and cables rated 600 V and less.
 - 2. Connectors, splices, and terminations rated 600 V and less.

1.3 ACTION SUBMITTALS

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

1.4 INFORMATIONAL SUBMITTALS

- A. Field quality-control reports.

PART 2 - PRODUCTS

2.1 CONDUCTORS AND CABLES

- A. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - 1. Alcan Products Corporation; Alcan Cable Division.
 - 2. Alpha Wire.
 - 3. Belden Inc.
 - 4. Encore Wire Corporation.
 - 5. General Cable Technologies Corporation.
 - 6. Southwire Incorporated.
- B. Copper Conductors: Comply with NEMA WC 70/ICEA S-95-658.
- C. Conductor Insulation: Comply with NEMA WC 70/ICEA S-95-658 for Type THHN-2-THWN-2.
- D. Multiconductor Cable: Comply with NEMA WC 70/ICEA S-95-658 for metal-clad cable, Type MC with ground wire.

2.2 CONNECTORS AND SPLICES

- A. Manufacturers: Subject to compliance with requirements, provide products by the following:
1. AFC Cable Systems, Inc.
 2. Gardner Bender.
 3. Hubbell Power Systems, Inc.
 4. Ideal Industries, Inc.
 5. IlSCO; a branch of Bardes Corporation.
 6. NSi Industries LLC.
 7. O-Z/Gedney; a brand of the EGS Electrical Group.
 8. 3M; Electrical Markets Division.
 9. Tyco Electronics.
- B. Description: Factory-fabricated connectors and splices of size, ampacity rating, material, type, and class for application and service indicated.

2.3 SYSTEM DESCRIPTION

- 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. Comply with NFPA 70.

PART 3 - EXECUTION

3.1 CONDUCTOR MATERIAL APPLICATIONS

- A. Feeders: Copper. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.
- B. Branch Circuits: Copper. Solid for No. 12 AWG and smaller; stranded for No. 8 AWG and larger, except VFC cable, which shall be extra flexible stranded.

3.2 CONDUCTOR INSULATION AND MULTICONDUCTOR CABLE APPLICATIONS AND WIRING METHODS

- A. Service Entrance: Type THHN-2-THWN-2, single conductors in raceway.
- B. Exposed Feeders: Type THHN-2-THWN-2, single conductors in raceway.
- C. Feeders Concealed in Ceilings, Walls, Partitions, and Crawlspace: Type THHN-2-THWN-2, single conductors in raceway.
- D. Feeders Concealed in Concrete, below Slabs-on-Grade, and Underground: Type THHN-2-THWN-2, single conductors in raceway.
- E. Exposed Branch Circuits, Including in Crawlspace: Type THHN-2-THWN-2, single conductors in raceway.

- F. Branch Circuits Concealed in Ceilings, Walls, and Partitions: Type THHN-2-THWN-2, single conductors in raceway.
- G. Branch Circuits Concealed in Concrete, below Slabs-on-Grade, and Underground: Type THHN-2-THWN-2, single conductors in raceway.
- H. Cord Drops and Portable Appliance Connections: Type SO, hard service cord with stainless-steel, wire-mesh, strain relief device at terminations to suit application.

3.3 INSTALLATION OF CONDUCTORS AND CABLES

- A. Conceal cables in finished walls, ceilings, and floors unless otherwise indicated.
- B. Each branch circuit for a computer load shall have an individual neutral conductor. Increasing the neutral conductor size, or "super neutral," is not allowed for multiple branch circuits.
- C. Feeders and branch circuits shall have a ground conductor.
- D. Install no more than 3 phase wires in any feeder or branch circuit conduit.
- E. Wire size on 120 Volt, 20 ampere branch circuit home run conductors over 75 feet in length (from closest wiring device at the home run designation to the associated panelboard shown on the electrical drawing sheets), shall be increased to No. 10 AWG (minimum) to limit excessive voltage drop.
- F. Complete raceway installation between conductor and cable termination points according to Section 260533 "Raceways and Boxes for Electrical Systems" prior to pulling conductors and cables.
- G. Use manufacturer-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.
- H. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips, that will not damage cables or raceway.
- I. Install exposed cables parallel and perpendicular to surfaces of exposed structural members, and follow surface contours where possible.
- J. Support cables according to Section 260529 "Hangers and Supports for Electrical Systems."

3.4 CONNECTIONS

- A. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A-486B.
- B. Make splices, terminations, and taps that are compatible with conductor material.
- C. Wiring at Outlets: Install conductor at each outlet, with at least 6 inches of slack.

3.5 IDENTIFICATION

- A. Identify and color-code conductors and cables according to Section 260553 "Identification for Electrical Systems."
- B. Identify each spare conductor at each end with identity number and location of other end of conductor, and identify as spare conductor.

3.6 SLEEVE AND SLEEVE-SEAL INSTALLATION FOR ELECTRICAL PENETRATIONS

- A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies. Comply with requirements in Section 260544 "Sleeves and Sleeve Seals for Electrical Raceways and Cabling."

3.7 FIRESTOPPING

- A. Apply firestopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly according to Section 078413 "Penetration Firestopping."

3.8 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections:
 - 1. After installing conductors and cables and before electrical circuitry has been energized, test and service entrance and feeder conductors for compliance with requirements.
 - 2. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
- B. Test and Inspection Reports: Prepare a written report to record the following:
 - 1. Procedures used.
 - 2. Results that comply with requirements.
 - 3. Results that do not comply with requirements and corrective action taken to achieve compliance with requirements.
- C. Cables will be considered defective if they do not pass tests and inspections.

END OF SECTION 260519

SECTION 260526 - GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

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: Grounding systems and equipment.
- B. Section includes grounding systems and equipment, plus the following special applications:
 - 1. Underground distribution grounding.
 - 2. Ground bonding common with lightning protection system.

1.3 ACTION SUBMITTALS

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

1.4 INFORMATIONAL SUBMITTALS

- A. Informational Submittals: Plans showing dimensioned as-built locations of grounding features specified in "Field Quality Control" Article, including the following:
 - 1. Ground rods.
 - 2. Ground rings.
 - 3. Grounding arrangements and connections for separately derived systems.
- B. Field quality-control reports.

1.5 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For grounding to include in emergency, operation, and maintenance manuals. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:
 - 1. Instructions for periodic testing and inspection of grounding features at connections for separately derived systems based on NETA MTS.
 - a. Tests shall determine if ground-resistance or impedance values remain within specified maximums, and instructions shall recommend corrective action if values do not.
 - b. Include recommended testing intervals.

1.6 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. Comply with UL 467 for grounding and bonding materials and equipment.

PART 2 - PRODUCTS

2.1 CONDUCTORS

- A. Insulated Conductors: Copper or tinned-copper wire or cable insulated for 600 V unless otherwise required by applicable Code or authorities having jurisdiction.
- B. Bare Copper Conductors:
 - 1. Solid Conductors: ASTM B 3.
 - 2. Stranded Conductors: ASTM B 8.
 - 3. Tinned Conductors: ASTM B 33.
 - 4. Bonding Cable: 28 kmil, 14 strands of No. 17 AWG conductor, 1/4 inch in diameter.
 - 5. Bonding Conductor: No. 4 or No. 6 AWG, stranded conductor.
 - 6. Bonding Jumper: Copper tape, braided conductors terminated with copper ferrules; 1-5/8 inches wide and 1/16 inch thick.
 - 7. Tinned Bonding Jumper: Tinned-copper tape, braided conductors terminated with copper ferrules; 1-5/8 inches wide and 1/16 inch thick.
- C. Grounding Bus: Predrilled rectangular bars of annealed copper, 1/4 by 4 inches in cross section, with 9/32-inch holes spaced 1-1/8 inches apart. Stand-off insulators for mounting shall comply with UL 891 for use in switchboards, 600 V. Lexan or PVC, impulse tested at 5000 V.

2.2 CONNECTORS

- A. Listed and labeled by an NRTL acceptable to authorities having jurisdiction for applications in which used and for specific types, sizes, and combinations of conductors and other items connected.
- B. Bolted Connectors for Conductors and Pipes: Copper or copper alloy, pressure type with at least two bolts.
 - 1. Pipe Connectors: Clamp type, sized for pipe.
- C. Welded Connectors: Exothermic-welding kits of types recommended by kit manufacturer for materials being joined and installation conditions.
- D. Bus-bar Connectors: Mechanical type, cast silicon bronze, solderless compression-type wire terminals, and long-barrel, two-bolt connection to ground bus bar.

2.3 GROUNDING ELECTRODES

- A. Ground Rods: Copper-clad steel; 3/4 inch by 10 feet in diameter.

PART 3 - EXECUTION

3.1 APPLICATIONS

- A. Conductors: Install solid conductor for No. 8 AWG and smaller, and stranded conductors for No. 6 AWG and larger unless otherwise indicated.
- B. Underground Grounding Conductors: Install bare tinned-copper conductor, No. 2/0 AWG minimum.
 - 1. Bury at least 24 inches below grade.
 - 2. Duct-Bank Grounding Conductor: Bury 12 inches above duct bank when indicated as part of duct-bank installation.
- C. Isolated Grounding Conductors: Green-colored insulation with continuous yellow stripe. On feeders with isolated ground, identify grounding conductor where visible to normal inspection, with alternating bands of green and yellow tape, with at least three bands of green and two bands of yellow.
- D. Grounding Bus: Install in electrical and telephone equipment rooms, in rooms housing service equipment, and elsewhere as indicated.
 - 1. Install bus on insulated spacers 2 inches minimum from wall, 6 inches above finished floor unless otherwise indicated.
 - 2. Where indicated on both sides of doorways, route bus up to top of door frame, across top of doorway, and down to specified height above floor; connect to horizontal bus.
- E. Conductor Terminations and Connections:
 - 1. Pipe and Equipment Grounding Conductor Terminations: Bolted connectors.
 - 2. Underground Connections: Welded connectors.
 - 3. Connections to Structural Steel: Welded connectors.

3.2 GROUNDING UNDERGROUND DISTRIBUTION SYSTEM COMPONENTS

- A. Comply with IEEE C2 grounding requirements.

3.3 EQUIPMENT GROUNDING

- A. Install insulated equipment grounding conductors with all feeders and branch circuits.

- B. Install insulated equipment grounding conductors with the following items, in addition to those required by NFPA 70:
 - 1. Feeders and branch circuits.
 - 2. Lighting circuits.
 - 3. Receptacle circuits.
 - 4. Single-phase motor and appliance branch circuits.
 - 5. Three-phase motor and appliance branch circuits.
 - 6. Flexible raceway runs.
 - 7. Metal-clad cable runs.
 - 8. Computer and Rack-Mounted Electronic Equipment Circuits: Install insulated equipment grounding conductor in branch-circuit runs from equipment-area power panels.

- C. Air-Duct Equipment Circuits: Install insulated equipment grounding conductor to duct-mounted electrical devices operating at 120 V and more, including air cleaners, heaters, dampers, humidifiers, and other duct electrical equipment. Bond conductor to each unit and to air duct and connected metallic piping.

- D. Water Heater, Heat-Tracing, and Antifrost Heating Cables: Install a separate insulated equipment grounding conductor to each electric water heater and heat-tracing cable. Bond conductor to heater units, piping, connected equipment, and components.

- E. Isolated Grounding Receptacle Circuits: Install an insulated equipment grounding conductor connected to the receptacle grounding terminal. Isolate conductor from raceway and from panelboard grounding terminals. Terminate at equipment grounding conductor terminal of the applicable derived system or service unless otherwise indicated.

- F. Signal and Communication Equipment: In addition to grounding and bonding required by NFPA 70, provide a separate grounding system complying with requirements in TIA/ATIS J-STD-607-A.
 - 1. For telephone, alarm, voice and data, and other communication equipment, provide No. 4 AWG minimum insulated grounding conductor in raceway from grounding electrode system to each service location, terminal cabinet, wiring closet, and central equipment location.
 - 2. Service and Central Equipment Locations and Wiring Closets: Terminate grounding conductor on a 1/4-by-4-by-12-inch grounding bus.
 - 3. Terminal Cabinets: Terminate grounding conductor on cabinet grounding terminal.

- G. Metal Poles Supporting Outdoor Lighting Fixtures: Install grounding electrode and a separate insulated equipment grounding conductor in addition to grounding conductor installed with branch-circuit conductors.

3.4 INSTALLATION

- A. Grounding Conductors: Route along shortest and straightest paths possible unless otherwise indicated or required by Code. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.

- B. Ground Bonding Common with Lightning Protection System: Comply with NFPA 780 and UL 96 when interconnecting with lightning protection system. Bond electrical power system

ground directly to lightning protection system grounding conductor at closest point to electrical service grounding electrode. Use bonding conductor sized same as system grounding electrode conductor, and install in conduit.

- C. Ground Rods: Drive rods until tops are 2 inches below finished floor or final grade unless otherwise indicated.
 - 1. Interconnect ground rods with grounding electrode conductor below grade and as otherwise indicated. Make connections without exposing steel or damaging coating if any.
 - 2. For grounding electrode system, install at least three rods spaced at least one-rod length from each other and located at least the same distance from other grounding electrodes, and connect to the service grounding electrode conductor.
- D. Bonding Straps and Jumpers: Install in locations accessible for inspection and maintenance except where routed through short lengths of conduit.
 - 1. Bonding to Structure: Bond straps directly to basic structure, taking care not to penetrate any adjacent parts.
 - 2. Bonding to Equipment Mounted on Vibration Isolation Hangers and Supports: Install bonding so vibration is not transmitted to rigidly mounted equipment.
 - 3. Use exothermic-welded connectors for outdoor locations; if a disconnect-type connection is required, use a bolted clamp.
- E. Grounding and Bonding for Piping:
 - 1. Metal Water Service Pipe: Install insulated copper grounding conductors, in conduit, from building's main service equipment, or grounding bus, to main metal water service entrances to building. Connect grounding conductors to main metal water service pipes; use a bolted clamp connector or bolt a lug-type connector to a pipe flange by using one of the lug bolts of the flange. Where a dielectric main water fitting is installed, connect grounding conductor on street side of fitting. Bond metal grounding conductor conduit or sleeve to conductor at each end.
 - 2. Water Meter Piping: Use braided-type bonding jumpers to electrically bypass water meters. Connect to pipe with a bolted connector.
 - 3. Bond each aboveground portion of gas piping system downstream from equipment shutoff valve.
- F. Bonding Interior Metal Ducts: Bond metal air ducts to equipment grounding conductors of associated fans, blowers, electric heaters, and air cleaners. Install bonding jumper to bond across flexible duct connections to achieve continuity.
- G. Ground Ring: Install a grounding conductor, electrically connected to each building structure ground rod and to each steel column, extending around the perimeter of building.
 - 1. Install tinned-copper conductor not less than No. 2/0 AWG for ground ring and for taps to building steel.
 - 2. Bury ground ring not less than 24 inches from building's foundation.

- H. Ufer Ground (Concrete-Encased Grounding Electrode): Fabricate according to NFPA 70; use a minimum of 20 feet of bare copper conductor not smaller than No. 4 AWG.
 - 1. If concrete foundation is less than 20 feet long, coil excess conductor within base of foundation.
 - 2. Bond grounding conductor to reinforcing steel in at least four locations and to anchor bolts. Extend grounding conductor below grade and connect to building's grounding grid or to grounding electrode external to concrete.

3.5 LABELING

- A. Comply with requirements in Section 260553 "Identification for Electrical Systems" for instruction signs. The label or its text shall be green.
- B. Install labels at the telecommunications bonding conductor and grounding equalizer and at the grounding electrode conductor where exposed.
 - 1. Label Text: "If this connector or cable is loose or if it must be removed for any reason, notify the facility manager."

3.6 FIELD QUALITY CONTROL

- A. 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.
- B. Tests and Inspections:
 - 1. After installing grounding system but before permanent electrical circuits have been energized, test for compliance with requirements.
 - 2. Inspect physical and mechanical condition. Verify tightness of accessible, bolted, electrical connections with a calibrated torque wrench according to manufacturer's written instructions.
 - 3. Test completed grounding system at each location where a maximum ground-resistance level is specified, at service disconnect enclosure grounding terminal and at individual ground rods. Make tests at ground rods before any conductors are connected.
 - a. Measure ground resistance no fewer than two full days after last trace of precipitation and without soil being moistened by any means other than natural drainage or seepage and without chemical treatment or other artificial means of reducing natural ground resistance.
 - b. Perform tests by fall-of-potential method according to IEEE 81.
- C. Grounding system will be considered defective if it does not pass tests and inspections.
- D. Prepare test and inspection reports.

- E. Report measured ground resistances that exceed the following values:
1. Power and Lighting Equipment or System with Capacity of 500 kVA and Less: 10 ohms.
 2. Power and Lighting Equipment or System with Capacity of 500 to 1000 kVA: 5 ohms.
 3. Power and Lighting Equipment or System with Capacity More Than 1000 kVA: 3 ohms.
 4. Panelboards Serving Electronic Equipment: 3 ohm(s).
- F. Excessive Ground Resistance: If resistance to ground exceeds specified values, notify Architect promptly and include recommendations to reduce ground resistance.

END OF SECTION 260526

SECTION 260529 - HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

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. This Section includes the following:
 - 1. Hangers and supports for electrical equipment and systems.
 - 2. Construction requirements for concrete bases.
- B. Related Sections include the following:
 - 1. Section 260548 "Vibration and Seismic Controls for Electrical Systems" for products and installation requirements necessary for compliance with seismic criteria.

1.3 DEFINITIONS

- A. EMT: Electrical metallic tubing.
- B. IMC: Intermediate metal conduit.
- C. RMC: Rigid metal conduit.

1.4 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Design supports for multiple raceways, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
- B. Rated Strength: Adequate in tension, shear, and pullout force to resist maximum loads calculated or imposed for this Project, with a minimum structural safety factor of five times the applied force.

1.5 ACTION SUBMITTALS

- A. Product Data: For the following:
 - 1. Steel slotted support systems.
 - 2. Nonmetallic slotted support systems.

- B. Shop Drawings: Signed and sealed by a qualified professional engineer. Show fabrication and installation details and include calculations for the following:
 - 1. Trapeze hangers. Include Product Data for components.
 - 2. Steel slotted channel systems. Include Product Data for components.
 - 3. Nonmetallic slotted channel systems. Include Product Data for components.
 - 4. Equipment supports.

1.6 INFORMATIONAL SUBMITTALS

- A. Welding certificates.

1.7 QUALITY ASSURANCE

- A. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
- B. Comply with NFPA 70.

1.8 COORDINATION

- A. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified together with concrete Specifications.
- B. Coordinate installation of roof curbs, equipment supports, and roof penetrations. These items are specified in Section 077200 "Roof Accessories."

PART 2 - PRODUCTS

2.1 SUPPORT, ANCHORAGE, AND ATTACHMENT COMPONENTS

- A. Steel Slotted Support Systems: Comply with MFMA-4, factory-fabricated components for field assembly.
 - 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Allied Tube & Conduit.
 - b. Cooper B-Line, Inc.; a division of Cooper Industries.
 - c. ERICO International Corporation.
 - d. GS Metals Corp.
 - e. Thomas & Betts Corporation.
 - f. Unistrut; Tyco International, Ltd.
 - g. Wesanco, Inc.
 - 2. Metallic Coatings: Hot-dip galvanized after fabrication and applied according to MFMA-4.

3. Nonmetallic Coatings: Manufacturer's standard PVC, polyurethane, or polyester coating applied according to MFMA-4.
 4. Painted Coatings: Manufacturer's standard painted coating applied according to MFMA-4.
 5. Channel Dimensions: Selected for applicable load criteria.
- B. Nonmetallic Slotted Support Systems: Structural-grade, factory-formed, glass-fiber-resin channels and angles with 9/16-inch-diameter holes at a maximum of 8 inches o.c., in at least 1 surface.
1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Allied Tube & Conduit.
 - b. Cooper B-Line, Inc.; a division of Cooper Industries.
 - c. Fabco Plastics Wholesale Limited.
 - d. Seasafe, Inc.
 2. Fittings and Accessories: Products of channel and angle manufacturer and designed for use with those items.
 3. Fitting and Accessory Materials: Same as channels and angles.
 4. Rated Strength: Selected to suit applicable load criteria.
- C. Raceway and Cable Supports: As described in NECA 1 and NECA 101.
- D. Conduit and Cable Support Devices: Steel hangers, clamps, and associated fittings, designed for types and sizes of raceway or cable to be supported.
- E. Support for Conductors in Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug or plugs for non-armored electrical conductors or cables in riser conduits. Plugs shall have number, size, and shape of conductor gripping pieces as required to suit individual conductors or cables supported. Body shall be malleable iron.
- F. Structural Steel for Fabricated Supports and Restraints: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.
- G. Mounting, Anchoring, and Attachment Components: Items for fastening electrical items or their supports to building surfaces include the following:
1. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete, steel, or wood, with tension, shear, and pullout capacities appropriate for supported loads and building materials where used.
 - a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1) Hilti Inc.
 - 2) ITW Ramset/Red Head; a division of Illinois Tool Works, Inc.
 - 3) MKT Fastening, LLC.
 - 4) Simpson Strong-Tie Co., Inc.; Masterset Fastening Systems Unit.

2. Mechanical-Expansion Anchors: Insert-wedge-type, zinc-coated steel, for use in hardened portland cement concrete with tension, shear, and pullout capacities appropriate for supported loads and building materials in which used.
 - a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1) Cooper B-Line, Inc.; a division of Cooper Industries.
 - 2) Empire Tool and Manufacturing Co., Inc.
 - 3) Hilti Inc.
 - 4) ITW Ramset/Red Head; a division of Illinois Tool Works, Inc.
 - 5) MKT Fastening, LLC.
3. Concrete Inserts: Steel or malleable-iron, slotted support system units similar to MSS Type 18; complying with MFMA-4 or MSS SP-58.
4. Clamps for Attachment to Steel Structural Elements: MSS SP-58, type suitable for attached structural element.
5. Through Bolts: Structural type, hex head, and high strength. Comply with ASTM A 325.
6. Toggle Bolts: All-steel springhead type.
7. Hanger Rods: Threaded steel.

2.2 FABRICATED METAL EQUIPMENT SUPPORT ASSEMBLIES

- A. Description: Welded or bolted, structural-steel shapes, shop or field fabricated to fit dimensions of supported equipment.
- B. Materials: Comply with requirements in Section 055000 "Metal Fabrications" for steel shapes and plates.

PART 3 - EXECUTION

3.1 APPLICATION

- A. Comply with NECA 1 and NECA 101 for application of hangers and supports for electrical equipment and systems except if requirements in this Section are stricter.
- B. Maximum Support Spacing and Minimum Hanger Rod Size for Raceway: Space supports for EMT, IMC, and RMC as required by NFPA 70. Minimum rod size shall be 1/4 inch in diameter.
- C. Multiple Raceways or Cables: Install trapeze-type supports fabricated with steel slotted or other support system, sized so capacity can be increased by at least 25 percent in future without exceeding specified design load limits.
 1. Secure raceways and cables to these supports with two-bolt conduit clamps.

3.2 SUPPORT INSTALLATION

- A. Comply with NECA 1 and NECA 101 for installation requirements except as specified in this Article.
- B. Raceway Support Methods: In addition to methods described in NECA 1, EMT, IMC, and RMC may be supported by openings through structure members, as permitted in NFPA 70.
- C. Strength of Support Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 lb.
- D. Mounting and Anchorage of Surface-Mounted Equipment and Components: Anchor and fasten electrical items and their supports to building structural elements by the following methods unless otherwise indicated by code:
 - 1. To Wood: Fasten with lag screws or through bolts.
 - 2. To New Concrete: Bolt to concrete inserts.
 - 3. To Masonry: Approved toggle-type bolts on hollow masonry units and expansion anchor fasteners on solid masonry units.
 - 4. To Existing Concrete: Expansion anchor fasteners.
 - 5. Instead of expansion anchors, powder-actuated driven threaded studs provided with lock washers and nuts may be used in existing standard-weight concrete 4 inches thick or greater. Do not use for anchorage to lightweight-aggregate concrete or for slabs less than 4 inches thick.
 - 6. To Steel: Beam clamps (MSS Type 19, 21, 23, 25, or 27) complying with MSS SP-69.
 - 7. To Light Steel: Sheet metal screws.
 - 8. Items Mounted on Hollow Walls and Nonstructural Building Surfaces: Mount cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices on slotted-channel racks attached to substrate by means that meet seismic-restraint strength and anchorage requirements.
- E. Drill holes for expansion anchors in concrete at locations and to depths that avoid reinforcing bars.

3.3 INSTALLATION OF FABRICATED METAL SUPPORTS

- A. Comply with installation requirements in Section 055000 "Metal Fabrications" for site-fabricated metal supports.
- B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor electrical materials and equipment.
- C. Field Welding: Comply with AWS D1.1/D1.1M.

3.4 CONCRETE BASES

- A. Construct concrete bases of dimensions indicated but not less than 4 inches larger in both directions than supported unit, and so anchors will be a minimum of 10 bolt diameters from edge of the base.
- B. Use 3000-psi, 28-day compressive-strength concrete. Concrete materials, reinforcement, and placement requirements are specified in Section 033000 "Cast-in-Place Concrete."
 - 1. Form concrete pads with framing lumber with form release compounds. Chamfer top edge and corners of pad. Paint top, chamfered areas, and floor area 4 inches around sides with black paint. Paint sides yellow. Paint with concrete paint to match existing facility standard. Verify paint type with Owner.
 - 2. Install reinforcing bars, tied to frame, and place anchor bolts and sleeves to facilitate securing units.
 - 3. Place concrete and allow to cure before installation of units.
- C. Anchor equipment to concrete base.
 - 1. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 - 2. Install anchor bolts to elevations required for proper attachment to supported equipment.
 - 3. Install anchor bolts according to anchor-bolt manufacturer's written instructions.

3.5 PAINTING

- A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.
 - 1. Apply paint by brush or spray to provide minimum dry film thickness of 2.0 mils.
- B. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

END OF SECTION 260529

SECTION 260533 - RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS

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. Metal conduits, tubing, and fittings.
2. Nonmetal conduits, tubing, and fittings.
3. Metal wireways and auxiliary gutters.
4. Boxes, enclosures, and cabinets.

B. Related Requirements:

1. Section 260543 "Underground Ducts and Raceways for Electrical Systems" for exterior ductbanks, manholes, and underground utility construction.
2. Section 270528 "Pathways for Communications Systems" for conduits, wireways, surface pathways, innerduct, boxes, faceplate adapters, enclosures, cabinets, and handholes serving communications systems.

1.3 DEFINITIONS

- A. GRC: Galvanized rigid steel conduit.
- B. IMC: Intermediate metal conduit.

1.4 ACTION SUBMITTALS

- A. Product Data: For surface raceways, wireways and fittings, floor boxes, hinged-cover enclosures, and cabinets.

1.5 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Conduit routing plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of items involved:
 1. Structural members in paths of conduit groups with common supports.
 2. HVAC and plumbing items and architectural features in paths of conduit groups with common supports.
- B. Qualification Data: For professional engineer.

- C. Seismic Qualification Certificates: For enclosures, cabinets, and conduit racks and their mounting provisions, including those for internal 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.
 - 4. Detailed description of conduit support devices and interconnections on which the certification is based and their installation requirements.
- D. Source quality-control reports.

PART 2 - PRODUCTS

2.1 METAL CONDUITS, TUBING, AND FITTINGS

- A. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - 1. AFC Cable Systems, Inc.
 - 2. Allied Tube & Conduit; a Tyco International Ltd. Co.
 - 3. Anamet Electrical, Inc.
 - 4. Electri-Flex Company.
 - 5. O-Z/Gedney; a brand of EGS Electrical Group.
 - 6. Picoma Industries, a subsidiary of Mueller Water Products, Inc.
 - 7. Republic Conduit.
 - 8. Robroy Industries.
 - 9. Southwire Company.
 - 10. Thomas & Betts Corporation.
 - 11. Western Tube and Conduit Corporation.
 - 12. Wheatland Tube Company; a division of John Maneely Company.
- B. Listing and Labeling: Metal conduits, tubing, and fittings shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- C. GRC: Comply with ANSI C80.1 and UL 6.
- D. IMC: Comply with ANSI C80.6 and UL 1242.
- E. PVC-Coated Steel Conduit: PVC-coated rigid steel conduit.
 - 1. Comply with NEMA RN 1.
 - 2. Coating Thickness: 0.040 inch, minimum.
- F. EMT: Comply with ANSI C80.3 and UL 797.
- G. FMC: Comply with UL 1; zinc-coated steel.
- H. LFMC: Flexible steel conduit with PVC jacket and complying with UL 360.

- I. Fittings for Metal Conduit: Comply with NEMA FB 1 and UL 514B.
 - 1. Conduit Fittings for Hazardous (Classified) Locations: Comply with UL 886 and NFPA 70.
 - 2. Fittings for EMT:
 - a. Material: Steel.
 - b. Type: Compression.
 - 3. Expansion Fittings: PVC or steel to match conduit type, complying with UL 651, rated for environmental conditions where installed, and including flexible external bonding jumper.
 - 4. Coating for Fittings for PVC-Coated Conduit: Minimum thickness of 0.040 inch, with overlapping sleeves protecting threaded joints.
- J. Joint Compound for IMC, GRC, or ARC: Approved, as defined in NFPA 70, by authorities having jurisdiction for use in conduit assemblies, and compounded for use to lubricate and protect threaded conduit joints from corrosion and to enhance their conductivity.

2.2 NONMETALLIC CONDUITS, TUBING, AND FITTINGS

- A. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - 1. AFC Cable Systems, Inc.
 - 2. Anamet Electrical, Inc.
 - 3. Arneo Corporation.
 - 4. CANTEX Inc.
 - 5. CertainTeed Corp.
 - 6. Condux International, Inc.
 - 7. Electri-Flex Company.
 - 8. Kraloy.
 - 9. Lamson & Sessions; Carlon Electrical Products.
 - 10. Niedax-Kleinhuis USA, Inc.
 - 11. RACO; a Hubbell company.
 - 12. Thomas & Betts Corporation.
- B. Listing and Labeling: Nonmetallic conduits, tubing, and fittings shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- C. ENT: Comply with NEMA TC 13 and UL 1653.
- D. RNC: Type EPC-40-PVC, complying with NEMA TC 2 and UL 651 unless otherwise indicated.
- E. LFNC: Comply with UL 1660.
- F. Rigid HDPE: Comply with UL 651A.
- G. Continuous HDPE: Comply with UL 651B.

- H. Coilable HDPE: Preassembled with conductors or cables, and complying with ASTM D 3485.
- I. RTRC: Comply with UL 1684A and NEMA TC 14.
- J. Fittings for ENT and RNC: Comply with NEMA TC 3; match to conduit or tubing type and material.
- K. Fittings for LFNC: Comply with UL 514B.
- L. Solvent cements and adhesive primers shall have a VOC content of 510 and 550 g/L or less, respectively, when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.3 METAL WIREWAYS AND AUXILIARY GUTTERS

- A. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - 1. Cooper B-Line, Inc.
 - 2. Hoffman; a Pentair company.
 - 3. Mono-Systems, Inc.
 - 4. Square D; a brand of Schneider Electric.
- B. Description: Sheet metal, complying with UL 870 and NEMA 250, Type 1 unless otherwise indicated, and sized according to NFPA 70.
 - 1. Metal wireways installed outdoors shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- C. Fittings and Accessories: Include covers, couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for complete system.
- D. Wireway Covers: Screw-cover type unless otherwise indicated.
- E. Finish: Manufacturer's standard enamel finish.

2.4 BOXES, ENCLOSURES, AND CABINETS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Adalet.
 - 2. Cooper Technologies Company; Cooper Crouse-Hinds.
 - 3. EGS/Appleton Electric.
 - 4. Erickson Electrical Equipment Company.
 - 5. FSR Inc.
 - 6. Hoffman; a Pentair company.
 - 7. Hubbell Incorporated; Killark Division.
 - 8. Kraloy.
 - 9. Milbank Manufacturing Co.
 - 10. Mono-Systems, Inc.
 - 11. O-Z/Gedney; a brand of EGS Electrical Group.

12. RACO; a Hubbell Company.
 13. Robroy Industries.
 14. Spring City Electrical Manufacturing Company.
 15. Stahlin Non-Metallic Enclosures; a division of Robroy Industries.
 16. Thomas & Betts Corporation.
 17. Wiremold / Legrand.
- B. General Requirements for Boxes, Enclosures, and Cabinets: Boxes, enclosures, and cabinets installed in wet locations shall be listed for use in wet locations.
- C. Sheet Metal Outlet and Device Boxes: Comply with NEMA OS 1 and UL 514A.
- D. Cast-Metal Outlet and Device Boxes: Comply with NEMA FB 1, ferrous alloy, Type FD, with gasketed cover.
- E. Nonmetallic Outlet and Device Boxes: Comply with NEMA OS 2 and UL 514C.
- F. Metal Floor Boxes:
1. Material: Cast metal or sheet metal.
 2. Type: Fully adjustable.
 3. Shape: Rectangular.
 4. Listing and Labeling: Metal floor boxes shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- G. Luminaire Outlet Boxes: Nonadjustable, designed for attachment of luminaire weighing 50 lb. Outlet boxes designed for attachment of luminaires weighing more than 50 lb shall be listed and marked for the maximum allowable weight.
- H. Paddle Fan Outlet Boxes: Nonadjustable, designed for attachment of paddle fan weighing 70 lb.
1. Listing and Labeling: Paddle fan outlet boxes shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- I. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.
- J. Cast-Metal Access, Pull, and Junction Boxes: Comply with NEMA FB 1 and UL 1773, cast aluminum with gasketed cover.
- K. Box extensions used to accommodate new building finishes shall be of same material as recessed box.
- L. Device Box Dimensions: 4 inches by 2-1/8 inches by 2-1/8 inches deep.
- M. Gangable boxes are allowed.
- N. Hinged-Cover Enclosures: Comply with UL 50 and NEMA 250, Type 1 with continuous-hinge cover with flush latch unless otherwise indicated.

1. Metal Enclosures: Steel, finished inside and out with manufacturer's standard enamel.
2. Nonmetallic Enclosures: Plastic.
3. Interior Panels: Steel; all sides finished with manufacturer's standard enamel.

O. Cabinets:

1. NEMA 250, Type 1 galvanized-steel box with removable interior panel and removable front, finished inside and out with manufacturer's standard enamel.
2. Hinged door in front cover with flush latch and concealed hinge.
3. Key latch to match panelboards.
4. Metal barriers to separate wiring of different systems and voltage.
5. Accessory feet where required for freestanding equipment.
6. Nonmetallic cabinets shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

PART 3 - EXECUTION

3.1 RACEWAY APPLICATION

A. Outdoors: Apply raceway products as specified below unless otherwise indicated:

1. Exposed Conduit: IMC.
2. Concealed Conduit, Aboveground: EMT.
3. Underground Conduit: RNC, Type EPC-40-PVC, encased.
4. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFMC.
5. Boxes and Enclosures, Aboveground: NEMA 250, Type 3R.

B. Indoors: Apply raceway products as specified below unless otherwise indicated:

1. Exposed, Not Subject to Physical Damage: EMT.
2. Exposed, Not Subject to Severe Physical Damage: EMT.
3. Exposed and Subject to Severe Physical Damage: GRC. Raceway locations include the following:
 - a. Apparatus Bay.
 - b. Mechanical rooms.
4. Concealed in Ceilings and Interior Walls and Partitions: EMT.
5. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): FMC, except use LFMC in damp or wet locations.
6. Damp or Wet Locations: GRC.
7. Boxes and Enclosures: NEMA 250, Type 1, except use NEMA 250, Type 4 stainless steel in institutional and commercial kitchens and damp or wet locations.

C. Minimum Raceway Size: 3/4-inch trade size.

D. Raceway Fittings: Compatible with raceways and suitable for use and location.

1. Rigid and Intermediate Steel Conduit: Use threaded rigid steel conduit fittings unless otherwise indicated. Comply with NEMA FB 2.10.
 2. PVC Externally Coated, Rigid Steel Conduits: Use only fittings listed for use with this type of conduit. Patch and seal all joints, nicks, and scrapes in PVC coating after installing conduits and fittings. Use sealant recommended by fitting manufacturer and apply in thickness and number of coats recommended by manufacturer.
 3. EMT: Use compression, steel fittings. Comply with NEMA FB 2.10.
 4. Flexible Conduit: Use only fittings listed for use with flexible conduit. Comply with NEMA FB 2.20.
- E. Install nonferrous conduit or tubing for circuits operating above 60 Hz. Where aluminum raceways are installed for such circuits and pass through concrete, install in nonmetallic sleeve.
- F. Do not install aluminum conduits, boxes, or fittings in contact with concrete or earth.
- G. Install surface raceways only where indicated on Drawings.
- H. Do not install nonmetallic conduit where ambient temperature exceeds 120 deg F.

3.2 INSTALLATION

- A. Comply with NECA 1 and NECA 101 for installation requirements except where requirements on Drawings or in this article are stricter. Comply with NECA 102 for aluminum conduits. Comply with NFPA 70 limitations for types of raceways allowed in specific occupancies and number of floors.
- B. Keep raceways at least 6 inches away from parallel runs of flues and steam or hot-water pipes. Install horizontal raceway runs above water and steam piping.
- C. Complete raceway installation before starting conductor installation.
- D. Comply with requirements in Section 260529 "Hangers and Supports for Electrical Systems" for hangers and supports.
- E. Arrange stub-ups so curved portions of bends are not visible above finished slab.
- F. Install no more than the equivalent of three 90-degree bends in any conduit run except for control wiring conduits, for which fewer bends are allowed. Support within 12 inches of changes in direction.
- G. Conceal conduit and EMT within finished walls, ceilings, and floors unless otherwise indicated. Install conduits parallel or perpendicular to building lines.
- H. Support conduit within 12 inches of enclosures to which attached. Provide support straps intended for this type of installation.
- I. Raceways Embedded in Slabs:
 1. Run conduit larger than 1-inch trade size, parallel or at right angles to main reinforcement. Where at right angles to reinforcement, place conduit close to slab support. Secure raceways to reinforcement at maximum 10-foot intervals.

2. Arrange raceways to cross building expansion joints at right angles with expansion fittings.
 3. Arrange raceways to keep a minimum of 1 inch of concrete cover in all directions.
 4. Do not embed threadless fittings in concrete unless specifically approved by Architect for each specific location.
 5. Change from ENT to GRC before rising above floor.
- J. Stub-ups to Above Recessed Ceilings:
1. Use EMT, IMC, or RMC for raceways.
 2. Use a conduit bushing or insulated fitting to terminate stub-ups not terminated in hubs or in an enclosure.
- K. Threaded Conduit Joints, Exposed to Wet, Damp, Corrosive, or Outdoor Conditions: Apply listed compound to threads of raceway and fittings before making up joints. Follow compound manufacturer's written instructions.
- L. Coat field-cut threads on PVC-coated raceway with a corrosion-preventing conductive compound prior to assembly.
- M. Raceway Terminations at Locations Subject to Moisture or Vibration: Use insulating bushings to protect conductors including conductors smaller than No. 4 AWG.
- N. Terminate threaded conduits into threaded hubs or with locknuts on inside and outside of boxes or cabinets. Install bushings on conduits up to 1-1/4-inch trade size and insulated throat metal bushings on 1-1/2-inch trade size and larger conduits terminated with locknuts. Install insulated throat metal grounding bushings on service conduits.
- O. Install raceways square to the enclosure and terminate at enclosures with locknuts. Install locknuts hand tight plus 1/4 turn more.
- P. Do not rely on locknuts to penetrate nonconductive coatings on enclosures. Remove coatings in the locknut area prior to assembling conduit to enclosure to assure a continuous ground path.
- Q. Cut conduit perpendicular to the length. For conduits 2-inch trade size and larger, use roll cutter or a guide to make cut straight and perpendicular to the length.
- R. Install pull wires in empty raceways. Use polypropylene or monofilament plastic line with not less than 200-lb tensile strength. Leave at least 12 inches of slack at each end of pull wire. Cap underground raceways designated as spare above grade alongside raceways in use.
- S. Install raceway sealing fittings at accessible locations according to NFPA 70 and fill them with listed sealing compound. For concealed raceways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces. Install raceway sealing fittings according to NFPA 70.
- T. Install devices to seal raceway interiors at accessible locations. Locate seals so no fittings or boxes are between the seal and the following changes of environments. Seal the interior of all raceways at the following points:

1. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.
 2. Where an underground service raceway enters a building or structure.
 3. Where otherwise required by NFPA 70.
- U. Comply with manufacturer's written instructions for solvent welding RNC and fittings.
- V. Expansion-Joint Fittings:
1. Install in each run of aboveground RNC that is located where environmental temperature change may exceed 30 deg F and that has straight-run length that exceeds 25 feet. Install in each run of aboveground RMC and EMT conduit that is located where environmental temperature change may exceed 100 deg F and that has straight-run length that exceeds 100 feet.
 2. Install type and quantity of fittings that accommodate temperature change listed for each of the following locations:
 - a. Outdoor Locations Not Exposed to Direct Sunlight: 125 deg F temperature change.
 - b. Outdoor Locations Exposed to Direct Sunlight: 155 deg F temperature change.
 - c. Indoor Spaces Connected with Outdoors without Physical Separation: 125 deg F temperature change.
 - d. Attics: 135 deg F temperature change.
 3. Install fitting(s) that provide expansion and contraction for at least 0.00041 inch per foot of length of straight run per deg F of temperature change for PVC conduits. Install fitting(s) that provide expansion and contraction for at least 0.000078 inch per foot of length of straight run per deg F of temperature change for metal conduits.
 4. Install expansion fittings at all locations where conduits cross building or structure expansion joints.
 5. Install each expansion-joint fitting with position, mounting, and piston setting selected according to manufacturer's written instructions for conditions at specific location at time of installation. Install conduit supports to allow for expansion movement.
- W. Flexible Conduit Connections: Comply with NEMA RV 3. Use a maximum of 72 inches of flexible conduit for recessed and semirecessed luminaires, equipment subject to vibration, noise transmission, or movement; and for transformers and motors.
1. Use LFMC in damp or wet locations subject to severe physical damage.
 2. Use LFMC or LFNC in damp or wet locations not subject to severe physical damage.
- X. Mount boxes at heights indicated on Drawings. If mounting heights of boxes are not individually indicated, give priority to ADA requirements. Install boxes with height measured to top of box unless otherwise indicated.
- Y. Recessed Boxes in Masonry Walls: Saw-cut opening for box in center of cell of masonry block, and install box flush with surface of wall. Prepare block surfaces to provide a flat surface for a raintight connection between box and cover plate or supported equipment and box.
- Z. Horizontally separate boxes mounted on opposite sides of walls so they are not in the same vertical channel.

- AA. Locate boxes so that cover or plate will not span different building finishes.
- BB. Support boxes of three gangs or more from more than one side by spanning two framing members or mounting on brackets specifically designed for the purpose.
- CC. Fasten junction and pull boxes to or support from building structure. Do not support boxes by conduits.
- DD. Set metal floor boxes level and flush with finished floor surface.
- EE. Set nonmetallic floor boxes level. Trim after installation to fit flush with finished floor surface.

3.3 INSTALLATION OF UNDERGROUND CONDUIT

A. Direct-Buried Conduit:

1. Excavate trench bottom to provide firm and uniform support for conduit. Prepare trench bottom as specified in Section 312000 "Earth Moving" for pipe less than 6 inches in nominal diameter.
2. Install backfill as specified in Section 312000 "Earth Moving."
3. After installing conduit, backfill and compact. Start at tie-in point, and work toward end of conduit run, leaving conduit at end of run free to move with expansion and contraction as temperature changes during this process. Firmly hand tamp backfill around conduit to provide maximum supporting strength. After placing controlled backfill to within 12 inches of finished grade, make final conduit connection at end of run and complete backfilling with normal compaction as specified in Section 312000 "Earth Moving."
4. Install manufactured duct elbows for stub-ups at poles and equipment and at building entrances through floor unless otherwise indicated. Encase elbows for stub-up ducts throughout length of elbow.
5. Install manufactured rigid steel conduit elbows for stub-ups at poles and equipment and at building entrances through floor.
 - a. Couple steel conduits to ducts with adapters designed for this purpose, and encase coupling with 3 inches of concrete for a minimum of 12 inches on each side of the coupling.
 - b. For stub-ups at equipment mounted on outdoor concrete bases and where conduits penetrate building foundations, extend steel conduit horizontally a minimum of 60 inches from edge of foundation or equipment base. Install insulated grounding bushings on terminations at equipment.
6. Warning Planks: Bury warning planks approximately 12 inches above direct-buried conduits but a minimum of 6 inches below grade. Align planks along centerline of conduit.
7. Underground Warning Tape: Comply with requirements in Section 260553 "Identification for Electrical Systems."

3.4 SLEEVE AND SLEEVE-SEAL INSTALLATION FOR ELECTRICAL PENETRATIONS

- A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies. Comply with requirements in Section 260544 "Sleeves and Sleeve Seals for Electrical Raceways and Cabling."

3.5 FIRESTOPPING

- A. Install firestopping at penetrations of fire-rated floor and wall assemblies. Comply with requirements in Section 078413 "Penetration Firestopping."

3.6 PROTECTION

- A. Protect coatings, finishes, and cabinets from damage and deterioration.
 - 1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
 - 2. Repair damage to PVC coatings or paint finishes with matching touchup coating recommended by manufacturer.

END OF SECTION 260533

SECTION 260543 - UNDERGROUND DUCTS AND RACEWAYS FOR ELECTRICAL SYSTEMS

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. This Section includes the following:
 - 1. Conduit, ducts, and duct accessories for concrete-encased duct banks.
 - 2. Handholes and boxes.

1.3 DEFINITION

- A. RNC: Rigid nonmetallic conduit.

1.4 ACTION SUBMITTALS

- A. Product Data: For the following:
 - 1. Duct-bank materials, including separators and miscellaneous components.
 - 2. Ducts and conduits and their accessories, including elbows, end bells, bends, fittings, and solvent cement.
 - 3. Accessories for handholes and boxes.
 - 4. Warning tape.
- B. Shop Drawings for Factory-Fabricated Handholes and Boxes Other Than Precast Concrete: Include dimensioned plans, sections, and elevations, and fabrication and installation details, including the following:
 - 1. Duct entry provisions, including locations and duct sizes.
 - 2. Cover design.
 - 3. Grounding details.
 - 4. Dimensioned locations of cable rack inserts, and pulling-in and lifting irons.

1.5 INFORMATIONAL SUBMITTALS

- A. Duct-Bank Coordination Drawings: Show duct profiles and coordination with other utilities and underground structures.
 - 1. Include plans and sections, drawn to scale, and show bends and locations of expansion fittings.
 - 2. Drawings shall be signed and sealed by a qualified professional engineer.

- B. Product Certificates: For concrete and steel used in precast concrete handholes, as required by ASTM C 858.
- C. Qualification Data: For professional engineer and testing agency.
- D. Source quality-control test reports.
- E. Field quality-control test reports.

1.6 QUALITY ASSURANCE

- A. Testing Agency Qualifications: Qualified according to ASTM E 329 for testing indicated.
- B. Comply with ANSI C2.
- C. Comply with NFPA 70.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver ducts to Project site with ends capped. Store nonmetallic ducts with supports to prevent bending, warping, and deforming.
- B. Store precast concrete underground utility structures at Project site as recommended by manufacturer to prevent physical damage. Arrange so identification markings are visible.
- C. Lift and support precast concrete units only at designated lifting or supporting points.

1.8 PROJECT CONDITIONS

- A. Interruption of Existing Electrical Service: Do not interrupt electrical service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary electrical service according to requirements indicated:
 - 1. Notify Architect no fewer than two days in advance of proposed interruption of electrical service.
 - 2. Do not proceed with interruption of electrical service without Architect's written permission.

1.9 COORDINATION

- A. Coordinate layout and installation of ducts, handholes, and boxes with final arrangement of other utilities, site grading, and surface features as determined in the field.
- B. Coordinate elevations of ducts and duct-bank entrances into handholes and boxes with final locations and profiles of ducts and duct banks as determined by coordination with other utilities, underground obstructions, and surface features. Revise locations and elevations from those indicated as required to suit field conditions and to ensure that duct runs drain to manholes and handholes, and as approved by Architect.

PART 2 - PRODUCTS

2.1 CONDUIT

- A. Rigid Steel Conduit: Galvanized. Comply with ANSI C80.1.
- B. RNC: NEMA TC 2, Type EPC-40-PVC, UL 651, with matching fittings by same manufacturer as the conduit, complying with NEMA TC 3 and UL 514B.

2.2 NONMETALLIC DUCTS AND DUCT ACCESSORIES

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. [ARNCO Corp.](#)
2. [Beck Manufacturing.](#)
3. [Cantex, Inc.](#)
4. [CertainTeed Corp.: Pipe & Plastics Group.](#)
5. [Condux International, Inc.](#)
6. [ElecSys, Inc.](#)
7. [Electri-Flex Company.](#)
8. [IPEX Inc.](#)
9. [Lamson & Sessions; Carlon Electrical Products.](#)
10. [Manhattan/CDT; a division of Cable Design Technologies.](#)
11. [Spiraduct/AFC Cable Systems, Inc.](#)

- B. Duct Accessories:

1. Duct Separators: Factory-fabricated rigid PVC interlocking spacers, sized for type and sizes of ducts with which used, and selected to provide minimum duct spacings indicated while supporting ducts during concreting or backfilling.
2. Warning Tape: Underground-line warning tape specified in Section 260553 "Identification for Electrical Systems."

2.3 HANDHOLES AND BOXES OTHER THAN PRECAST CONCRETE

- A. Description: Comply with SCTE 77.

1. Color: Gray.
2. Configuration: Units shall be designed for flush burial and have open bottom, unless otherwise indicated.
3. Cover: Weatherproof, secured by tamper-resistant locking devices and having structural load rating consistent with enclosure.
4. Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.
5. Cover Legend: Molded lettering, "ELECTRIC."
6. Direct-Buried Wiring Entrance Provisions: Knockouts equipped with insulated bushings or end-bell fittings, selected to suit box material, sized for wiring indicated, and arranged for secure, fixed installation in enclosure wall.
7. Duct Entrance Provisions: Duct-terminating fittings shall mate with entering ducts for secure, fixed installation in enclosure wall.

8. Handholes 12 inches wide by 24 inches long and larger shall have factory-installed inserts for cable racks and pulling-in irons.
- B. Polymer Concrete Handholes and Boxes with Polymer Concrete Cover: Molded of sand and aggregate, bound together with a polymer resin, and reinforced with steel or fiberglass or a combination of the two.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. [Armorcast Products Company.](#)
 - b. [Carson Industries LLC.](#)
 - c. [CDR Systems Corporation.](#)
 - d. [NewBasis.](#)

2.4 SOURCE QUALITY CONTROL

- A. Test and inspect precast concrete utility structures according to ASTM C 1037.
- B. Nonconcrete Handhole and Pull-Box Prototype Test: Test prototypes of manholes and boxes for compliance with SCTE 77. Strength tests shall be for specified tier ratings of products supplied.
1. Tests of materials shall be performed by a independent testing agency.
 2. Strength tests of complete boxes and covers shall be by either an independent testing agency or the manufacturer. A qualified registered professional engineer shall certify tests by manufacturer.
 3. Testing machine pressure gages shall have current calibration certification complying with ISO 9000 and ISO 10012, and traceable to NIST standards.

PART 3 - EXECUTION

3.1 UNDERGROUND DUCT APPLICATION

- A. Ducts for Electrical Feeders 600 V and Less: RNC, NEMA Type EPC-40-PVC, in concrete-encased duct bank, unless otherwise indicated.
- B. Ducts for Electrical Feeders 600 V and Less: RNC, NEMA Type EPC-40-PVC, in direct-buried duct bank, unless otherwise indicated.
- C. Ducts for Electrical Branch Circuits: RNC, NEMA Type EPC-40-PVC, in direct-buried duct bank, unless otherwise indicated.
- D. Underground Ducts for Telephone, Communications, or Data Utility Service Cables: RNC, NEMA Type EPC-40-PVC, in concrete-encased duct bank, unless otherwise indicated.
- E. Underground Ducts for Telephone, Communications, or Data Utility Service Cables: RNC, NEMA Type EPC-40-PVC direct-buried duct bank, unless otherwise indicated.

- F. Underground Ducts for Telephone, Communications, or Data Circuits: RNC, NEMA Type EPC-40-PVC, in direct-buried duct bank, unless otherwise indicated.
- G. Underground Ducts Crossing Driveways: RNC, NEMA Type EPC-40-PVC, encased in reinforced concrete.

3.2 UNDERGROUND ENCLOSURE APPLICATION

- A. Handholes and Boxes for 600 V and Less[, Including Telephone, Communications, and Data Wiring:
 - 1. Units in Roadways and Other Deliberate Traffic Paths: Precast concrete. AASHTO HB 17, H-20 structural load rating.
 - 2. Units in Driveway, Parking Lot, and Off-Roadway Locations, Subject to Occasional, Nondeliberate Loading by Heavy Vehicles: Polymer concrete, SCTE 77, Tier 15 structural load rating.
 - 3. Units in Sidewalk and Similar Applications with a Safety Factor for Nondeliberate Loading by Vehicles: Polymer concrete units, SCTE 77, Tier 8 structural load rating.
 - 4. Units Subject to Light-Duty Pedestrian Traffic Only: Fiberglass-reinforced polyester resin, structurally tested according to SCTE 77 with 3000-lbf vertical loading.

3.3 EARTHWORK

- A. Excavation and Backfill: Comply with Section 312000 "Earth Moving," but do not use heavy-duty, hydraulic-operated, compaction equipment.
- B. Restore surface features at areas disturbed by excavation and reestablish original grades, unless otherwise indicated. Replace removed sod immediately after backfilling is completed.
- C. Restore areas disturbed by trenching, storing of dirt, cable laying, and other work. Restore vegetation and include necessary topsoiling, fertilizing, liming, seeding, sodding, sprigging, and mulching. Comply with Section 329200 "Turf and Grasses" and Section 329300 "Plants."
- D. Cut and patch existing pavement in the path of underground ducts and utility structures according to Section 017329 "Cutting and Patching."

3.4 DUCT INSTALLATION

- A. Slope: Pitch ducts a minimum slope of 1:300 down toward manholes and handholes and away from buildings and equipment. Slope ducts from a high point in runs between two manholes to drain in both directions.
- B. Curves and Bends: Use 5-degree angle couplings for small changes in direction. Use manufactured long sweep bends with a minimum radius of 48 inches, both horizontally and vertically, at other locations, unless otherwise indicated.
- C. Joints: Use solvent-cemented joints in ducts and fittings and make watertight according to manufacturer's written instructions. Stagger couplings so those of adjacent ducts do not lie in same plane.

- D. Duct Entrances to Polymer Concrete Handholes: Use end bells, spaced approximately 10 inches o.c. for 5-inch ducts, and vary proportionately for other duct sizes.
1. Begin change from regular spacing to end-bell spacing 10 feet from the end bell without reducing duct line slope and without forming a trap in the line.
 2. Direct-Buried Duct Banks: Install an expansion and deflection fitting in each conduit in the area of disturbed earth adjacent to manhole or handhole.
 3. Grout end bells into structure walls from both sides to provide watertight entrances.
- E. Building Wall Penetrations: Make a transition from underground duct to rigid steel conduit at least 10 feet outside the building wall without reducing duct line slope away from the building, and without forming a trap in the line. Use fittings manufactured for duct-to-conduit transition. Install conduit penetrations of building walls as specified in Section 260544 "Sleeves and Sleeve Seals for Electrical Raceways and Cabling."
- F. Sealing: Provide temporary closure at terminations of ducts that have cables pulled. Seal spare ducts at terminations. Use sealing compound and plugs to withstand at least 15-psig hydrostatic pressure.
- G. Pulling Cord: Install 100-lbf- test nylon cord in ducts, including spares.
- H. Concrete-Encased Ducts: Support ducts on duct separators.
1. Separator Installation: Space separators close enough to prevent sagging and deforming of ducts, with not less than 4 spacers per 20 feet of duct. Secure separators to earth and to ducts to prevent floating during concreting. Stagger separators approximately 6 inches between tiers. Tie entire assembly together using fabric straps; do not use tie wires or reinforcing steel that may form conductive or magnetic loops around ducts or duct groups.
 2. Concreting Sequence: Pour each run of envelope between manholes or other terminations in one continuous operation.
 - a. Start at one end and finish at the other, allowing for expansion and contraction of ducts as their temperature changes during and after the pour. Use expansion fittings installed according to manufacturer's written recommendations, or use other specific measures to prevent expansion-contraction damage.
 - b. If more than one pour is necessary, terminate each pour in a vertical plane and install 3/4-inch reinforcing rod dowels extending 18 inches into concrete on both sides of joint near corners of envelope.
 3. Pouring Concrete: Spade concrete carefully during pours to prevent voids under and between conduits and at exterior surface of envelope. Do not allow a heavy mass of concrete to fall directly onto ducts. Use a plank to direct concrete down sides of bank assembly to trench bottom. Allow concrete to flow to center of bank and rise up in middle, uniformly filling all open spaces. Do not use power-driven agitating equipment unless specifically designed for duct-bank application.
 4. Reinforcement: Reinforce concrete-encased duct banks where they cross disturbed earth and where indicated. Arrange reinforcing rods and ties without forming conductive or magnetic loops around ducts or duct groups.
 5. Forms: Use walls of trench to form side walls of duct bank where soil is self-supporting and concrete envelope can be poured without soil inclusions; otherwise, use forms.

6. Minimum Space between Ducts: 3 inches between ducts and exterior envelope wall, 2 inches between ducts for like services, and 4 inches between power and signal ducts.
7. Depth: Install top of duct bank at least 24 inches below finished grade in areas not subject to deliberate traffic, and at least 30 inches below finished grade in deliberate traffic paths for vehicles, unless otherwise indicated.
8. Stub-Ups: Use manufactured rigid steel conduit elbows for stub-ups at poles and equipment and at building entrances through the floor.
 - a. Couple steel conduits to ducts with adapters designed for this purpose, and encase coupling with 3 inches of concrete.
 - b. Stub-Ups to Equipment: For equipment mounted on outdoor concrete bases, extend steel conduit horizontally a minimum of 60 inches from edge of base. Install insulated grounding bushings on terminations at equipment.
9. Warning Tape: Bury warning tape approximately 12 inches above all concrete-encased ducts and duct banks. Align tape parallel to and within 3 inches of the centerline of duct bank. Provide an additional warning tape for each 12-inch increment of duct-bank width over a nominal 18 inches. Space additional tapes 12 inches apart, horizontally.

I. Direct-Buried Duct Banks:

1. Support ducts on duct separators coordinated with duct size, duct spacing, and outdoor temperature.
2. Space separators close enough to prevent sagging and deforming of ducts, with not less than 4 spacers per 20 feet of duct. Secure separators to earth and to ducts to prevent displacement during backfill and yet permit linear duct movement due to expansion and contraction as temperature changes. Stagger spacers approximately 6 inches between tiers.
3. Excavate trench bottom to provide firm and uniform support for duct bank. Prepare trench bottoms as specified in Section 312000 "Earth Moving" for pipes less than 6 inches in nominal diameter.
4. Install backfill as specified in Section 312000 "Earth Moving."
5. After installing first tier of ducts, backfill and compact. Start at tie-in point and work toward end of duct run, leaving ducts at end of run free to move with expansion and contraction as temperature changes during this process. Repeat procedure after placing each tier. After placing last tier, hand-place backfill to 4 inches over ducts and hand tamp. Firmly tamp backfill around ducts to provide maximum supporting strength. Use hand tamper only. After placing controlled backfill over final tier, make final duct connections at end of run and complete backfilling with normal compaction as specified in Section 312000 "Earth Moving."
6. Install ducts with a minimum of 3 inches between ducts for like services and 6 inches between power and signal ducts.
7. Depth: Install top of duct bank at least 36 inches below finished grade, unless otherwise indicated.
8. Set elevation of bottom of duct bank below the frost line.
9. Install manufactured duct elbows for stub-ups at poles and equipment and at building entrances through the floor, unless otherwise indicated. Encase elbows for stub-up ducts throughout the length of the elbow.
10. Install manufactured rigid steel conduit elbows for stub-ups at poles and equipment and at building entrances through the floor.

- a. Couple steel conduits to ducts with adapters designed for this purpose, and encase coupling with 3 inches of concrete.
- b. For equipment mounted on outdoor concrete bases, extend steel conduit horizontally a minimum of 60 inches from edge of equipment pad or foundation. Install insulated grounding bushings on terminations at equipment.

3.5 INSTALLATION OF HANDHOLES AND BOXES OTHER THAN PRECAST CONCRETE

- A. Install handholes and boxes level and plumb and with orientation and depth coordinated with connecting ducts to minimize bends and deflections required for proper entrances. Use box extension if required to match depths of ducts, and seal joint between box and extension as recommended by the manufacturer.
- B. Unless otherwise indicated, support units on a level bed of crushed stone or gravel, graded from 1/2-inch sieve to No. 4 sieve and compacted to same density as adjacent undisturbed earth.
- C. Elevation: In paved areas and trafficways, set so cover surface will be flush with finished grade. Set covers of other handholes 1 inch above finished grade.
- D. Install removable hardware, including pulling eyes, cable stanchions, cable arms, and insulators, as required for installation and support of cables and conductors and as indicated. Select arm lengths to be long enough to provide spare space for future cables, but short enough to preserve adequate working clearances in the enclosure.
- E. Field-cut openings for ducts and conduits according to enclosure manufacturer's written instructions. Cut wall of enclosure with a tool designed for material to be cut. Size holes for terminating fittings to be used, and seal around penetrations after fittings are installed.
- F. For enclosures installed in asphalt paving and subject to occasional, nondeliberate, heavy-vehicle loading, form and pour a concrete ring encircling, and in contact with, enclosure and with top surface screeded to top of box cover frame. Bottom of ring shall rest on compacted earth.
 1. Concrete: 3000 psi, 28-day strength, complying with Section 033000 "Cast-in-Place Concrete," with a troweled finish.
 2. Dimensions: 10 inches wide by 12 inches deep

3.6 GROUNDING

- A. Ground underground ducts and utility structures according to Section 260526 "Grounding and Bonding for Electrical Systems."

3.7 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections and prepare test reports:
 1. Demonstrate capability and compliance with requirements on completion of installation of underground ducts and utility structures.

2. Pull aluminum or wood test mandrel through duct to prove joint integrity and test for out-of-round duct. Provide mandrel equal to 80 percent fill of duct. If obstructions are indicated, remove obstructions and retest.
3. Test handhole grounding to ensure electrical continuity of grounding and bonding connections. Measure and report ground resistance as specified in Section 260526 "Grounding and Bonding for Electrical Systems."

B. Correct deficiencies and retest as specified above to demonstrate compliance.

3.8 CLEANING

- A. Pull leather-washer-type duct cleaner, with graduated washer sizes, through full length of ducts. Follow with rubber duct swab for final cleaning and to assist in spreading lubricant throughout ducts.
- B. Clean internal surfaces of manholes, including sump. Remove foreign material.

END OF SECTION 260543

SECTION 260544 - SLEEVES AND SLEEVE SEALS FOR ELECTRICAL RACEWAYS AND CABLING

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. Sleeves for raceway and cable penetration of non-fire-rated construction walls and floors.
2. Sleeve-seal systems.
3. Sleeve-seal fittings.
4. Grout.
5. Silicone sealants.

B. Related Requirements:

1. Section 078413 "Penetration Firestopping" for penetration firestopping installed in fire-resistance-rated walls, horizontal assemblies, and smoke barriers, with and without penetrating items.

1.3 ACTION SUBMITTALS

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

PART 2 - PRODUCTS

2.1 SLEEVES

A. Wall Sleeves:

1. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, zinc coated, plain ends.
2. Cast-Iron Pipe Sleeves: Cast or fabricated "wall pipe," equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop unless otherwise indicated.

- B. Sleeves for Conduits Penetrating Non-Fire-Rated Gypsum Board Assemblies: Galvanized-steel sheet; 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint, with tabs for screw-fastening the sleeve to the board.

- C. PVC-Pipe Sleeves: ASTM D 1785, Schedule 40.

- D. Molded-PVC Sleeves: With nailing flange for attaching to wooden forms.
- E. Molded-PE or -PP Sleeves: Removable, tapered-cup shaped, and smooth outer surface with nailing flange for attaching to wooden forms.
- F. Sleeves for Rectangular Openings:
 - 1. Material: Galvanized sheet steel.
 - 2. Minimum Metal Thickness:
 - a. For sleeve cross-section rectangle perimeter less than 50 inches and with no side larger than 16 inches, thickness shall be 0.052 inch.
 - b. For sleeve cross-section rectangle perimeter 50 inches or more and one or more sides larger than 16 inches, thickness shall be 0.138 inch.

2.2 SLEEVE-SEAL SYSTEMS

- A. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and raceway or cable.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Advance Products & Systems, Inc.
 - b. CALPICO, Inc.
 - c. Metraflex Company (The).
 - d. Pipeline Seal and Insulator, Inc.
 - e. Proco Products, Inc.
 - 2. Sealing Elements: EPDM rubber interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
 - 3. Pressure Plates: Carbon steel.
 - 4. Connecting Bolts and Nuts: Carbon steel, with corrosion-resistant coating, of length required to secure pressure plates to sealing elements.

2.3 SLEEVE-SEAL FITTINGS

- A. Description: Manufactured plastic, sleeve-type, waterstop assembly made for embedding in concrete slab or wall. Unit shall have plastic or rubber waterstop collar with center opening to match piping OD.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Presealed Systems.

2.4 GROUT

- A. Description: Nonshrink; recommended for interior and exterior sealing openings in non-fire-rated walls or floors.

- B. Standard: ASTM C 1107/C 1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.
- C. Design Mix: 5000-psi, 28-day compressive strength.
- D. Packaging: Premixed and factory packaged.

2.5 SILICONE SEALANTS

- A. Silicone Sealants: Single-component, silicone-based, neutral-curing elastomeric sealants of grade indicated below.
 - 1. Grade: Pourable (self-leveling) formulation for openings in floors and other horizontal surfaces that are not fire rated.
 - 2. Sealant shall have VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- B. Silicone Foams: Multicomponent, silicone-based liquid elastomers that, when mixed, expand and cure in place to produce a flexible, nonshrinking foam.

PART 3 - EXECUTION

3.1 SLEEVE INSTALLATION FOR NON-FIRE-RATED ELECTRICAL PENETRATIONS

- A. Comply with NECA 1.
- B. Comply with NEMA VE 2 for cable tray and cable penetrations.
- C. Sleeves for Conduits Penetrating Above-Grade Non-Fire-Rated Concrete and Masonry-Unit Floors and Walls:
 - 1. Interior Penetrations of Non-Fire-Rated Walls and Floors:
 - a. Seal annular space between sleeve and raceway or cable, using joint sealant appropriate for size, depth, and location of joint. Comply with requirements in Section 079200 "Joint Sealants."
 - b. Seal space outside of sleeves with mortar or grout. Pack sealing material solidly between sleeve and wall so no voids remain. Tool exposed surfaces smooth; protect material while curing.
 - 2. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.
 - 3. Size pipe sleeves to provide 1/4-inch annular clear space between sleeve and raceway or cable unless sleeve seal is to be installed or unless seismic criteria require different clearance.
 - 4. Install sleeves for wall penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of walls. Cut sleeves to length for mounting flush with both surfaces of walls. Deburr after cutting.
 - 5. Install sleeves for floor penetrations. Extend sleeves installed in floors 2 inches above finished floor level. Install sleeves during erection of floors.

- D. Sleeves for Conduits Penetrating Non-Fire-Rated Gypsum Board Assemblies:
 - 1. Use circular metal sleeves unless penetration arrangement requires rectangular sleeved opening.
 - 2. Seal space outside of sleeves with approved joint compound for gypsum board assemblies.
- E. Roof-Penetration Sleeves: Seal penetration of individual raceways and cables with flexible boot-type flashing units applied in coordination with roofing work.
- F. Aboveground, Exterior-Wall Penetrations: Seal penetrations using cast-iron pipe sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.
- G. Underground, Exterior-Wall and Floor Penetrations: Install cast-iron pipe sleeves. Size sleeves to allow for 1-inch annular clear space between raceway or cable and sleeve for installing sleeve-seal system.

3.2 SLEEVE-SEAL-SYSTEM INSTALLATION

- A. Install sleeve-seal systems in sleeves in exterior concrete walls and slabs-on-grade at raceway entries into building.
- B. Install type and number of sealing elements recommended by manufacturer for raceway or cable material and size. Position raceway or cable in center of sleeve. Assemble mechanical sleeve seals and install in annular space between raceway or cable and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

END OF SECTION 260544

SECTION 260548 - VIBRATION AND SEISMIC CONTROLS FOR ELECTRICAL SYSTEMS

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. This Section includes the following:

1. Isolation pads.
2. Spring isolators.
3. Restrained spring isolators.
4. Channel support systems.
5. Restraint cables.
6. Hanger rod stiffeners.
7. Anchorage bushings and washers.

- B. Related Sections include the following:

1. Section 260529 "Hangers and Supports for Electrical Systems" for commonly used electrical supports and installation requirements.

1.3 DEFINITIONS

- A. The IBC: International Building Code.
- B. ICC-ES: ICC-Evaluation Service.
- C. OSHPD: Office of Statewide Health Planning and Development for the State of California.

1.4 PERFORMANCE REQUIREMENTS

- A. Seismic-Restraint Loading:
 1. See Structural Code Sheet.

1.5 ACTION SUBMITTALS

- A. Product Data: For the following:
 1. Include rated load, rated deflection, and overload capacity for each vibration isolation device.

2. Illustrate and indicate style, material, strength, fastening provision, and finish for each type and size of seismic-restraint component used.
 - a. Tabulate types and sizes of seismic restraints, complete with report numbers and rated strength in tension and shear as evaluated by an evaluation service member of ICC-ES.
 - b. Annotate to indicate application of each product submitted and compliance with requirements.
 3. Restrained-Isolation Devices: Include ratings for horizontal, vertical, and combined loads.
- B. Delegated-Design Submittal: For vibration isolation and seismic-restraint details 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. Design Calculations: Calculate static and dynamic loading due to equipment weight and operation, seismic forces required to select vibration isolators and seismic restraints.
 - a. Coordinate design calculations with wind-load calculations required for equipment mounted outdoors. Comply with requirements in other electrical Sections for equipment mounted outdoors.
 2. Indicate materials and dimensions and identify hardware, including attachment and anchorage devices.
 3. Field-fabricated supports.
 4. Seismic-Restraint Details:
 - a. Design Analysis: To support selection and arrangement of seismic restraints. Include calculations of combined tensile and shear loads.
 - b. Details: Indicate fabrication and arrangement. Detail attachments of restraints to the restrained items and to the structure. Show attachment locations, methods, and spacings. Identify components, list their strengths, and indicate directions and values of forces transmitted to the structure during seismic events. Indicate association with vibration isolation devices.
 - c. Preapproval and Evaluation Documentation: By an evaluation service member of ICC-ES, showing maximum ratings of restraint items and the basis for approval (tests or calculations).

1.6 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Show coordination of seismic bracing for electrical components with other systems and equipment in the vicinity, including other supports and seismic restraints.
- B. Qualification Data: For professional engineer.
- C. Welding certificates.
- D. Field quality-control test reports.

1.7 QUALITY ASSURANCE

- A. Comply with seismic-restraint requirements in the IBC unless requirements in this Section are more stringent.
- B. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
- C. Seismic-restraint devices shall have horizontal and vertical load testing and analysis and shall bear anchorage preapproval OPA number from OSHPD, preapproval by ICC-ES, or preapproval by another agency acceptable to authorities having jurisdiction, showing maximum seismic-restraint ratings. Ratings based on independent testing are preferred to ratings based on calculations. If preapproved ratings are not available, submittals based on independent testing are preferred. Calculations (including combining shear and tensile loads) to support seismic-restraint designs must be signed and sealed by a qualified professional engineer.
- D. Comply with NFPA 70.

PART 2 - PRODUCTS

2.1 VIBRATION ISOLATORS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Ace Mountings Co., Inc.
 - 2. Amber/Booth Company, Inc.
 - 3. California Dynamics Corporation.
 - 4. Isolation Technology, Inc.
 - 5. Kinetics Noise Control.
 - 6. Mason Industries.
 - 7. Vibration Eliminator Co., Inc.
 - 8. Vibration Isolation.
 - 9. Vibration Mountings & Controls, Inc.
- B. Pads: Arrange in single or multiple layers of sufficient stiffness for uniform loading over pad area, molded with a nonslip pattern and galvanized-steel baseplates, and factory cut to sizes that match requirements of supported equipment.
 - 1. Resilient Material: Oil- and water-resistant neoprene.
- C. Spring Isolators: Freestanding, laterally stable, open-spring isolators.
 - 1. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
 - 2. Minimum Additional Travel: 50 percent of the required deflection at rated load.
 - 3. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
 - 4. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.

5. Baseplates: Factory drilled for bolting to structure and bonded to 1/4-inch-thick, rubber isolator pad attached to baseplate underside. Baseplates shall limit floor load to 500 psig.
6. Top Plate and Adjustment Bolt: Threaded top plate with adjustment bolt and cap screw to fasten and level equipment.

2.2 SEISMIC-RESTRAINT DEVICES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 1. Amber/Booth Company, Inc.
 2. California Dynamics Corporation.
 3. Cooper B-Line, Inc.; a division of Cooper Industries.
 4. Hilti Inc.
 5. Loos & Co.; Seismic Earthquake Division.
 6. Mason Industries.
 7. TOLCO Incorporated; a brand of NIBCO INC.
 8. Unistrut; Tyco International, Ltd.
- B. General Requirements for Restraint Components: Rated strengths, features, and application requirements shall be as defined in reports by an evaluation service member of ICC-ES.
 1. Structural Safety Factor: Allowable strength in tension, shear, and pullout force of components shall be at least four times the maximum seismic forces to which they will be subjected.
- C. Channel Support System: MFMA-3, shop- or field-fabricated support assembly made of slotted steel channels with accessories for attachment to braced component at one end and to building structure at the other end and other matching components and with corrosion-resistant coating; and rated in tension, compression, and torsion forces.
- D. Restraint Cables: ASTM A 603 galvanized-steel cables with end connections made of steel assemblies with thimbles, brackets, swivels, and bolts designed for restraining cable service; and with a minimum of two clamping bolts for cable engagement.
- E. Hanger Rod Stiffener: Reinforcing steel angle clamped to hanger rod. Do not weld stiffeners to rods.
- F. Bushings for Floor-Mounted Equipment Anchor: Neoprene bushings designed for rigid equipment mountings, and matched to type and size of anchors and studs.
- G. Bushing Assemblies for Wall-Mounted Equipment Anchorage: Assemblies of neoprene elements and steel sleeves designed for rigid equipment mountings, and matched to type and size of attachment devices.
- H. Resilient Isolation Washers and Bushings: One-piece, molded, oil- and water-resistant neoprene, with a flat washer face.
- I. Mechanical Anchor: Drilled-in and stud-wedge or female-wedge type in zinc-coated steel for interior applications and stainless steel for exterior applications. Select anchors with strength

required for anchor and as tested according to ASTM E 488. Minimum length of eight times diameter.

- J. Adhesive Anchor: Drilled-in and capsule anchor system containing polyvinyl or urethane methacrylate-based resin and accelerator, or injected polymer or hybrid mortar adhesive. Provide anchor bolts and hardware with zinc-coated steel for interior applications and stainless steel for exterior applications. Select anchor bolts with strength required for anchor and as tested according to ASTM E 488.

2.3 FACTORY FINISHES

- A. Finish: Manufacturer's standard prime-coat finish ready for field painting.
- B. Finish: Manufacturer's standard paint applied to factory-assembled and -tested equipment before shipping.
 - 1. Powder coating on springs and housings.
 - 2. All hardware shall be galvanized. Hot-dip galvanize metal components for exterior use.
 - 3. Baked enamel or powder coat for metal components on isolators for interior use.
 - 4. Color-code or otherwise mark vibration isolation and seismic-control devices to indicate capacity range.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and equipment to receive vibration isolation and seismic-control devices for compliance with requirements for installation tolerances and other conditions affecting performance.
- B. Examine roughing-in of reinforcement and cast-in-place anchors to verify actual locations before installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 APPLICATIONS

- A. Multiple Raceways or Cables: Secure raceways and cables to trapeze member with clamps approved for application by an evaluation service member of ICC-ES.
- B. Hanger Rod Stiffeners: Install hanger rod stiffeners where indicated or scheduled on Drawings to receive them and where required to prevent buckling of hanger rods due to seismic forces.
- C. Strength of Support and Seismic-Restraint Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static and seismic loads within specified loading limits.

3.3 SEISMIC-RESTRAINT DEVICE INSTALLATION

A. Equipment and Hanger Restraints:

1. Install restrained isolators on electrical equipment.
2. Install resilient, bolt-isolation washers on equipment anchor bolts where clearance between anchor and adjacent surface exceeds 0.125 inch.
3. Install seismic-restraint devices using methods approved by an evaluation service member of ICC-ES providing required submittals for component.

B. Install bushing assemblies for mounting bolts for wall-mounted equipment, arranged to provide resilient media where equipment or equipment-mounting channels are attached to wall.

C. Attachment to Structure: If specific attachment is not indicated, anchor bracing to structure at flanges of beams, at upper truss chords of bar joists, or at concrete members.

D. Drilled-in Anchors:

1. Identify position of reinforcing steel and other embedded items prior to drilling holes for anchors. Do not damage existing reinforcing or embedded items during coring or drilling. Notify the structural engineer if reinforcing steel or other embedded items are encountered during drilling. Locate and avoid prestressed tendons, electrical and telecommunications conduit, and gas lines.
2. Do not drill holes in concrete or masonry until concrete, mortar, or grout has achieved full design strength.
3. Wedge Anchors: Protect threads from damage during anchor installation. Heavy-duty sleeve anchors shall be installed with sleeve fully engaged in the structural element to which anchor is to be fastened.
4. Adhesive Anchors: Clean holes to remove loose material and drilling dust prior to installation of adhesive. Place adhesive in holes proceeding from the bottom of the hole and progressing toward the surface in such a manner as to avoid introduction of air pockets in the adhesive.
5. Set anchors to manufacturer's recommended torque, using a torque wrench.
6. Install zinc-coated steel anchors for interior and stainless-steel anchors for exterior applications.

3.4 ACCOMMODATION OF DIFFERENTIAL SEISMIC MOTION

- #### A. Install flexible connections in runs of raceways, cables, wireways, cable trays, and busways where they cross seismic joints, where adjacent sections or branches are supported by different structural elements, and where they terminate with connection to equipment that is anchored to a different structural element from the one supporting them as they approach equipment.

3.5 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Tests and Inspections:

1. Provide evidence of recent calibration of test equipment by a testing agency acceptable to authorities having jurisdiction.
2. Schedule test with Owner, through Architect, before connecting anchorage device to restrained component (unless postconnection testing has been approved), and with at least seven days' advance notice.
3. Obtain Architect's approval before transmitting test loads to structure. Provide temporary load-spreading members.
4. Test at least four of each type and size of installed anchors and fasteners selected by Architect.
5. Test to 90 percent of rated proof load of device.
6. Measure isolator restraint clearance.
7. Measure isolator deflection.
8. Verify snubber minimum clearances.
9. If a device fails test, modify all installations of same type and retest until satisfactory results are achieved.

C. Remove and replace malfunctioning units and retest as specified above.

D. Prepare test and inspection reports.

3.6 ADJUSTING

A. Adjust isolators after isolated equipment is at operating weight.

B. Adjust limit stops on restrained spring isolators to mount equipment at normal operating height. After equipment installation is complete, adjust limit stops so they are out of contact during normal operation.

C. Adjust active height of spring isolators.

D. Adjust restraints to permit free movement of equipment within normal mode of operation.

END OF SECTION 260548

SECTION 260553 - IDENTIFICATION FOR ELECTRICAL SYSTEMS

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. Identification for raceways.
 - 2. Identification of power and control cables.
 - 3. Identification for conductors.
 - 4. Underground-line warning tape.
 - 5. Warning labels and signs.
 - 6. Instruction signs.
 - 7. Equipment identification labels.
 - 8. Miscellaneous identification products.

1.3 ACTION SUBMITTALS

- A. Product Data: For each electrical identification product indicated.
- B. Samples: For each type of label and sign to illustrate size, colors, lettering style, mounting provisions, and graphic features of identification products.
- C. Identification Schedule: An index of nomenclature of electrical equipment and system components used in identification signs and labels.

1.4 QUALITY ASSURANCE

- A. Comply with ANSI A13.1.
- B. Comply with NFPA 70.
- C. Comply with 29 CFR 1910.144 and 29 CFR 1910.145.
- D. Comply with ANSI Z535.4 for safety signs and labels.
- E. Adhesive-attached labeling materials, including label stocks, laminating adhesives, and inks used by label printers, shall comply with UL 969.

1.5 COORDINATION

- A. Coordinate identification names, abbreviations, colors, and other features with requirements in other Sections requiring identification applications, Drawings, Shop Drawings, manufacturer's wiring diagrams, and the Operation and Maintenance Manual; and with those required by codes, standards, and 29 CFR 1910.145. Use consistent designations throughout Project.
- B. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.
- C. Coordinate installation of identifying devices with location of access panels and doors.
- D. Install identifying devices before installing acoustical ceilings and similar concealment.

PART 2 - PRODUCTS

2.1 POWER AND CONTROL RACEWAY IDENTIFICATION MATERIALS

- A. Comply with ANSI A13.1 for minimum size of letters for legend and for minimum length of color field for each raceway size.
- B. Colors for Raceways Carrying Circuits at 600 V or Less:
 - 1. Black letters on an white field.
 - 2. Legend: Indicate voltage and system or service type.
- C. Vinyl Labels for Raceways Carrying Circuits at 600 V or Less: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound clear adhesive tape for securing ends of legend label.
- D. Snap-Around Labels for Raceways Carrying Circuits at 600 V or Less: Slit, pretensioned, flexible, preprinted, color-coded acrylic sleeve, with diameter sized to suit diameter of raceway or cable it identifies and to stay in place by gripping action.
- E. Snap-Around, Color-Coding Bands for Raceways Carrying Circuits at 600 V or Less: Slit, pretensioned, flexible, solid-colored acrylic sleeve, 2 inches long, with diameter sized to suit diameter of raceway or cable it identifies and to stay in place by gripping action.
- F. Tape and Stencil for Raceways Carrying Circuits More Than 600 V: 4-inch- wide black stripes on 10-inch centers diagonally over orange background that extends full length of raceway or duct and is 12 inches wide. Stop stripes at legends.
- G. Metal Tags: Brass or aluminum, 2 by 2 by 0.05 inch, with stamped legend, punched for use with self-locking cable tie fastener.
- H. Write-On Tags: Polyester tag, 0.010 inch thick, with corrosion-resistant grommet and cable tie for attachment to conductor or cable.
 - 1. Marker for Tags: Permanent, waterproof, black ink marker recommended by tag manufacturer.

2.2 ARMORED AND METAL-CLAD CABLE IDENTIFICATION MATERIALS

- A. Comply with ANSI A13.1 for minimum size of letters for legend and for minimum length of color field for each cable size.
- B. Colors for Cables Carrying Circuits at 600 V and Less:
 - 1. Black letters on an orange field.
 - 2. Legend: Indicate voltage and system or service type.
- C. Vinyl Labels: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound clear adhesive tape for securing ends of legend label.
- D. Self-Adhesive Vinyl Tape: Colored, heavy duty, waterproof, fade resistant; 2 inches wide; compounded for outdoor use.
- E. Heat-Shrink Preprinted Tubes: Flame-retardant polyolefin tube with machine-printed identification label. Sized to suit diameter of and shrinks to fit firmly around cable it identifies. Full shrink recovery at a maximum of 200 deg F. Comply with UL 224.

2.3 POWER AND CONTROL CABLE IDENTIFICATION MATERIALS

- A. Comply with ANSI A13.1 for minimum size of letters for legend and for minimum length of color field for each cable size.
- B. Vinyl Labels: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound clear adhesive tape for securing ends of legend label.
- C. Self-Adhesive, Self-Laminating Polyester Labels: Preprinted, 3-mil-thick flexible label with acrylic pressure-sensitive adhesive that provides a clear, weather- and chemical-resistant, self-laminating, protective shield over the legend. Labels sized to fit the cable diameter such that the clear shield overlaps the entire printed legend.
- D. Heat-Shrink Preprinted Tubes: Flame-retardant polyolefin tube with machine-printed identification label. Sized to suit diameter of and shrinks to fit firmly around cable it identifies. Full shrink recovery at a maximum of 200 deg F. Comply with UL 224.
- E. Metal Tags: Brass or aluminum, 2 by 2 by 0.05 inch, with stamped legend, punched for use with self-locking cable tie fastener.
- F. Write-On Tags: Polyester tag, 0.010 inch thick, with corrosion-resistant grommet and cable tie for attachment to conductor or cable.
 - 1. Marker for Tags: Permanent, waterproof, black ink marker recommended by tag manufacturer.
 - 2. Marker for Tags: Machine-printed, permanent, waterproof, black ink marker recommended by printer manufacturer.
- G. Snap-Around Labels: Slit, pretensioned, flexible, preprinted, color-coded acrylic sleeve, with diameter sized to suit diameter of cable it identifies and to stay in place by gripping action.

- H. Snap-Around, Color-Coding Bands: Slit, pretensioned, flexible, solid-colored acrylic sleeve, 2 inches long, with diameter sized to suit diameter of cable it identifies and to stay in place by gripping action.

2.4 CONDUCTOR IDENTIFICATION MATERIALS

- A. Color-Coding Conductor Tape: Colored, self-adhesive vinyl tape not less than 3 mils thick by 1 to 2 inches wide.
- B. Self-Adhesive, Self-Laminating Polyester Labels: Preprinted, 3-mil-thick flexible label with acrylic pressure-sensitive adhesive that provides a clear, weather- and chemical-resistant, self-laminating, protective shield over the legend. Labels sized to fit the conductor diameter such that the clear shield overlaps the entire printed legend.
- C. Snap-Around Labels: Slit, pretensioned, flexible, preprinted, color-coded acrylic sleeve, with diameter sized to suit diameter of conductor it identifies and to stay in place by gripping action.
- D. Snap-Around, Color-Coding Bands: Slit, pretensioned, flexible, solid-colored acrylic sleeve with diameter sized to suit diameter of conductor it identifies and to stay in place by gripping action.
- E. Heat-Shrink Preprinted Tubes: Flame-retardant polyolefin tube with machine-printed identification label. Sized to suit diameter of and shrinks to fit firmly around conductor it identifies. Full shrink recovery at a maximum of 200 deg F. Comply with UL 224.
- F. Marker Tapes: Vinyl or vinyl-cloth, self-adhesive wraparound type, with circuit identification legend machine printed by thermal transfer or equivalent process.

2.5 UNDERGROUND-LINE WARNING TAPE

- A. Tape:
 - 1. Recommended by manufacturer for the method of installation and suitable to identify and locate underground electrical and communications utility lines.
 - 2. Printing on tape shall be permanent and shall not be damaged by burial operations.
 - 3. Tape material and ink shall be chemically inert, and not subject to degrading when exposed to acids, alkalis, and other destructive substances commonly found in soils.
- B. Color and Printing:
 - 1. Comply with ANSI Z535.1 through ANSI Z535.5.
 - 2. Inscriptions for Red-Colored Tapes: ELECTRIC LINE, HIGH VOLTAGE.
 - 3. Inscriptions for Orange-Colored Tapes: TELEPHONE CABLE, CATV CABLE, COMMUNICATIONS CABLE, OPTICAL FIBER CABLE.

2.6 WARNING LABELS AND SIGNS

- A. Comply with NFPA 70 and 29 CFR 1910.145.

- B. Self-Adhesive Warning Labels: Factory-printed, multicolor, pressure-sensitive adhesive labels, configured for display on front cover, door, or other access to equipment unless otherwise indicated.
- C. Baked-Enamel Warning Signs:
 - 1. Preprinted aluminum signs, punched or drilled for fasteners, with colors, legend, and size required for application.
 - 2. 1/4-inch grommets in corners for mounting.
 - 3. Nominal size, 7 by 10 inches.
- D. Metal-Backed, Butyrate Warning Signs:
 - 1. Weather-resistant, nonfading, preprinted, cellulose-acetate butyrate signs with 0.0396-inch galvanized-steel backing; and with colors, legend, and size required for application.
 - 2. 1/4-inch grommets in corners for mounting.
 - 3. Nominal size, 10 by 14 inches.
- E. Warning label and sign shall include, but are not limited to, the following legends:
 - 1. Multiple Power Source Warning: "DANGER - ELECTRICAL SHOCK HAZARD - EQUIPMENT HAS MULTIPLE POWER SOURCES."
 - 2. Workspace Clearance Warning: "WARNING - OSHA REGULATION - AREA IN FRONT OF ELECTRICAL EQUIPMENT MUST BE KEPT CLEAR FOR 36 INCHES."
 - 3. Arc Flash Warning: "DANGER - ARC FLASH HAZARD" or "WARNING - ARC FLASH HAZARD."

2.7 INSTRUCTION SIGNS

- A. Engraved, laminated acrylic or melamine plastic, minimum 1/16 inch thick for signs up to 20 sq. inches and 1/8 inch thick for larger sizes.
 - 1. Engraved legend with black letters on white face.
 - 2. Punched or drilled for mechanical fasteners.
 - 3. Framed with mitered acrylic molding and arranged for attachment at applicable equipment.
- B. Adhesive Film Label: Machine printed, in black, by thermal transfer or equivalent process. Minimum letter height shall be 3/8 inch.
- C. Adhesive Film Label with Clear Protective Overlay: Machine printed, in black, by thermal transfer or equivalent process. Minimum letter height shall be 3/8 inch. Overlay shall provide a weatherproof and UV-resistant seal for label.

2.8 EQUIPMENT IDENTIFICATION LABELS

- A. Adhesive Film Label: Machine printed, in black, by thermal transfer or equivalent process. Minimum letter height shall be 3/8 inch.

- B. Adhesive Film Label with Clear Protective Overlay: Machine printed, in black, by thermal transfer or equivalent process. Minimum letter height shall be 3/8 inch. Overlay shall provide a weatherproof and UV-resistant seal for label.
- C. Self-Adhesive, Engraved, Laminated Acrylic or Melamine Label: Adhesive backed, with white letters on a dark-gray background. Minimum letter height shall be 3/8 inch.
- D. Engraved, Laminated Acrylic or Melamine Label: Punched or drilled for screw mounting. White letters on a dark-gray background. Minimum letter height shall be 3/8 inch.
- E. Stenciled Legend: In nonfading, waterproof, black ink or paint. Minimum letter height shall be 1 inch.

2.9 CABLE TIES

- A. General-Purpose Cable Ties: Fungus inert, self extinguishing, one piece, self locking, Type 6/6 nylon.
 1. Minimum Width: 3/16 inch.
 2. Tensile Strength at 73 deg F, According to ASTM D 638: 12,000 psi.
 3. Temperature Range: Minus 40 to plus 185 deg F.
 4. Color: Black except where used for color-coding.
- B. UV-Stabilized Cable Ties: Fungus inert, designed for continuous exposure to exterior sunlight, self extinguishing, one piece, self locking, Type 6/6 nylon.
 1. Minimum Width: 3/16 inch.
 2. Tensile Strength at 73 deg F, According to ASTM D 638: 12,000 psi.
 3. Temperature Range: Minus 40 to plus 185 deg F.
 4. Color: Black.
- C. Plenum-Rated Cable Ties: Self extinguishing, UV stabilized, one piece, self locking.
 1. Minimum Width: 3/16 inch.
 2. Tensile Strength at 73 deg F, According to ASTM D 638: 7000 psi.
 3. UL 94 Flame Rating: 94V-0.
 4. Temperature Range: Minus 50 to plus 284 deg F.
 5. Color: Black.

2.10 MISCELLANEOUS IDENTIFICATION PRODUCTS

- A. Paint: Comply with requirements in painting Sections for paint materials and application requirements. Select paint system applicable for surface material and location (exterior or interior).
- B. Fasteners for Labels and Signs: Self-tapping, stainless-steel screws or stainless-steel machine screws with nuts and flat and lock washers.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Verify identity of each item before installing identification products.
- B. Location: Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment.
- C. Apply identification devices to surfaces that require finish after completing finish work.
- D. Self-Adhesive Identification Products: Clean surfaces before application, using materials and methods recommended by manufacturer of identification device.
- E. Attach signs and plastic labels that are not self-adhesive type with mechanical fasteners appropriate to the location and substrate.
- F. Attach plastic raceway and cable labels that are not self-adhesive type with clear vinyl tape with adhesive appropriate to the location and substrate.
- G. System Identification Color-Coding Bands for Raceways and Cables: Each color-coding band shall completely encircle cable or conduit. Place adjacent bands of two-color markings in contact, side by side. Locate bands at changes in direction, at penetrations of walls and floors, at 50-foot maximum intervals in straight runs, and at 25-foot maximum intervals in congested areas.
- H. Aluminum Wraparound Marker Labels and Metal Tags: Secure tight to surface of conductor or cable at a location with high visibility and accessibility.
- I. Cable Ties: For attaching tags. Use general-purpose type, except as listed below:
 - 1. Outdoors: UV-stabilized nylon.
 - 2. In Spaces Handling Environmental Air: Plenum rated.
- J. Underground-Line Warning Tape: During backfilling of trenches install continuous underground-line warning tape directly above line at 6 to 8 inches below finished grade. Use multiple tapes where width of multiple lines installed in a common trench or concrete envelope exceeds 16 inches overall.
- K. Painted Identification: Comply with requirements in painting Sections for surface preparation and paint application.

3.2 IDENTIFICATION SCHEDULE

- A. Accessible Raceways and Metal-Clad Cables, 600 V or Less, for Service, Feeder, and Branch Circuits More Than 30 A, and 120 V to ground: Identify with self-adhesive vinyl label. Install labels at 30-foot maximum intervals.
- B. Accessible Raceways and Cables within Buildings: Identify the covers of each junction and pull box of the following systems with self-adhesive vinyl labels with the wiring system legend and system voltage. System legends shall be as follows:

1. Emergency Power.
 2. Power.
 3. UPS.
- C. Power-Circuit Conductor Identification, 600 V or Less: For conductors in vaults, pull and junction boxes, manholes, and handholes, use color-coding conductor tape to identify the phase.
1. Color-Coding for Phase Identification, 600 V or Less: Use colors listed below for ungrounded service, feeder, and branch-circuit conductors.
 - a. Color shall be factory applied or field applied for sizes larger than No. 8 AWG, if authorities having jurisdiction permit.
 - b. Colors for 208/120-V Circuits:
 - 1) Phase A: Black.
 - 2) Phase B: Red.
 - 3) Phase C: Blue.
 - c. Field-Applied, Color-Coding Conductor Tape: Apply in half-lapped turns for a minimum distance of 6 inches from terminal points and in boxes where splices or taps are made. Apply last two turns of tape with no tension to prevent possible unwinding. Locate bands to avoid obscuring factory cable markings.
- D. Install instructional sign including the color-code for grounded and ungrounded conductors using adhesive-film-type labels.
- E. Control-Circuit Conductor Identification: For conductors and cables in pull and junction boxes, manholes, and handholes, use self-adhesive vinyl labels with the conductor or cable designation, origin, and destination.
- F. Control-Circuit Conductor Termination Identification: For identification at terminations provide self-adhesive vinyl labels with the conductor designation.
- G. Conductors to Be Extended in the Future: Attach write-on tags to conductors and list.
- H. Auxiliary Electrical Systems Conductor Identification: Identify field-installed alarm, control, and signal connections.
1. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, and pull points. Identify by system and circuit designation.
 2. Use system of marker tape designations that is uniform and consistent with system used by manufacturer for factory-installed connections.
 3. Coordinate identification with Project Drawings, manufacturer's wiring diagrams, and the Operation and Maintenance Manual.
- I. Locations of Underground Lines: Identify with underground-line warning tape for power, lighting, communication, and control wiring and optical fiber cable.
1. Limit use of underground-line warning tape to direct-buried cables.
 2. Install underground-line warning tape for both direct-buried cables and cables in raceway.

- J. Workspace Indication: Install floor marking tape to show working clearances in the direction of access to live parts. Workspace shall be as required by NFPA 70 and 29 CFR 1926.403 unless otherwise indicated. Do not install at flush-mounted panelboards and similar equipment in finished spaces.
- K. Warning Labels for Indoor Cabinets, Boxes, and Enclosures for Power and Lighting: Self-adhesive warning labels.
 - 1. Comply with 29 CFR 1910.145.
 - 2. Identify system voltage with black letters on an orange background.
 - 3. Apply to exterior of door, cover, or other access.
 - 4. For equipment with multiple power or control sources, apply to door or cover of equipment including, but not limited to, the following:
 - a. Power transfer switches.
 - b. Controls with external control power connections.
- L. Operating Instruction Signs: Install instruction signs to facilitate proper operation and maintenance of electrical systems and items to which they connect. Install instruction signs with approved legend where instructions are needed for system or equipment operation.
- M. Emergency Operating Instruction Signs: Install instruction signs with white legend on a red background with minimum 3/8-inch-high letters for emergency instructions at equipment used for power transfer.
- N. Equipment Identification Labels: On each unit of equipment, install unique designation label that is consistent with wiring diagrams, schedules, and the Operation and Maintenance Manual. Apply labels to disconnect switches and protection equipment, central or master units, control panels, control stations, terminal cabinets, and racks of each system. Systems include power, lighting, control, communication, signal, monitoring, and alarm systems unless equipment is provided with its own identification.
 - 1. Labeling Instructions:
 - a. Indoor Equipment: Engraved, laminated acrylic or melamine label. Unless otherwise indicated, provide a single line of text with 1/2-inch-high black letters on 1-1/2-inch-high label with white background; where two lines of text are required, use labels 2 inches high.
 - b. Outdoor Equipment: Engraved, laminated acrylic or melamine label.
 - c. Elevated Components: Increase sizes of labels and letters to those appropriate for viewing from the floor.
 - d. Unless provided with self-adhesive means of attachment, fasten labels with appropriate mechanical fasteners that do not change the NEMA or NRTL rating of the enclosure.
 - 2. Equipment to Be Labeled:
 - a. Panelboards: Typewritten directory of circuits in the location provided by panelboard manufacturer. Panelboard identification shall be engraved, laminated acrylic or melamine label.
 - b. Enclosures and electrical cabinets.

- c. Access doors and panels for concealed electrical items.
- d. Emergency system boxes and enclosures.
- e. Enclosed switches.
- f. Enclosed circuit breakers.
- g. Enclosed controllers.
- h. Variable-speed controllers.
- i. Push-button stations.
- j. Power transfer equipment.
- k. Contactors.
- l. Monitoring and control equipment.
- m. UPS equipment.

END OF SECTION 260553

SECTION 260923 - LIGHTING CONTROL DEVICES

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. Time switches.
2. Photoelectric switches.
3. Indoor occupancy sensors.
4. Outdoor motion sensors.
5. Emergency shunt relays.

B. Related Requirements:

1. Section 262726 "Wiring Devices" for wall-box dimmers, wall-switch occupancy sensors, and manual light switches.

1.3 ACTION SUBMITTALS

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

- B. Shop Drawings: Show installation details for occupancy and light-level sensors.

1. Interconnection diagrams showing field-installed wiring.
2. Include diagrams for power, signal, and control wiring.

1.4 INFORMATIONAL SUBMITTALS

- A. Field quality-control reports.

1.5 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For each type of lighting control device to include in emergency, operation, and maintenance manuals.

PART 2 - PRODUCTS

2.1 TIME SWITCHES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Cooper Industries, Inc.
 2. Intermatic, Inc.
 3. Invensys Controls.
 4. Leviton Mfg. Company Inc.
 5. NSi Industries LLC; TORK Products.
 6. Tyco Electronics; ALR Brand.
- B. Electronic Time Switches: Solid state, programmable, with alphanumeric display; complying with UL 917.
1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
 2. Contact Configuration: SPST.
 3. Contact Rating: 20-A ballast load, 120-/240-V ac.

2.2 OUTDOOR PHOTOELECTRIC SWITCHES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Cooper Industries, Inc.
 2. Intermatic, Inc.
 3. NSi Industries LLC; TORK Products.
 4. Tyco Electronics; ALR Brand.
- B. Description: Solid state, with SPST dry contacts rated for 1800-VA tungsten or 1000-VA inductive, to operate connected relay, contactor coils, or microprocessor input; complying with UL 773A.
1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
 2. Light-Level Monitoring Range: 1.5 to 10 fc, with an adjustment for turn-on and turn-off levels within that range, and a directional lens in front of the photocell to prevent fixed light sources from causing turn-off.
 3. Time Delay: Fifteen second minimum, to prevent false operation.
 4. Surge Protection: Metal-oxide varistor.
 5. Mounting: Twist lock complies with NEMA C136.10, with base-and-stem mounting or stem-and-swivel mounting accessories as required to direct sensor to the north sky exposure.

2.3 INDOOR OCCUPANCY SENSORS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Bryant Electric; a Hubbell company.
 2. Cooper Industries, Inc.
 3. Hubbell Building Automation, Inc.
 4. Leviton Mfg. Company Inc.
 5. Lightolier Controls.
 6. Lithonia Lighting; Acuity Lighting Group, Inc.
 7. Lutron Electronics Co., Inc.
 8. NSi Industries LLC; TORK Products.
 9. Sensor Switch, Inc.
 10. Square D; a brand of Schneider Electric.
 11. Watt Stopper.
- B. General Requirements for Sensors: Wall- or ceiling-mounted, solid-state indoor occupancy sensors with a separate power pack.
1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
 2. Operation: Unless otherwise indicated, turn lights on when coverage area is occupied, and turn them off when unoccupied; with a time delay for turning lights off, adjustable over a minimum range of 1 to 15 minutes.
 3. Sensor Output: Contacts rated to operate the connected relay, complying with UL 773A. Sensor is powered from the power pack.
 4. Power Pack: Dry contacts rated for 20-A ballast load at 120- and 277-V ac, for 13-A tungsten at 120-V ac, and for 1 hp at 120-V ac. Sensor has 24-V dc, 150-mA, Class 2 power source, as defined by NFPA 70.
 5. Mounting:
 - a. Sensor: Suitable for mounting in any position on a standard outlet box.
 - b. Relay: Externally mounted through a 1/2-inch knockout in a standard electrical enclosure.
 - c. Time-Delay and Sensitivity Adjustments: Recessed and concealed behind hinged door.
 6. Indicator: Digital display, to show when motion is detected during testing and normal operation of sensor.
 7. Bypass Switch: Override the "on" function in case of sensor failure.
 8. Automatic Light-Level Sensor: Adjustable from 2 to 200 fc; turn lights off when selected lighting level is present.
- C. Dual-Technology Type: Wall- or ceiling-mounted; detect occupants in coverage area using PIR and ultrasonic detection methods. The particular technology or combination of technologies that control on-off functions is selectable in the field by operating controls on unit.
1. Sensitivity Adjustment: Separate for each sensing technology.
 2. Detector Sensitivity: Detect occurrences of 6-inch-minimum movement of any portion of a human body that presents a target of not less than 36 sq. in. and detect a person of

average size and weight moving not less than 12 inches in either a horizontal or a vertical manner at an approximate speed of 12 inches/s.

3. Detection Coverage (Standard Room): Detect occupancy anywhere within a circular area of 1000 sq. ft. when mounted on a 96-inch-high ceiling.

2.4 SWITCHBOX-MOUNTED OCCUPANCY SENSORS

- A. Manufacturers: Subject to compliance with requirements, provide products by the following:

1. Bryant Electric; a Hubbell company.
2. Cooper Industries, Inc.
3. Hubbell Building Automation, Inc.
4. Leviton Mfg. Company Inc.
5. Lightolier Controls.
6. Lithonia Lighting; Acuity Lighting Group, Inc.
7. Lutron Electronics Co., Inc.
8. NSi Industries LLC; TORK Products.
9. Sensor Switch, Inc.
10. Square D; a brand of Schneider Electric.
11. Watt Stopper.

- B. General Requirements for Sensors: Automatic-wall-switch occupancy sensor, suitable for mounting in a single gang switchbox.

1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
2. Operating Ambient Conditions: Dry interior conditions, 32 to 120 deg F.
3. Power Pack: Dry contacts rated for 20-A ballast load at 120- and 277-V ac, for 13-A tungsten at 120-V ac, and for 1 hp at 120-V ac. Sensor has 24-V dc, 150-mA, Class 2 power source, as defined by NFPA 70

2.5 HIGH-BAY OCCUPANCY SENSORS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Hubbell Building Automation, Inc.

- B. General Description: Solid-state unit. The unit is designed to operate with the lamp and ballasts indicated.

1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
2. Operation: Turn lights on when coverage area is occupied, and to half-power when unoccupied; with a time delay for turning lights to half-power that is adjustable over a minimum range of 1 to 16 minutes.
3. Continuous Lamp Monitoring: When lamps are dimmed continuously for 24 hours, automatically turn lamps on to full power for 15 minutes for every 24 hours of continuous dimming.
4. Operating Ambient Conditions: 32 to 149 deg F.

5. Mounting: Threaded pipe.
 6. Time-Delay and Sensitivity Adjustments: Recessed and concealed behind hinged door.
 7. Detector Technology: PIR.
 8. Power and dimming control from the lighting fixture ballast that has been modified to include the dimming capacitor and MyzerPORT option.
- C. Detector Coverage: User selectable by interchangeable PIR lenses, suitable for mounting heights from 12 to 50 feet.
- D. Accessories: Obtain manufacturer's installation and maintenance kit with laser alignment tool for sensor positioning and power port connectors.

2.6 OUTDOOR MOTION SENSORS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Bryant Electric; a Hubbell company.
 2. Cooper Industries, Inc.
 3. Hubbell Building Automation, Inc.
 4. Leviton Mfg. Company Inc.
 5. Lithonia Lighting; Acuity Lighting Group, Inc.
 6. NSi Industries LLC; TORK Products.
 7. Sensor Switch, Inc.
 8. Watt Stopper.
- B. General Requirements for Sensors: Solid-state outdoor motion sensors.
1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
 2. PIR type, weatherproof. Detect occurrences of 6-inch-minimum movement of any portion of a human body that presents a target of not less than 36 sq. in. Comply with UL 773A.
 3. Switch Rating:
 - a. Lighting-Fixture-Mounted Sensor: 500-VA fluorescent.
 - b. Separately Mounted Sensor: Dry contacts rated for 20-A ballast load at 120- and 277-V ac, for 13-A tungsten at 120-V ac, and for 1 hp at 120-V ac. Sensor has 24-V dc, 150-mA, Class 2 power source, as defined by NFPA 70.
 4. Switch Type: SP.
 5. Voltage: 120-V type.
 6. Detector Coverage:
 - a. Standard Range: 210-degree field of view, with a minimum coverage area of 900 sq. ft..
 - b. Long Range: 180-degree field of view and 110-foot detection range.
 7. Ambient-Light Override: Concealed, field-adjustable, light-level sensor from. The switch prevents the lights from turning on when the light level is higher than the set point of the sensor.

8. Concealed, field-adjustable, "off" time-delay selector at up to 30 minutes.
9. Adaptive Technology: Self-adjusting circuitry detects and memorizes usage patterns of the space and help eliminate false "off" switching.
10. Operating Ambient Conditions: Suitable for operation in ambient temperatures ranging from minus 40 to plus 130 deg F, rated as "raintight" according to UL 773A.

2.7 EMERGENCY SHUNT RELAY

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 1. Lighting Control and Design; Acuity Lighting Group, Inc.
 2. Watt Stopper.
- B. Description: Normally closed, electrically held relay, arranged for wiring in parallel with manual or automatic switching contacts; complying with UL 924.
 1. Coil Rating: 120 V.

2.8 CONDUCTORS AND CABLES

- A. Power Wiring to Supply Side of Remote-Control Power Sources: Not smaller than No. 12 AWG. Comply with requirements in Section 260519 "Low-Voltage Electrical Power Conductors and Cables."
- B. Classes 2 and 3 Control Cable: Multiconductor cable with stranded-copper conductors not smaller than No. 18 AWG. Comply with requirements in Section 260519 "Low-Voltage Electrical Power Conductors and Cables."
- C. Class 1 Control Cable: Multiconductor cable with stranded-copper conductors not smaller than No. 14 AWG. Comply with requirements in Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

PART 3 - EXECUTION

3.1 SENSOR INSTALLATION

- A. Coordinate layout and installation of ceiling-mounted devices with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, smoke detectors, fire-suppression systems, and partition assemblies.
- B. Install and aim sensors in locations to achieve not less than 90 percent coverage of areas indicated. Do not exceed coverage limits specified in manufacturer's written instructions.

3.2 WIRING INSTALLATION

- A. Wiring Method: Comply with Section 260519 "Low-Voltage Electrical Power Conductors and Cables." Minimum conduit size is 1/2 inch.

- B. Wiring within Enclosures: Comply with NECA 1. Separate power-limited and nonpower-limited conductors according to conductor manufacturer's written instructions.
- C. Size conductors according to lighting control device manufacturer's written instructions unless otherwise indicated.
- D. Splices, Taps, and Terminations: Make connections only on numbered terminal strips in junction, pull, and outlet boxes; terminal cabinets; and equipment enclosures.

3.3 IDENTIFICATION

- A. Identify components and power and control wiring according to Section 260553 "Identification for Electrical Systems."
 - 1. Identify controlled circuits in lighting contactors.
 - 2. Identify circuits or luminaires controlled by photoelectric and occupancy sensors at each sensor.
- B. Label time switches and contactors with a unique designation.

3.4 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.
- B. Perform the following tests and inspections with the assistance of a factory-authorized service representative:
 - 1. Operational Test: After installing time switches and sensors, and after electrical circuitry has been energized, start units to confirm proper unit operation.
 - 2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- C. Lighting control devices will be considered defective if they do not pass tests and inspections.
- D. Prepare test and inspection reports.

3.5 ADJUSTING

- A. Occupancy Adjustments: When requested within 12 months from date of Substantial Completion, provide on-site assistance in adjusting sensors to suit actual occupied conditions. Provide up to two visits to Project during other-than-normal occupancy hours for this purpose.
 - 1. For occupancy and motion sensors, verify operation at outer limits of detector range. Set time delay to suit Owner's operations.
 - 2. Align high-bay occupancy sensors using manufacturer's laser aiming tool.

3.6 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain lighting control devices.

END OF SECTION 260923

SECTION 262416 - PANELBOARDS

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. Distribution panelboards.
 - 2. Lighting and appliance branch-circuit panelboards.

1.3 DEFINITIONS

- A. SVR: Suppressed voltage rating.
- B. TVSS: Transient voltage surge suppressor.

1.4 PERFORMANCE REQUIREMENTS

- A. Seismic Performance: Panelboards 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."

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of panelboard, switching and overcurrent protective device, transient voltage suppression device, accessory, and component indicated. Include dimensions and manufacturers' technical data on features, performance, electrical characteristics, ratings, and finishes.
- B. Shop Drawings: For each panelboard and related equipment.
 - 1. Include dimensioned plans, elevations, sections, and details. Show tabulations of installed devices, equipment features, and ratings.
 - 2. Detail enclosure types and details for types other than NEMA 250, Type 1.
 - 3. Detail bus configuration, current, and voltage ratings.
 - 4. Short-circuit current rating of panelboards and overcurrent protective devices.
 - 5. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.

6. Include wiring diagrams for power, signal, and control wiring.

1.6 INFORMATIONAL SUBMITTALS

- A. Seismic Qualification Certificates: Submit certification that panelboards, overcurrent protective devices, accessories, and components will withstand seismic forces defined in Section 260548 "Vibration and Seismic Controls for Electrical Systems." Include the following:
 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.
- B. Field Quality-Control Reports:
 1. Test procedures used.
 2. Test results that comply with requirements.
 3. Results of failed tests and corrective action taken to achieve test results that comply with requirements.
- C. Panelboard Schedules: For installation in panelboards.

1.7 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For panelboards and components to include in emergency, operation, and maintenance manuals. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:
 1. Manufacturer's written instructions for testing and adjusting overcurrent protective devices.

1.8 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 1. Keys: Two spares for each type of panelboard cabinet lock.
 2. Circuit Breakers Including GFCI and AFCI Types: Two spares for each panelboard.

1.9 QUALITY ASSURANCE

- A. Source Limitations: Obtain panelboards, overcurrent protective devices, components, and accessories from single source from single manufacturer.
- B. Product Selection for Restricted Space: Drawings indicate maximum dimensions for panelboards including clearances between panelboards and adjacent surfaces and other items. Comply with indicated maximum dimensions.

- 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.
- D. Comply with NEMA PB 1.
- E. Comply with NFPA 70.

1.10 DELIVERY, STORAGE, AND HANDLING

- A. Handle and prepare panelboards for installation according to NEMA PB 1.

1.11 PROJECT CONDITIONS

- A. Environmental Limitations:

- 1. Do not deliver or install panelboards until spaces are enclosed and weathertight, wet work in spaces is complete and dry, work above panelboards is complete, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.

1.12 COORDINATION

- A. Coordinate layout and installation of panelboards and components with other construction that penetrates walls or is supported by them, including electrical and other types of equipment, raceways, piping, encumbrances to workspace clearance requirements, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.
- B. Coordinate sizes and locations of concrete bases with actual equipment provided. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified with concrete.

1.13 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace transient voltage suppression devices that fail in materials or workmanship within specified warranty period.
 - 1. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR PANELBOARDS

- A. Fabricate and test panelboards according to IEEE 344 to withstand seismic forces defined in Section 260548 "Vibration and Seismic Controls for Electrical Systems."
- B. Enclosures: Surface-mounted cabinets.

1. Rated for environmental conditions at installed location.
 - a. Indoor Dry and Clean Locations: NEMA 250, Type 1.
 - b. Other Wet or Damp Indoor Locations: NEMA 250, Type 4.
 2. Hinged Front Cover: Entire front trim hinged to box and with standard door within hinged trim cover.
 3. Finishes:
 - a. Panels and Trim: Steel, factory finished immediately after cleaning and pretreating with manufacturer's standard two-coat, baked-on finish consisting of prime coat and thermosetting topcoat.
 - b. Back Boxes: Galvanized steel.
 4. Inside panelboard door, mounted in transparent card holder.
- C. Incoming Mains Location: Top and bottom as required.
- D. Phase, Neutral, and Ground Buses:
1. Material: Hard-drawn copper, 98 percent conductivity.
 2. Equipment Ground Bus: Adequate for feeder and branch-circuit equipment grounding conductors; bonded to box.
 3. Extra-Capacity Neutral Bus: Neutral bus rated 200 percent of phase bus and UL listed as suitable for nonlinear loads.
- E. Conductor Connectors: Suitable for use with conductor material and sizes.
1. Material: Hard-drawn copper, 98 percent conductivity.
 2. Main and Neutral Lugs: Compression type.
 3. Ground Lugs and Bus-Configured Terminators: Compression type.
 4. Feed-Through Lugs: compression type, suitable for use with conductor material. Locate at opposite end of bus from incoming lugs or main device.
 5. Subfeed (Double) Lugs: Compression type suitable for use with conductor material. Locate at same end of bus as incoming lugs or main device.
 6. Extra-Capacity Neutral Lugs: Rated 200 percent of phase lugs mounted on extra-capacity neutral bus.
- F. Service Equipment Label: NRTL labeled for use as service equipment for panelboards with one or more main service disconnecting and overcurrent protective devices.
- G. Future Devices: Mounting brackets, bus connections, filler plates, and necessary appurtenances required for future installation of devices.
- H. Panelboard Short-Circuit Current Rating: Fully rated to interrupt symmetrical short-circuit current available at terminals.
- I. Panelboards shall be labeled to warn qualified persons of potential electric arc flash hazards per NEC 110.16.

2.2 DISTRIBUTION PANELBOARDS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
 - 2. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
 - 3. Siemens Energy & Automation, Inc.
 - 4. Square D; a brand of Schneider Electric.
- B. Panelboards: NEMA PB 1, power and feeder distribution type.
- C. Doors: Secured with vault-type latch with tumbler lock; keyed alike.
 - 1. For doors more than 36 inches high, provide two latches, keyed alike.
- D. Mains: Circuit breaker or lugs only.
- E. Branch Overcurrent Protective Devices for Circuit-Breaker Frame Sizes 125 A and Smaller: Bolt-on circuit breakers.
- F. Branch Overcurrent Protective Devices for Circuit-Breaker Frame Sizes Larger Than 125 A: Bolt-on circuit breakers; plug-in circuit breakers where individual positive-locking device requires mechanical release for removal.

2.3 LIGHTING AND APPLIANCE BRANCH-CIRCUIT PANELBOARDS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
 - 2. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
 - 3. Siemens Energy & Automation, Inc.
 - 4. Square D; a brand of Schneider Electric.
- B. Panelboards: NEMA PB 1, lighting and appliance branch-circuit type.
- C. Mains: Circuit breaker or lugs only.
- D. Branch Overcurrent Protective Devices: Plug-in circuit breakers, replaceable without disturbing adjacent units.
- E. Doors: Concealed hinges; secured with flush latch with tumbler lock; keyed alike.

2.4 DISCONNECTING AND OVERCURRENT PROTECTIVE DEVICES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
 - 2. General Electric Company; GE Consumer & Industrial - Electrical Distribution.

3. Siemens Energy & Automation, Inc.
 4. Square D; a brand of Schneider Electric.
- B. Molded-Case Circuit Breaker (MCCB): Comply with UL 489, with interrupting capacity to meet available fault currents.
1. Thermal-Magnetic Circuit Breakers: Inverse time-current element for low-level overloads, and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.
 2. GFCI Circuit Breakers: Single- and two-pole configurations with Class A ground-fault protection (6-mA trip).
 3. Arc-Fault Circuit Interrupter (AFCI) Circuit Breakers: Comply with UL 1699; 120/240-V, single-pole configuration.
 4. Molded-Case Circuit-Breaker (MCCB) Features and Accessories:
 - a. Standard frame sizes, trip ratings, and number of poles.
 - b. Mechanical style, suitable for number, size, trip ratings, and conductor materials.
 - c. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HID for feeding fluorescent and high-intensity discharge (HID) lighting circuits.
 - d. Ground-Fault Protection: Integrally mounted relay and trip unit with adjustable pickup and time-delay settings, push-to-test feature, and ground-fault indicator.
 - e. Shunt Trip: 120-V trip coil energized from separate circuit, set to trip at 75 percent of rated voltage.
 - f. Multipole units enclosed in a single housing or factory assembled to operate as a single unit.
 - g. Handle Clamp: Loose attachment, for holding circuit-breaker handle in on position.

2.5 PANELBOARD SUPPRESSORS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Current Technology; a subsidiary of Danahar Corporation.
 2. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
 3. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
 4. Liebert Corporation.
 5. Siemens Energy & Automation, Inc.
 6. Square D; a brand of Schneider Electric.
- B. Surge Protection Device: IEEE C62.41-compliant, integrally mounted, solid-state, parallel-connected, non-modular type, with sine-wave tracking suppression and filtering modules, UL 1449, second edition, short-circuit current rating matching or exceeding the panelboard short-circuit rating, and with the following features and accessories:
1. Accessories:
 - a. LED indicator lights for power and protection status.
 - b. Audible alarm, with silencing switch, to indicate when protection has failed.

- c. One set of dry contacts rated at 5 A and 250-V ac, for remote monitoring of protection status.
- C. Surge Protection Device: IEEE C62.41-compliant, integrally mounted, plug-in, solid-state, parallel-connected, modular (with field-replaceable modules) type, with sine-wave tracking suppression and filtering modules, UL 1449, second edition, short-circuit current rating matching or exceeding the panelboard short-circuit rating, and with the following features and accessories:
 - 1. Accessories:
 - a. Fuses rated at 200-kA interrupting capacity.
 - b. Fabrication using bolted compression lugs for internal wiring.
 - c. Redundant suppression circuits.
 - d. Redundant replaceable modules.
 - e. Arrangement with wire connections to phase buses, neutral bus, and ground bus.
 - f. LED indicator lights for power and protection status.
 - g. Audible alarm, with silencing switch, to indicate when protection has failed.
 - h. Form-C contacts rated at 5 A and 250-V ac, one normally open and one normally closed, for remote monitoring of system operation. Contacts shall reverse position on failure of any surge diversion module or on opening of any current-limiting device. Coordinate with building power monitoring and control system.
 - i. Four-digit, transient-event counter set to totalize transient surges.
 - 2. Peak Single-Impulse Surge Current Rating: 120 kA per mode/240 kA per phase.
 - 3. Minimum single-impulse current ratings, using 8-by-20-mic.sec. waveform described in IEEE C62.41.2.
 - a. Line to Neutral: 70,000 A.
 - b. Line to Ground: 70,000 A.
 - c. Neutral to Ground: 50,000 A.
 - 4. Withstand Capabilities: 12,000 IEEE C62.41, Category C3 (10 kA), 8-by-20-mic.sec. surges with less than 5 percent change in clamping voltage.
 - 5. Protection modes and UL 1449 SVR for grounded wye circuits with 208Y/120-V, three-phase, four-wire circuits shall be as follows:
 - a. Line to Neutral: 400 V for 208Y/120.
 - b. Line to Ground: 400 V for 208Y/120.
 - c. Neutral to Ground: 400 V for 208Y/120.

2.6 ACCESSORY COMPONENTS AND FEATURES

- A. Accessory Set: Include tools and miscellaneous items required for overcurrent protective device test, inspection, maintenance, and operation.
- B. Portable Test Set: For testing functions of solid-state trip devices without removing from panelboard. Include relay and meter test plugs suitable for testing panelboard meters and switchboard class relays.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Receive, inspect, handle, and store panelboards according to NEMA PB 1.1.
- B. Examine panelboards before installation. Reject panelboards that are damaged or rusted or have been subjected to water saturation.
- C. Examine elements and surfaces to receive panelboards for compliance with installation tolerances and other conditions affecting performance of the Work.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install panelboards and accessories according to NEMA PB 1.1.
- B. Equipment Mounting: Install panelboards on concrete bases, 4-inch nominal thickness. Comply with requirements for concrete base specified in Division 3 "Cast-in-Place Concrete."
 - 1. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around full perimeter of base.
 - 2. For panelboards, 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 panelboards.
 - 5. Attach panelboard to the vertical finished or structural surface behind the panelboard.
- C. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from panelboards.
- D. Comply with mounting and anchoring requirements specified in Section 260548 "Vibration and Seismic Controls for Electrical Systems."
- E. Mount top of trim 90 inches above finished floor and with a minimum clearance of 6 inches above finished floor, unless otherwise indicated.
- F. Mount panelboard cabinet plumb and rigid without distortion of box. Mount recessed panelboards with fronts uniformly flush with wall finish and mating with back box.
- G. Install overcurrent protective devices and controllers not already factory installed.
 - 1. Set field-adjustable, circuit-breaker trip ranges.
- H. Install filler plates in unused spaces.
- I. Stub four 1-inch empty conduits from panelboard into accessible ceiling space or space designated to be ceiling space in the future. Stub four 1-inch empty conduits into raised floor space or below slab not on grade.

- J. Arrange conductors in gutters into groups and bundle and wrap with wire ties after completing load balancing.
- K. Comply with NECA 1.

3.3 IDENTIFICATION

- A. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs complying with Section 260553 "Identification for Electrical Systems."
- B. Create a directory to indicate installed circuit loads after balancing panelboard loads; incorporate Owner's final room designations. Obtain approval before installing. Use a computer or typewriter to create directory; handwritten directories are not acceptable.
- C. Panelboard Nameplates: Label each panelboard with a nameplate complying with requirements for identification specified in Section 260553 "Identification for Electrical Systems."
- D. Device Nameplates: Label each branch circuit device in distribution panelboards with a nameplate complying with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

3.4 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
- B. Acceptance Testing Preparation:
 - 1. Test insulation resistance for each panelboard bus, component, connecting supply, feeder, and control circuit.
 - 2. Test continuity of each circuit.
- C. Tests and Inspections:
 - 1. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
 - 2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
- D. Panelboards will be considered defective if they do not pass tests and inspections.
- E. Prepare test and inspection reports, including a certified report that identifies panelboards included and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

3.5 ADJUSTING

- A. Adjust moving parts and operable component to function smoothly, and lubricate as recommended by manufacturer.

- B. Load Balancing: After Substantial Completion, but not more than 60 days after Final Acceptance, measure load balancing and make circuit changes.
1. Measure as directed during period of normal system loading.
 2. Perform load-balancing circuit changes outside normal occupancy/working schedule of the facility and at time directed. Avoid disrupting critical 24-hour services such as fax machines and on-line data processing, computing, transmitting, and receiving equipment.
 3. After circuit changes, recheck loads during normal load period. Record all load readings before and after changes and submit test records.
 4. Tolerance: Difference exceeding 20 percent between phase loads, within a panelboard, is not acceptable. Rebalance and recheck as necessary to meet this minimum requirement.

END OF SECTION 262416

SECTION 262726 - WIRING DEVICES

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. Receptacles, receptacles with integral GFCI, and associated device plates.
2. Twist-locking receptacles.
3. Weather-resistant receptacles.
4. Snap switches and wall-box dimmers.
5. Solid-state fan speed controls.
6. Wall-switch and exterior occupancy sensors.
7. Communications outlets.
8. Pendant cord-connector devices.
9. Cord and plug sets.
10. Floor service outlets and multioutlet assemblies.

1.3 DEFINITIONS

- A. EMI: Electromagnetic interference.
- B. GFCI: Ground-fault circuit interrupter.
- C. Pigtail: Short lead used to connect a device to a branch-circuit conductor.
- D. RFI: Radio-frequency interference.
- E. TVSS: Transient voltage surge suppressor.
- F. UTP: Unshielded twisted pair.

1.4 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:

1. Receptacles for Owner-Furnished Equipment: Match plug configurations.
2. Cord and Plug Sets: Match equipment requirements.

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: List of legends and description of materials and process used for premarking wall plates.

1.6 INFORMATIONAL SUBMITTALS

- A. Field quality-control reports.

1.7 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For wiring devices to include in all manufacturers' packing-label warnings and instruction manuals that include labeling conditions.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers' Names: Shortened versions (shown in parentheses) of the following manufacturers' names are used in other Part 2 articles:
 - 1. Cooper Wiring Devices; Division of Cooper Industries, Inc. (Cooper).
 - 2. Hubbell Incorporated; Wiring Device-Kellems (Hubbell).
 - 3. Leviton Mfg. Company Inc. (Leviton).
 - 4. Pass & Seymour/Legrand (Pass & Seymour).
- B. Source Limitations: Obtain each type of wiring device and associated wall plate from single source from single manufacturer.

2.2 GENERAL WIRING-DEVICE REQUIREMENTS

- A. Wiring Devices, Components, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Comply with NFPA 70.
- C. Devices that are manufactured for use with modular plug-in connectors may be substituted under the following conditions:
 - 1. Connectors shall comply with UL 2459 and shall be made with stranding building wire.
 - 2. Devices shall comply with the requirements in this Section.

2.3 STRAIGHT-BLADE RECEPTACLES

- A. Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 Configuration 5-20R, UL 498, and FS W-C-596.

1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Cooper; 5351 (single), CR5362 (duplex).
 - b. Hubbell; HBL5351 (single), HBL5352 (duplex).
 - c. Leviton; 5891 (single), 5352 (duplex).
 - d. Pass & Seymour; 5361 (single), 5362 (duplex).

2.4 GFCI RECEPTACLES

A. General Description:

1. Straight blade, non-feed-through type.
2. Comply with NEMA WD 1, NEMA WD 6, UL 498, UL 943 Class A, and FS W-C-596.
3. Include indicator light that shows when the GFCI has malfunctioned and no longer provides proper GFCI protection.
4. Exterior GFCI receptacles shall be weather-resistant type.

B. Duplex GFCI Convenience Receptacles, 125 V, 20 A:

1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Cooper; VGF20.
 - b. Hubbell; GFR5352L.
 - c. Pass & Seymour; 2095.
 - d. Leviton; 7590.

2.5 TWIST-LOCKING RECEPTACLES

A. Single Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 Configuration L5-20R, and UL 498.

1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Cooper; CWL520R.
 - b. Hubbell; HBL2310.
 - c. Leviton; 2310.
 - d. Pass & Seymour; L520-R.

2.6 PENDANT CORD-CONNECTOR DEVICES

A. Description:

1. Matching, locking-type plug and receptacle body connector.
2. NEMA WD 6 Configurations L5-20P and L5-20R, heavy-duty grade, and FS W-C-596.
3. Body: Nylon, with screw-open, cable-gripping jaws and provision for attaching external cable grip.
4. External Cable Grip: Woven wire-mesh type made of high-strength, galvanized-steel wire strand, matched to cable diameter, and with attachment provision designed for corresponding connector.

2.7 CORD AND PLUG SETS

A. Description:

1. Match voltage and current ratings and number of conductors to requirements of equipment being connected.
2. Cord: Rubber-insulated, stranded-copper conductors, with Type SOW-A jacket; with green-insulated grounding conductor and ampacity of at least 130 percent of the equipment rating.
3. Plug: Nylon body and integral cable-clamping jaws. Match cord and receptacle type for connection.

2.8 TOGGLE SWITCHES

A. Comply with NEMA WD 1, UL 20, and FS W-S-896.

B. Switches, 120/277 V, 20 A:

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

1) Single Pole:

- a) Cooper; AH1221.
- b) Hubbell; HBL1221.
- c) Leviton; 1221-2.
- d) Pass & Seymour; CSB20AC1.

2) Two Pole:

- a) Cooper; AH1222.
- b) Hubbell; HBL1222.
- c) Leviton; 1222-2.
- d) Pass & Seymour; CSB20AC2.

3) Three Way:

- a) Cooper; AH1223.
- b) Hubbell; HBL1223.
- c) Leviton; 1223-2.
- d) Pass & Seymour; CSB20AC3.

4) Four Way:

- a) Cooper; AH1224.
- b) Hubbell; HBL1224.
- c) Leviton; 1224-2.
- d) Pass & Seymour; CSB20AC4.

C. Single-Pole, Double-Throw, Momentary-Contact, Center-off Switches: 120/277 V, 20 A; for use with mechanically held lighting contactors.

1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Cooper; 1995.
 - b. Hubbell; HBL1557.
 - c. Leviton; 1257.
 - d. Pass & Seymour; 1251.

D. Combination Toggle Switch and Fan Speed Controls:

1. Modular, 120-V, full-wave, solid-state units with integral, quiet on-off switches and audible frequency and EMI/RFI filters.
2. Comply with UL 1917.
3. Three-speed adjustable slider, 1.5 A.

2.9 WALL-BOX DIMMERS

- A. Dimmer Switches: Modular, full-wave, solid-state units with integral, quiet on-off switches, with audible frequency and EMI/RFI suppression filters.
- B. Control: Continuously adjustable slider with toggle switch; with single-pole or three-way switching. Comply with UL 1472.
- C. Fluorescent Lamp Dimmer Switches: Modular; compatible with dimmer ballasts; trim potentiometer to adjust low-end dimming; dimmer-ballast combination capable of consistent dimming with low end not greater than 20 percent of full brightness.

2.10 WALL PLATES

- A. Single and combination types shall match corresponding wiring devices.
 1. Plate-Securing Screws: Metal with head color to match plate finish.
 2. Material for Finished Spaces: Smooth, high-impact thermoplastic.
 3. Material for Unfinished Spaces: Smooth, high-impact thermoplastic.
 4. Material for Damp Locations: Thermoplastic with spring-loaded lift cover, and listed and labeled for use in wet and damp locations.
- B. Wet-Location, "While-In-Use" Weatherproof Cover Plates: NEMA 250, complying with Type 3R, weather-resistant with lockable cover.

2.11 FLOOR SERVICE FITTINGS

- A. Type: Modular, flush-type, dual-service units suitable for wiring method used.
- B. Compartments: Barrier separates power from voice and data communication cabling.
- C. Service Plate: Rectangular, solid brass with satin finish.
- D. Power Receptacle: NEMA WD 6 Configuration 5-20R, gray finish, unless otherwise indicated.
- E. Voice and Data Communication Outlet: Blank cover with bushed cable opening.

2.12 PREFABRICATED MULTIOUTLET ASSEMBLIES

- A. Manufacturers: Subject to compliance with requirements, provide one of the following:
 - 1. Hubbell Incorporated; Wiring Device-Kellems.
 - 2. Wiremold/Legrand.
- B. Description:
 - 1. Two-piece surface metal raceway, with factory-wired multioutlet harness.
 - 2. Components shall be products from single manufacturer designed for use as a complete, matching assembly of raceways and receptacles.
- C. Raceway Material: Metal, with manufacturer's standard finish.
- D. Multioutlet Harness:
 - 1. Receptacles: 20-A, 125-V, NEMA WD 6 Configuration 5-20R receptacles complying with NEMA WD 1, UL 498, and FS W-C-596.
 - 2. Receptacle Spacing: 12 inches.
 - 3. Wiring: No. 12 AWG solid, Type THHN copper, single circuit.

2.13 FINISHES

- A. Device Color:
 - 1. Wiring Devices Connected to Normal Power System: Ivory unless otherwise indicated or required by NFPA 70 or device listing.
 - 2. Wiring Devices Connected to Emergency Power System: Red.
- B. Wall Plate Color: For plastic covers, match device color.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Comply with NECA 1, including mounting heights listed in that standard, unless otherwise indicated.
- B. Coordination with Other Trades:
 - 1. Protect installed devices and their boxes. Do not place wall finish materials over device boxes and do not cut holes for boxes with routers that are guided by riding against outside of boxes.
 - 2. Keep outlet boxes free of plaster, drywall joint compound, mortar, cement, concrete, dust, paint, and other material that may contaminate the raceway system, conductors, and cables.
 - 3. Install device boxes in brick or block walls so that the cover plate does not cross a joint unless the joint is troweled flush with the face of the wall.
 - 4. Install wiring devices after all wall preparation, including painting, is complete.

C. Conductors:

1. Do not strip insulation from conductors until right before they are spliced or terminated on devices.
2. Strip insulation evenly around the conductor using tools designed for the purpose. Avoid scoring or nicking of solid wire or cutting strands from stranded wire.
3. The length of free conductors at outlets for devices shall meet provisions of NFPA 70, Article 300, without pigtails.
4. Existing Conductors:
 - a. Cut back and pigtail, or replace all damaged conductors.
 - b. Straighten conductors that remain and remove corrosion and foreign matter.
 - c. Pigtailling existing conductors is permitted, provided the outlet box is large enough.

D. Device Installation:

1. Replace devices that have been in temporary use during construction and that were installed before building finishing operations were complete.
2. Keep each wiring device in its package or otherwise protected until it is time to connect conductors.
3. Do not remove surface protection, such as plastic film and smudge covers, until the last possible moment.
4. Connect devices to branch circuits using pigtails that are not less than 6 inches in length.
5. When there is a choice, use side wiring with binding-head screw terminals. Wrap solid conductor tightly clockwise, two-thirds to three-fourths of the way around terminal screw.
6. Use a torque screwdriver when a torque is recommended or required by manufacturer.
7. When conductors larger than No. 12 AWG are installed on 15- or 20-A circuits, splice No. 12 AWG pigtails for device connections.
8. Tighten unused terminal screws on the device.
9. When mounting into metal boxes, remove the fiber or plastic washers used to hold device-mounting screws in yokes, allowing metal-to-metal contact.

E. Receptacle Orientation:

1. Install ground pin of vertically mounted receptacles down, and on horizontally mounted receptacles to the right.

F. Device Plates: Do not use oversized or extra-deep plates. Repair wall finishes and remount outlet boxes when standard device plates do not fit flush or do not cover rough wall opening.

G. Dimmers:

1. Install dimmers within terms of their listing.
2. Verify that dimmers used for fan speed control are listed for that application.
3. Install unshared neutral conductors on line and load side of dimmers according to manufacturers' device listing conditions in the written instructions.

H. Arrangement of Devices: Unless otherwise indicated, mount flush, with long dimension vertical and with grounding terminal of receptacles on top. Group adjacent switches under single, multigang wall plates.

- I. Adjust locations of floor service outlets and service poles to suit arrangement of partitions and furnishings.

3.2 GFCI RECEPTACLES

- A. Install non-feed-through-type GFCI receptacles where protection of downstream receptacles is not required.

3.3 IDENTIFICATION

- A. Comply with Section 260553 "Identification for Electrical Systems."
- B. Identify each receptacle with panelboard identification and circuit number. Use embossed adhesive with 3/16-inch white lettering on black background on face of plate, and durable wire markers or tags inside outlet boxes.

3.4 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections:
 - 1. Test Instruments: Use instruments that comply with UL 1436.
 - 2. Test Instrument for Convenience Receptacles: Digital wiring analyzer with digital readout or illuminated digital-display indicators of measurement.
- B. Tests for Convenience Receptacles:
 - 1. Line Voltage: Acceptable range is 105 to 132 V.
 - 2. Percent Voltage Drop under 15-A Load: A value of 6 percent or higher is unacceptable.
 - 3. Ground Impedance: Values of up to 2 ohms are acceptable.
 - 4. GFCI Trip: Test for tripping values specified in UL 1436 and UL 943.
 - 5. Using the test plug, verify that the device and its outlet box are securely mounted.
 - 6. Tests shall be diagnostic, indicating damaged conductors, high resistance at the circuit breaker, poor connections, inadequate fault current path, defective devices, or similar problems. Correct circuit conditions, remove malfunctioning units and replace with new ones, and retest as specified above.
- C. Wiring device will be considered defective if it does not pass tests and inspections.
- D. Prepare test and inspection reports.

END OF SECTION 262726

SECTION 262813 - FUSES

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. Cartridge fuses rated 600-V ac and less for use in enclosed switches and enclosed controllers.
2. Spare-fuse cabinets.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated. Include construction details, material, dimensions, descriptions of individual components, and finishes for spare-fuse cabinets. Include the following for each fuse type indicated:
 1. Ambient Temperature Adjustment Information: If ratings of fuses have been adjusted to accommodate ambient temperatures, provide list of fuses with adjusted ratings.
 - a. For each fuse having adjusted ratings, include location of fuse, original fuse rating, local ambient temperature, and adjusted fuse rating.
 - b. Provide manufacturer's technical data on which ambient temperature adjustment calculations are based.
 2. Dimensions and manufacturer's technical data on features, performance, electrical characteristics, and ratings.
 3. Fuse sizes for elevator feeders and elevator disconnect switches.

1.4 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For fuses to include in emergency, operation, and maintenance manuals. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:
 1. Ambient temperature adjustment information.
 2. Current-limitation curves for fuses with current-limiting characteristics.

1.5 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Fuses: Equal to 10 percent of quantity installed for each size and type, but no fewer than two of each size and type.

1.6 QUALITY ASSURANCE

- A. Source Limitations: Obtain fuses, for use within a specific product or circuit, from single source from single manufacturer.
- B. 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.
- C. Comply with NEMA FU 1 for cartridge fuses.
- D. Comply with NFPA 70.

1.7 COORDINATION

- A. Coordinate fuse ratings with utilization equipment nameplate limitations of maximum fuse size and with system short-circuit current levels.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Cooper Bussmann, Inc.
 - 2. Edison Fuse, Inc.
 - 3. Ferraz Shawmut, Inc.
 - 4. Littelfuse, Inc.

2.2 CARTRIDGE FUSES

- A. Characteristics: NEMA FU 1, nonrenewable cartridge fuses with voltage ratings consistent with circuit voltages.

2.3 SPARE-FUSE CABINET

- A. Characteristics: Wall-mounted steel unit with full-length, recessed piano-hinged door and key-coded cam lock and pull.

1. Size: Adequate for storage of spare fuses specified with 15 percent spare capacity minimum.
2. Finish: Gray, baked enamel.
3. Identification: "SPARE FUSES" in 1-1/2-inch-high letters on exterior of door.
4. Fuse Pullers: For each size of fuse, where applicable and available, from fuse manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine fuses before installation. Reject fuses that are moisture damaged or physically damaged.
- B. Examine holders to receive fuses for compliance with installation tolerances and other conditions affecting performance, such as rejection features.
- C. Examine utilization equipment nameplates and installation instructions. Install fuses of sizes and with characteristics appropriate for each piece of equipment.
- D. Evaluate ambient temperatures to determine if fuse rating adjustment factors must be applied to fuse ratings.
- E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 FUSE APPLICATIONS

- A. Cartridge Fuses:
 1. Service Entrance: Class L, fast acting.
 2. Feeders: Class L, fast acting.
 3. Motor Branch Circuits: Class RK1, time delay.
 4. Other Branch Circuits: Class RK1, time delay.
 5. Control Circuits: Class CC, fast acting.

3.3 INSTALLATION

- A. Install fuses in fusible devices. Arrange fuses so rating information is readable without removing fuse.
- B. Install spare-fuse cabinet(s).

3.4 IDENTIFICATION

- A. Install labels complying with requirements for identification specified in Section 260553 "Identification for Electrical Systems" and indicating fuse replacement information on inside door of each fused switch and adjacent to each fuse block, socket, and holder.

END OF SECTION 262813

SECTION 262816 - ENCLOSED SWITCHES AND CIRCUIT BREAKERS

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. Section Includes:
 - 1. Fusible switches.
 - 2. Nonfusible switches.
 - 3. Molded-case circuit breakers (MCCBs).
 - 4. Enclosures.

1.3 DEFINITIONS

- A. NC: Normally closed.
- B. NO: Normally open.
- C. SPDT: Single pole, double throw.

1.4 PERFORMANCE REQUIREMENTS

- A. Seismic Performance: Enclosed switches and circuit breakers 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."

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of enclosed switch, circuit breaker, accessory, and component indicated. Include dimensioned elevations, sections, weights, and manufacturers' technical data on features, performance, electrical characteristics, ratings, accessories, and finishes.
 - 1. Enclosure types and details for types other than NEMA 250, Type 1.
 - 2. Current and voltage ratings.
 - 3. Short-circuit current ratings (interrupting and withstand, as appropriate).
 - 4. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices, accessories, and auxiliary components.

- B. Shop Drawings: For enclosed switches and circuit breakers. Include plans, elevations, sections, details, and attachments to other work.
 - 1. Wiring Diagrams: For power, signal, and control wiring.

1.6 INFORMATIONAL SUBMITTALS

- A. Seismic Qualification Certificates: For enclosed switches and circuit breakers, 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.
- B. Field quality-control reports.
 - 1. Test procedures used.
 - 2. Test results that comply with requirements.
 - 3. Results of failed tests and corrective action taken to achieve test results that comply with requirements.
- C. Manufacturer's field service report.

1.7 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For enclosed switches and circuit breakers to include in emergency, operation, and maintenance manuals. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:
 - 1. Manufacturer's written instructions for testing and adjusting enclosed switches and circuit breakers.

1.8 QUALITY ASSURANCE

- A. Source Limitations: Obtain enclosed switches and circuit breakers, overcurrent protective devices, components, and accessories, within same product category, from single source from single manufacturer.
- B. Product Selection for Restricted Space: Drawings indicate maximum dimensions for enclosed switches and circuit breakers, including clearances between enclosures, and adjacent surfaces and other items. Comply with indicated maximum dimensions.
- 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.
- D. Comply with NFPA 70.

1.9 COORDINATION

- A. Coordinate layout and installation of switches, circuit breakers, and components with equipment served and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

PART 2 - PRODUCTS

2.1 FUSIBLE SWITCHES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
 - 2. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
 - 3. Siemens Energy & Automation, Inc.
 - 4. Square D; a brand of Schneider Electric.
- B. Type HD, Heavy Duty, Single Throw, 240-V ac, 1200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, with clips or bolt pads to accommodate indicated fuses, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.
- C. Accessories:
 - 1. Equipment Ground Kit: Internally mounted and labeled for copper and aluminum ground conductors.
 - 2. Neutral Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.
 - 3. Isolated Ground Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.
 - 4. Class R Fuse Kit: Provides rejection of other fuse types when Class R fuses are specified.
 - 5. Auxiliary Contact Kit: One NO/NC (Form "C") auxiliary contact(s), arranged to activate before switch blades open.
 - 6. Lugs: Mechanical type, suitable for number, size, and conductor material.
 - 7. Service-Rated Switches: Labeled for use as service equipment.

2.2 NONFUSIBLE SWITCHES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
 - 2. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
 - 3. Siemens Energy & Automation, Inc.
 - 4. Square D; a brand of Schneider Electric.

- B. Type HD, Heavy Duty, Single Throw, 240-V ac, 1200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.
- C. Accessories:
 - 1. Equipment Ground Kit: Internally mounted and labeled for copper and aluminum ground conductors.
 - 2. Neutral Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.
 - 3. Isolated Ground Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.
 - 4. Auxiliary Contact Kit: One NO/NC (Form "C") auxiliary contact(s), arranged to activate before switch blades open.
 - 5. Lugs: Mechanical type, suitable for number, size, and conductor material.

2.3 MOLDED-CASE CIRCUIT BREAKERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
 - 2. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
 - 3. Siemens Energy & Automation, Inc.
 - 4. Square D; a brand of Schneider Electric.
- B. General Requirements: Comply with UL 489, NEMA AB 1, and NEMA AB 3, with interrupting capacity to comply with available fault currents.
- C. Thermal-Magnetic Circuit Breakers: Inverse time-current element for low-level overloads and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.
- D. Adjustable, Instantaneous-Trip Circuit Breakers: Magnetic trip element with front-mounted, field-adjustable trip setting.
- E. Electronic Trip Circuit Breakers: Field-replaceable rating plug, rms sensing, with the following field-adjustable settings:
 - 1. Instantaneous trip.
 - 2. Long- and short-time pickup levels.
 - 3. Long- and short-time time adjustments.
 - 4. Ground-fault pickup level, time delay, and I^2t response.
- F. Current-Limiting Circuit Breakers: Frame sizes 400 A and smaller, and let-through ratings less than NEMA FU 1, RK-5.
- G. Integrally Fused Circuit Breakers: Thermal-magnetic trip element with integral limiter-style fuse listed for use with circuit breaker and trip activation on fuse opening or on opening of fuse compartment door.

H. Features and Accessories:

1. Standard frame sizes, trip ratings, and number of poles.
2. Lugs: Compression type, suitable for number, size, trip ratings, and conductor material.
3. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HID for feeding fluorescent and high-intensity discharge lighting circuits.
4. Shunt Trip: Trip coil energized from separate circuit, with coil-clearing contact.
5. Undervoltage Trip: Set to operate at 35 to 75 percent of rated voltage without intentional time delay.
6. Auxiliary Contacts: One SPDT switch with "a" and "b" contacts; "a" contacts mimic circuit-breaker contacts, "b" contacts operate in reverse of circuit-breaker contacts.
7. Electrical Operator: Provide remote control for on, off, and reset operations.

2.4 ENCLOSURES

- A. Enclosed Switches and Circuit Breakers: NEMA AB 1, NEMA KS 1, NEMA 250, and UL 50, to comply with environmental conditions at installed location.
 1. Indoor, Dry and Clean Locations: NEMA 250, Type 1.
 2. Outdoor Locations: NEMA 250, Type 3R.
 3. Wash-Down Areas: NEMA 250, Type 4X, stainless steel.
 4. Other Wet or Damp, Indoor Locations: NEMA 250, Type 4.
 5. Indoor Locations Subject to Dust, Falling Dirt, and Dripping Noncorrosive Liquids: NEMA 250, Type 12.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine elements and surfaces to receive enclosed switches and circuit breakers for compliance with installation tolerances and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install individual wall-mounted switches and circuit breakers with tops at uniform height unless otherwise indicated.
- B. Comply with mounting and anchoring requirements specified in Section 260548 "Vibration and Seismic Controls for Electrical Systems."
- C. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from enclosures and components.
- D. Install fuses in fusible devices.
- E. Comply with NECA 1.

3.3 IDENTIFICATION

- A. Comply with requirements in Section 260553 "Identification for Electrical Systems."
 - 1. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs.
 - 2. Label each enclosure with engraved metal or laminated-plastic nameplate.

3.4 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
- B. Acceptance Testing Preparation:
 - 1. Test insulation resistance for each enclosed switch and circuit breaker, component, connecting supply, feeder, and control circuit.
 - 2. Test continuity of each circuit.
- C. Tests and Inspections:
 - 1. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
 - 2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
 - 3. Perform the following infrared scan tests and inspections and prepare reports:
 - a. Initial Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each enclosed switch and circuit breaker. Remove front panels so joints and connections are accessible to portable scanner.
 - b. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each enclosed switch and circuit breaker 11 months after date of Substantial Completion.
 - c. Instruments and Equipment: Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.
 - 4. Test and adjust controls, remote monitoring, and safeties. Replace damaged and malfunctioning controls and equipment.
- D. Enclosed switches and circuit breakers will be considered defective if they do not pass tests and inspections.
- E. Prepare test and inspection reports, including a certified report that identifies enclosed switches and circuit breakers and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

3.5 ADJUSTING

- A. Adjust moving parts and operable components to function smoothly, and lubricate as recommended by manufacturer.

END OF SECTION 262816

SECTION 263600 - TRANSFER SWITCHES

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 transfer switches rated 600 V and less, including the following:
 - 1. Automatic transfer switches.
 - 2. Bypass/isolation switches.
 - 3. Remote annunciation systems.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated. Include rated capacities, weights, operating characteristics, furnished specialties, and accessories.
- B. Shop Drawings: Dimensioned plans, elevations, sections, and details showing minimum clearances, conductor entry provisions, gutter space, installed features and devices, and material lists for each switch specified.
 - 1. Single-Line Diagram: Show connections between transfer switch, bypass/isolation switch, power sources, and load; and show interlocking provisions for each combined transfer switch and bypass/isolation switch.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For manufacturer and testing agency.
- B. Manufacturer Seismic Qualification Certification: Submit certification that transfer switches accessories, and components will withstand seismic forces defined in Section 260548 "Vibration and Seismic Controls for Electrical Systems." Include the following:
 - 1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
 - a. 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."
 - b. 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."

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.

C. Field quality-control reports.

1.5 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For each type of product to include in emergency, operation, and maintenance manuals. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:
1. Features and operating sequences, both automatic and manual.
 2. List of all factory settings of relays; provide relay-setting and calibration instructions, including software, where applicable.

1.6 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Maintain a service center capable of providing training, parts, and emergency maintenance repairs within a response period of less than eight hours from time of notification.
- B. Testing Agency Qualifications: An independent agency, with the experience and capability to conduct the testing indicated, that is a member company of the InterNational Electrical Testing Association or is a nationally recognized testing laboratory (NRTL) as defined by OSHA in 29 CFR 1910.7, and that is acceptable to authorities having jurisdiction.
1. Testing Agency's Field Supervisor: Person currently certified by the InterNational Electrical Testing Association or the National Institute for Certification in Engineering Technologies to supervise on-site testing specified in Part 3.
- C. Source Limitations: Obtain automatic transfer switches through one source from a single manufacturer.
- D. 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.
- E. Comply with NEMA ICS 1.
- F. Comply with NFPA 70.
- G. Comply with NFPA 99.
- H. Comply with NFPA 110.
- I. Comply with UL 1008 unless requirements of these Specifications are stricter.

1.7 FIELD CONDITIONS

- A. Interruption of Existing Electrical Service: Do not interrupt electrical service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary electrical service:
 - 1. Notify Architect no fewer than 14 days in advance of proposed interruption of electrical service.
 - 2. Do not proceed with interruption of electrical service without Architect's written permission.

1.8 COORDINATION

- A. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Section 033000 "Cast-in-Place Concrete."

PART 2 - PRODUCTS

2.1 MANUFACTURED UNITS

- A. Contactor Transfer Switches:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - a. Caterpillar; Engine Div.
 - b. Emerson; ASCO Power Technologies, LP.
 - c. GE Zenith Controls.
 - d. Onan/Cummins Power Generation; Industrial Business Group.
 - e. Spectrum Detroit Diesel.

2.2 GENERAL TRANSFER-SWITCH PRODUCT REQUIREMENTS

- A. Indicated Current Ratings: Apply as defined in UL 1008 for continuous loading and total system transfer, including tungsten filament lamp loads not exceeding 30 percent of switch ampere rating, unless otherwise indicated.
- B. Tested Fault-Current Closing and Withstand Ratings: Adequate for duty imposed by protective devices at installation locations in Project under the fault conditions indicated, based on testing according to UL 1008.
 - 1. Where transfer switch includes internal fault-current protection, rating of switch and trip unit combination shall exceed indicated fault-current value at installation location.
- C. Solid-State Controls: Repetitive accuracy of all settings shall be plus or minus 2 percent or better over an operating temperature range of minus 20 to plus 70 deg C.

- D. Resistance to Damage by Voltage Transients: Components shall meet or exceed voltage-surge withstand capability requirements when tested according to IEEE C62.41. Components shall meet or exceed voltage-impulse withstand test of NEMA ICS 1.
- E. Electrical Operation: Accomplish by a nonfused, momentarily energized solenoid or electric-motor-operated mechanism, mechanically and electrically interlocked in both directions.
- F. Switch Characteristics: Designed for continuous-duty repetitive transfer of full-rated current between active power sources.
 - 1. Limitation: Switches using molded-case switches or circuit breakers or insulated-case circuit-breaker components are not acceptable.
 - 2. Switch Action: Double throw; mechanically held in both directions.
 - 3. Contacts: Silver composition or silver alloy for load-current switching. Conventional automatic transfer-switch units, rated 225 A and higher, shall have separate arcing contacts.
- G. Neutral Switching. Where four-pole switches are indicated, provide neutral pole switched simultaneously with phase poles.
- H. Heater: Equip switches exposed to outdoor temperatures and humidity, and other units indicated, with an internal heater. Provide thermostat within enclosure to control heater.
- I. Battery Charger: For generator starting batteries.
 - 1. Float type rated 10 A.
 - 2. Ammeter to display charging current.
 - 3. Fused ac inputs and dc outputs.
- J. Annunciation, Control, and Programming Interface Components: Devices at transfer switches for communicating with remote programming devices, annunciators, or annunciator and control panels shall have communication capability matched with remote device.
- K. Factory Wiring: Train and bundle factory wiring and label, consistent with Shop Drawings, either by color-code or by numbered or lettered wire and cable tape markers at terminations. Color-coding and wire and cable tape markers are specified in Section 260553 "Identification for Electrical Systems."
 - 1. Designated Terminals: Pressure type, suitable for types and sizes of field wiring indicated.
 - 2. Power-Terminal Arrangement and Field-Wiring Space: Suitable for top, side, or bottom entrance of feeder conductors as indicated.
 - 3. Control Wiring: Equipped with lugs suitable for connection to terminal strips.
- L. Enclosures: General-purpose NEMA 250, Type 1, complying with NEMA ICS 6 and UL 508, unless otherwise indicated.

2.3 AUTOMATIC TRANSFER SWITCHES

- A. Comply with Level 1 equipment according to NFPA 110.

- B. Switching Arrangement: Double-throw type, incapable of pauses or intermediate position stops during normal functioning, unless otherwise indicated.
- C. Manual Switch Operation: Under load, with door closed and with either or both sources energized. Transfer time is same as for electrical operation. Control circuit automatically disconnects from electrical operator during manual operation.
- D. Manual Switch Operation: Unloaded. Control circuit automatically disconnects from electrical operator during manual operation.
- E. Signal-Before-Transfer Contacts: A set of normally open/normally closed dry contacts operates in advance of retransfer to normal source. Interval is adjustable from 1 to 30 seconds.
- F. Digital Communication Interface: Matched to capability of remote annunciator or annunciator and control panel.
- G. Transfer Switches Based on Molded-Case-Switch Components: Comply with NEMA AB 1, UL 489, and UL 869A.
- H. Automatic Closed-Transition Transfer Switches: Include the following functions and characteristics:
 - 1. Fully automatic make-before-break operation.
 - 2. Load transfer without interruption, through momentary interconnection of both power sources not exceeding 100 ms.
 - 3. Initiation of No-Interruption Transfer: Controlled by in-phase monitor and sensors confirming both sources are present and acceptable.
 - a. Initiation occurs without active control of generator.
 - b. Controls ensure that closed-transition load transfer closure occurs only when the 2 sources are within plus or minus 5 electrical degrees maximum, and plus or minus 5 percent maximum voltage difference.
 - 4. Failure of power source serving load initiates automatic break-before-make transfer.
- I. In-Phase Monitor: Factory-wired, internal relay controls transfer so it occurs only when the two sources are synchronized in phase. Relay compares phase relationship and frequency difference between normal and emergency sources and initiates transfer when both sources are within 15 electrical degrees, and only if transfer can be completed within 60 electrical degrees. Transfer is initiated only if both sources are within 2 Hz of nominal frequency and 70 percent or more of nominal voltage.
- J. Motor Disconnect and Timing Relay: Controls designate starters so they disconnect motors before transfer and reconnect them selectively at an adjustable time interval after transfer. Control connection to motor starters is through wiring external to automatic transfer switch. Time delay for reconnecting individual motor loads is adjustable between 1 and 60 seconds, and settings are as indicated. Relay contacts handling motor-control circuit inrush and seal currents are rated for actual currents to be encountered.
- K. Programmed Neutral Switch Position: Switch operator has a programmed neutral position arranged to provide a midpoint between the two working switch positions, with an intentional,

time-controlled pause at midpoint during transfer. Pause is adjustable from 0.5 to 30 seconds minimum and factory set for 0.5 second, unless otherwise indicated. Time delay occurs for both transfer directions. Pause is disabled unless both sources are live.

L. Automatic Transfer-Switch Features:

1. Undervoltage Sensing for Each Phase of Normal Source: Sense low phase-to-ground voltage on each phase. Pickup voltage shall be adjustable from 85 to 100 percent of nominal, and dropout voltage is adjustable from 75 to 98 percent of pickup value. Factory set for pickup at 90 percent and dropout at 85 percent.
2. Adjustable Time Delay: For override of normal-source voltage sensing to delay transfer and engine start signals. Adjustable from zero to six seconds, and factory set for one second.
3. Voltage/Frequency Lockout Relay: Prevent premature transfer to generator. Pickup voltage shall be adjustable from 85 to 100 percent of nominal. Factory set for pickup at 90 percent. Pickup frequency shall be adjustable from 90 to 100 percent of nominal. Factory set for pickup at 95 percent.
4. Time Delay for Retransfer to Normal Source: Adjustable from 0 to 30 minutes, and factory set for 10 minutes to automatically defeat delay on loss of voltage or sustained undervoltage of emergency source, provided normal supply has been restored.
5. Test Switch: Simulate normal-source failure.
6. Switch-Position Pilot Lights: Indicate source to which load is connected.
7. Source-Available Indicating Lights: Supervise sources via transfer-switch normal- and emergency-source sensing circuits.
 - a. Normal Power Supervision: Green light with nameplate engraved "Normal Source Available."
 - b. Emergency Power Supervision: Red light with nameplate engraved "Emergency Source Available."
8. Unassigned Auxiliary Contacts: Two normally open, single-pole, double-throw contacts for each switch position, rated 10 A at 240-V ac.
9. Transfer Override Switch: Overrides automatic retransfer control so automatic transfer switch will remain connected to emergency power source regardless of condition of normal source. Pilot light indicates override status.
10. Engine Starting Contacts: One isolated and normally closed, and one isolated and normally open; rated 10 A at 32-V dc minimum.
11. Engine Shutdown Contacts: Instantaneous; shall initiate shutdown sequence at remote engine-generator controls after retransfer of load to normal source.
12. Engine Shutdown Contacts: Time delay adjustable from zero to five minutes, and factory set for five minutes. Contacts shall initiate shutdown at remote engine-generator controls after retransfer of load to normal source.
13. Engine-Generator Exerciser: Solid-state, programmable-time switch starts engine generator and transfers load to it from normal source for a preset time, then retransfers and shuts down engine after a preset cool-down period. Initiates exercise cycle at preset intervals adjustable from 7 to 30 days. Running periods are adjustable from 10 to 30 minutes. Factory settings are for 7-day exercise cycle, 20-minute running period, and 5-minute cool-down period. Exerciser features include the following:
 - a. Exerciser Transfer Selector Switch: Permits selection of exercise with and without load transfer.

- b. Push-button programming control with digital display of settings.
- c. Integral battery operation of time switch when normal control power is not available.

2.4 BYPASS/ISOLATION SWITCHES

- A. Comply with requirements for Level 1 equipment according to NFPA 110.
- B. Description: Manual type, arranged to select and connect either source of power directly to load, isolating transfer switch from load and from both power sources. Include the following features for each combined automatic transfer switch and bypass/isolation switch:
 - 1. Means to lock bypass/isolation switch in the position that isolates transfer switch with an arrangement that permits complete electrical testing of transfer switch while isolated. While isolated, interlocks prevent transfer-switch operation, except for testing or maintenance.
 - 2. Drawout Arrangement for Transfer Switch: Provide physical separation from live parts and accessibility for testing and maintenance operations.
 - 3. Bypass/Isolation Switch Current, Voltage, Closing, and Short-Circuit Withstand Ratings: Equal to or greater than those of associated automatic transfer switch, and with same phase arrangement and number of poles.
 - 4. Contact temperatures of bypass/isolation switches shall not exceed those of automatic transfer-switch contacts when they are carrying rated load.
 - 5. Operability: Constructed so load bypass and transfer-switch isolation can be performed by 1 person in no more than 2 operations in 15 seconds or less.
 - 6. Legend: Manufacturer's standard legend for control labels and instruction signs shall describe operating instructions.
 - 7. Maintainability: Fabricate to allow convenient removal of major components from front without removing other parts or main power conductors.
- C. Interconnection of Bypass/Isolation Switches with Automatic Transfer Switches: Factory-installed copper bus bars; plated at connection points and braced for the indicated available short-circuit current.

2.5 REMOTE ANNUNCIATOR SYSTEM

- A. Functional Description: Remote annunciator panel shall annunciate conditions for indicated transfer switches. Annunciation shall include the following:
 - 1. Sources available, as defined by actual pickup and dropout settings of transfer-switch controls.
 - 2. Switch position.
 - 3. Switch in test mode.
 - 4. Failure of communication link.
- B. Annunciator Panel: LED-lamp type with audible signal and silencing switch.
 - 1. Indicating Lights: Grouped for each transfer switch monitored.

2. Label each group, indicating transfer switch it monitors, location of switch, and identity of load it serves.
3. Mounting: Flush, modular, steel cabinet, unless otherwise indicated.
4. Lamp Test: Push-to-test or lamp-test switch on front panel.

2.6 SOURCE QUALITY CONTROL

- A. Factory test and inspect components, assembled switches, and associated equipment. Ensure proper operation. Check transfer time and voltage, frequency, and time-delay settings for compliance with specified requirements. Perform dielectric strength test complying with NEMA ICS 1.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Design each fastener and support to carry load indicated by seismic requirements and according to seismic-restraint details. See Section 260548 "Vibration and Seismic Controls for Electrical Systems."
- B. Floor-Mounting Switch: Anchor to floor by bolting.
 1. Concrete Bases: 4 inches high, reinforced, with chamfered edges. Extend base no more than 4 inches in all directions beyond the maximum dimensions of switch, unless otherwise indicated or unless required for seismic support. Construct concrete bases according to Section 260529 "Hangers and Supports for Electrical Systems."
- C. Annunciator and Control Panel Mounting: Flush in wall, unless otherwise indicated.
- D. Identify components according to Section 260553 "Identification for Electrical Systems."
- E. Set field-adjustable intervals and delays, relays, and engine exerciser clock.

3.2 CONNECTIONS

- A. Wiring to Remote Components: Match type and number of cables and conductors to control and communication requirements of transfer switches as recommended by manufacturer. Increase raceway sizes at no additional cost to Owner if necessary to accommodate required wiring.
- B. Wiring to Elevator Controller: Match type and number of cables and conductors to control Signal-Before-Transfer Contacts for Elevator. Cables and conductors shall be installed in conduit.
- C. Ground equipment according to Section 260526 "Grounding and Bonding for Electrical Systems."

- D. Connect wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

3.3 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
- B. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.
- C. Perform the following tests and inspections with the assistance of a factory-authorized service representative:
 - 1. After installing equipment and after electrical circuitry has been energized, test for compliance with requirements.
 - 2. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
 - 3. Measure insulation resistance phase-to-phase and phase-to-ground with insulation-resistance tester. Include external annunciation and control circuits. Use test voltages and procedure recommended by manufacturer. Comply with manufacturer's specified minimum resistance.
 - a. Check for electrical continuity of circuits and for short circuits.
 - b. Inspect for physical damage, proper installation and connection, and integrity of barriers, covers, and safety features.
 - c. Verify that manual transfer warnings are properly placed.
 - d. Perform manual transfer operation.
 - 4. After energizing circuits, demonstrate interlocking sequence and operational function for each switch at least three times.
 - a. Simulate power failures of normal source to automatic transfer switches and of emergency source with normal source available.
 - b. Simulate loss of phase-to-ground voltage for each phase of normal source.
 - c. Verify time-delay settings.
 - d. Verify pickup and dropout voltages by data readout or inspection of control settings.
 - e. Test bypass/isolation unit functional modes and related automatic transfer-switch operations.
 - f. Perform contact-resistance test across main contacts and correct values exceeding 500 microhms and values for 1 pole deviating by more than 50 percent from other poles.
 - g. Verify proper sequence and correct timing of automatic engine starting, transfer time delay, retransfer time delay on restoration of normal power, and engine cool-down and shutdown.
 - 5. Ground-Fault Tests: Coordinate with testing of ground-fault protective devices for power delivery from both sources.
 - a. Verify grounding connections and locations and ratings of sensors.

D. Testing Agency's Tests and Inspections:

1. After installing equipment and after electrical circuitry has been energized, test for compliance with requirements.
2. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
3. Measure insulation resistance phase-to-phase and phase-to-ground with insulation-resistance tester. Include external annunciation and control circuits. Use test voltages and procedure recommended by manufacturer. Comply with manufacturer's specified minimum resistance.
 - a. Check for electrical continuity of circuits and for short circuits.
 - b. Inspect for physical damage, proper installation and connection, and integrity of barriers, covers, and safety features.
 - c. Verify that manual transfer warnings are properly placed.
 - d. Perform manual transfer operation.
4. After energizing circuits, demonstrate interlocking sequence and operational function for each switch at least three times.
 - a. Simulate power failures of normal source to automatic transfer switches and of emergency source with normal source available.
 - b. Simulate loss of phase-to-ground voltage for each phase of normal source.
 - c. Verify time-delay settings.
 - d. Verify pickup and dropout voltages by data readout or inspection of control settings.
 - e. Test bypass/isolation unit functional modes and related automatic transfer-switch operations.
 - f. Perform contact-resistance test across main contacts and correct values exceeding 500 microhms and values for 1 pole deviating by more than 50 percent from other poles.
 - g. Verify proper sequence and correct timing of automatic engine starting, transfer time delay, retransfer time delay on restoration of normal power, and engine cool-down and shutdown.
5. Ground-Fault Tests: Coordinate with testing of ground-fault protective devices for power delivery from both sources.
 - a. Verify grounding connections and locations and ratings of sensors.

E. Coordinate tests with tests of generator and run them concurrently.

F. Report results of tests and inspections in writing. Record adjustable relay settings and measured insulation and contact resistances and time delays. Attach a label or tag to each tested component indicating satisfactory completion of tests.

G. Remove and replace malfunctioning units and retest as specified above.

H. Prepare test and inspection reports.

- I. Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each switch. Remove all access panels so joints and connections are accessible to portable scanner.
 - 1. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each switch 11 months after date of Substantial Completion.
 - 2. Instrument: Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.
 - 3. Record of Infrared Scanning: Prepare a certified report that identifies switches checked and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

3.4 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain transfer switches and related equipment as specified below. Refer to Section 017900 "Demonstration and Training."
- B. Coordinate this training with that for generator equipment.

END OF SECTION 263600

SECTION 264313 – SURGE PROTECTIVE DEVICES FOR LOW-VOLTAGE ELECTRICAL POWER CIRCUITS

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 field-mounted TVSS for low-voltage (120 to 600 V) power distribution and control equipment.
- B. Related Sections:
 - 1. Factory-installed TVSS devices in panels and switchboards are not allowed. All units shall be field mounted and wired to branch circuit breaker in panel or switchboard the device is protecting.

1.3 DEFINITIONS

- A. ATS: Acceptance Testing Specifications.
- B. SVR: Suppressed voltage rating.
- C. TVSS: Transient voltage surge suppressor(s), both singular and plural; also, transient voltage surge suppression.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated. Include rated capacities, operating weights, electrical characteristics, furnished specialties, and accessories.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified testing agency.
- B. Product Certificates: For TVSS devices, from manufacturer.
- C. Field quality-control reports.
- D. Warranties: Sample of special warranties.

1.6 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For TVSS devices to include in emergency, operation, and maintenance manuals.

1.7 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Replaceable Protection Modules: One of each size and type installed.

1.8 QUALITY ASSURANCE

- A. Testing Agency Qualifications: Member company of NETA or an NRTL.
 - 1. Testing Agency's Field Supervisor: Currently certified by NETA to supervise on-site testing.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a testing agency, and marked for intended location and application.
- C. Comply with IEEE C62.41.2 and test devices according to IEEE C62.45.
- D. Comply with NEMA LS 1.
- E. Comply with UL 1283 and UL 1449.
- F. Comply with NFPA 70.

1.9 PROJECT CONDITIONS

- A. Interruption of Existing Electrical Service: Do not interrupt electrical service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary electrical service according to requirements indicated:
 - 1. Notify Architect no fewer than two days in advance of proposed electrical service interruptions.
 - 2. Do not proceed with interruption of electrical service without Architect's written permission.
- B. Service Conditions: Rate TVSS devices for continuous operation under the following conditions unless otherwise indicated:
 - 1. Maximum Continuous Operating Voltage: Not less than 115 percent of nominal system operating voltage.
 - 2. Operating Temperature: 30 to 120 deg F.
 - 3. Humidity: 0 to 85 percent, noncondensing.
 - 4. Altitude: Less than 20,000 feet above sea level.

1.10 COORDINATION

- A. Coordinate location of field-mounted TVSS devices to allow adequate clearances for maintenance.
- B. Coordinate TVSS devices with Section 260913 "Electrical Power Monitoring and Control."

1.11 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of surge suppressors that fail in materials or workmanship within specified warranty period.
 - 1. Warranty Period: Five years from date of Substantial Completion.
- B. Special Warranty for Cord-Connected, Plug-in Surge Suppressors: Manufacturer's standard form in which manufacturer agrees to repair or replace electronic equipment connected to circuits protected by surge suppressors.

PART 2 - PRODUCTS

2.1 SERVICE ENTRANCE SUPPRESSORS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. ABB USA.
 - 2. AC Data Solutions.
 - 3. Advanced Protection Technologies Inc. (APT).
 - 4. Atlantic Scientific.
 - 5. Current Technology Inc.; Danaher Power Solutions.
 - 6. Danaher Power Solutions; United Power Products.
 - 7. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
 - 8. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
 - 9. Intermatic, Inc.
 - 10. LEA International.
 - 11. Leviton Mfg. Company Inc.
 - 12. Liebert Corporation; a division of Emerson Network Power.
 - 13. Northern Technologies, Inc.; a division of Emerson Network Power.
 - 14. Siemens Energy & Automation, Inc.
 - 15. Square D; a brand of Schneider Electric.
 - 16. Surge Suppression Incorporated.
- B. Surge Protection Devices:
 - 1. Comply with UL 1449.
 - 2. Modular design (with field-replaceable modules).
 - 3. Fuses, rated at 200-kA interrupting capacity.
 - 4. Fabrication using bolted compression lugs for internal wiring.
 - 5. Integral disconnect switch.
 - 6. Redundant suppression circuits.

7. Redundant replaceable modules.
 8. Arrangement with copper bus bars and for bolted connections to phase buses, neutral bus, and ground bus.
 9. Arrangement with wire connections to phase buses, neutral bus, and ground bus.
 10. LED indicator lights for power and protection status.
 11. Audible alarm, with silencing switch, to indicate when protection has failed.
 12. Form-C contacts rated at 5 A and 250-V ac, one normally open and one normally closed, for remote monitoring of protection status. Contacts shall reverse on failure of any surge diversion module or on opening of any current-limiting device. Coordinate with building power monitoring and control system.
 13. Four-digit transient-event counter set to totalize transient surges.
- C. Peak Single-Impulse Surge Current Rating: 320 kA per mode/640 kA per phase.
- D. Minimum single impulse current ratings, using 8-by-20-mic.sec waveform described in IEEE C62.41.2
1. Line to Neutral: 70,000 A.
 2. Line to Ground: 70,000 A.
 3. Neutral to Ground: 50,000 A.
- E. Protection modes and UL 1449 SVR for grounded wye circuits with 480Y/277 V, 208Y/120 V, 3-phase, 4-wire circuits shall be as follows:
1. Line to Neutral: 800 V for 480Y/277 V 400 V for 208Y/120 V.
 2. Line to Ground: 800 V for 480Y/277 V 400 V for 208Y/120 V.
 3. Neutral to Ground: 800 V for 480Y/277 V 400 V for 208Y/120 V.

2.2 PANELBOARD SUPPRESSORS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
1. ABB USA.
 2. AC Data Solutions.
 3. Advanced Protection Technologies Inc. (APT).
 4. Atlantic Scientific.
 5. Current Technology Inc.; Danaher Power Solutions.
 6. Danaher Power Solutions; United Power Products.
 7. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
 8. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
 9. Intermatic, Inc.
 10. LEA International.
 11. Leviton Mfg. Company Inc.
 12. Liebert Corporation; a division of Emerson Network Power.
 13. Northern Technologies, Inc.; a division of Emerson Network Power.
 14. Siemens Energy & Automation, Inc.
 15. Square D; a brand of Schneider Electric.
 16. Surge Suppression Incorporated.
- B. Surge Protection Devices:

1. Comply with UL 1449.
 2. Modular design (with field-replaceable modules).
 3. Short-circuit current rating complying with UL 1449, and matching or exceeding the panelboard short-circuit rating and redundant suppression circuits; with individually fused metal-oxide varistors.
 4. Fuses, rated at 200-kA interrupting capacity.
 5. Fabrication using bolted compression lugs for internal wiring.
 6. Integral disconnect switch.
 7. Redundant suppression circuits.
 8. Redundant replaceable modules.
 9. Arrangement with wire connections to phase buses, neutral bus, and ground bus.
 10. LED indicator lights for power and protection status.
 11. Audible alarm, with silencing switch, to indicate when protection has failed.
 12. Form-C contacts rated at 5 A and 250-V ac, one normally open and one normally closed, for remote monitoring of protection status. Contacts shall reverse on failure of any surge diversion module or on opening of any current-limiting device. Coordinate with building power monitoring and control system.
 13. Four-digit transient-event counter set to totalize transient surges.
- C. Peak Single-Impulse Surge Current Rating: 160 kA per mode/320 kA per phase.
- D. Minimum single impulse current ratings, using 8-by-20-mic.sec waveform described in IEEE C62.41.2:
1. Line to Neutral: 70,000 A.
 2. Line to Ground: 70,000 A.
 3. Neutral to Ground: 50,000 A.
- E. Protection modes and UL 1449 SVR for grounded wye circuits with 480Y/277 V 208Y/120 V, 3-phase, 4-wire circuits shall be as follows:
1. Line to Neutral: 800 V for 480Y/277 V 400 V for 208Y/120 V.
 2. Line to Ground: 800 V for 480Y/277 V 400 V for 208Y/120 V.
 3. Neutral to Ground: 800 V for 480Y/277 V 400 V for 208Y/120 V.

2.3 ENCLOSURES

- A. Indoor Enclosures: NEMA 250 Type 1.
- B. Outdoor Enclosures: NEMA 250 Type 3R.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install TVSS devices at service entrance on load side, with ground lead bonded to service entrance ground.
- B. Install TVSS devices for panelboards and auxiliary panels with conductors or buses between suppressor and points of attachment as short and straight as possible. Do not exceed manufacturer's recommended lead length. Do not bond neutral and ground.

1. Provide multiple, 30-A circuit breaker as a dedicated disconnecting means for TVSS unless otherwise indicated.

3.2 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.
- B. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.
 1. Verify that electrical wiring installation complies with manufacturer's written installation requirements.
- C. 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.
- D. Tests and Inspections:
 1. Perform each visual and mechanical inspection and electrical test stated in NETA ATS, "Surge Arresters, Low-Voltage Surge Protection Devices" Section. Certify compliance with test parameters.
 2. After installing TVSS devices but before electrical circuitry has been energized, test for compliance with requirements.
 3. Complete startup checks according to manufacturer's written instructions.
- E. TVSS device will be considered defective if it does not pass tests and inspections.
- F. Prepare test and inspection reports.

3.3 STARTUP SERVICE

- A. Do not energize or connect service entrance equipment, panelboards, control terminals, data terminals to their sources until TVSS devices are installed and connected.
- B. Do not perform insulation resistance tests of the distribution wiring equipment with the TVSS installed. Disconnect before conducting insulation resistance tests, and reconnect immediately after the testing is over.

3.4 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to maintain TVSS devices.

END OF SECTION 264313

SECTION 265100 - INTERIOR LIGHTING

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. Interior lighting fixtures, lamps, and ballasts.
2. LED lighting fixtures.
3. Emergency lighting units.
4. Exit signs.
5. Lighting fixture supports.

B. Related Sections:

1. Section 260923 "Lighting Control Devices" for automatic control of lighting, including time switches, photoelectric relays, occupancy sensors, and multipole lighting relays and contactors.
2. Section 262726 "Wiring Devices" for manual wall-box dimmers for incandescent lamps.

1.3 DEFINITIONS

- A. BF: Ballast factor.
- B. CCT: Correlated color temperature.
- C. CRI: Color-rendering index.
- D. HID: High-intensity discharge.
- E. LED: Light emitting diode.
- F. LER: Luminaire efficacy rating.
- G. Lumen: Measured output of lamp and luminaire, or both.
- H. Luminaire: Complete lighting fixture, including ballast housing if provided.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of lighting fixture, arranged in order of fixture designation. Include data on features, accessories, finishes, and the following:

1. Physical description of lighting fixture including dimensions.
2. Emergency lighting units including battery and charger.
3. Ballast, including BF.
4. Energy-efficiency data.
5. Life, output (lumens, CCT, and CRI), and energy-efficiency data for lamps.
6. Photometric data and adjustment factors based on laboratory tests, complying with IESNA Lighting Measurements Testing & Calculation Guides, of each lighting fixture type. The adjustment factors shall be for lamps, ballasts, and accessories identical to those indicated for the lighting fixture as applied in this Project.
 - a. Manufacturer Certified Data: Photometric data shall be certified by a manufacturer's laboratory with a current accreditation under the National Voluntary Laboratory Accreditation Program for Energy Efficient Lighting Products.
7. Wiring Diagrams: For power, signal, and control wiring.

B. Installation instructions.

1.5 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Reflected ceiling plan(s) 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. Lighting fixtures.
 2. Suspended ceiling components.
 3. Partitions and millwork that penetrate the ceiling or extends to within 12 inches of the plane of the luminaires.
 4. Ceiling-mounted projectors.
 5. Structural members to which suspension systems for lighting fixtures will be attached.
 6. Other items in finished ceiling including the following:
 - a. Air outlets and inlets.
 - b. Speakers.
 - c. Sprinklers.
 - d. Smoke and fire detectors.
 - e. Occupancy sensors.
 - f. Access panels.
 7. Perimeter moldings.
- B. Qualification Data: For qualified agencies providing photometric data for lighting fixtures.
- C. Product Certificates: For each type of ballast for bi-level and dimmer-controlled fixtures, from manufacturer.
- D. Field quality-control reports.
- E. Warranty: Sample of special warranty.

1.6 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For lighting equipment and fixtures to include in emergency, operation, and maintenance manuals.
 - 1. Provide a list of all lamp types used on Project; use ANSI and manufacturers' codes.

1.7 QUALITY ASSURANCE

- A. Luminaire Photometric Data Testing Laboratory Qualifications: Provided by manufacturers' laboratories that are accredited under the National Volunteer Laboratory Accreditation Program for Energy Efficient Lighting Products.
- B. 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.
- C. Comply with NFPA 70.

1.8 SPARE PARTS AND MAINTENANCE MATERIALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents. Materials shall be used to comply with unforeseen requirements by the authorities having jurisdiction. Upon completion of the project, materials left remaining shall be turned over to the Owner.
 - 1. Exit signs.
For each item in the list above, provide a quantity equal to 10 percent of amount of each type installed, but no fewer than 2 unit of each type. Include conduit, conductors and boxes, 50'-0" in length, to accommodate each unit installation.

1.9 COORDINATION

- A. Coordinate layout and installation of lighting fixtures and suspension system with other construction that penetrates ceilings or is supported by them, including HVAC equipment, fire-suppression system, and partition assemblies.

1.10 WARRANTY

- A. Special Warranty for Emergency Lighting Batteries: Manufacturer's standard form in which manufacturer of battery-powered emergency lighting unit agrees to repair or replace components of rechargeable batteries that fail in materials or workmanship within specified warranty period.
 - 1. Warranty Period for Emergency Lighting Unit Batteries: 10 years from date of Substantial Completion. Full warranty shall apply for first year, and prorated warranty for the remaining nine years.
- B. Special Warranty for LED Fixtures: Manufacturer's standard form in which manufacturer of LED light fixture agrees to repair or replace components of light fixture that fail in materials or workmanship within specified warranty period.

1. Warranty Period for LED Fixtures: 10 years from date of Substantial Completion. Full warranty shall apply for first year, and prorated warranty for the remaining nine years.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Products: Subject to compliance with requirements, provide one of the products indicated on Drawings.

2.2 GENERAL REQUIREMENTS FOR LIGHTING FIXTURES AND COMPONENTS

- A. Recessed Fixtures: Comply with NEMA LE 4 for ceiling compatibility for recessed fixtures.
- B. Incandescent Fixtures: Comply with UL 1598. Where LER is specified, test according to NEMA LE 5A.
- C. Fluorescent Fixtures: Comply with UL 1598. Where LER is specified, test according to NEMA LE 5 and NEMA LE 5A as applicable.
- D. LED Fixtures: Comply with UL 8750. Heat sink cooling without fans, pumps or moving parts.
- E. HID Fixtures: Comply with UL 1598. Where LER is specified, test according to NEMA LE 5B.
- F. Metal Parts: Free of burrs and sharp corners and edges.
- G. Sheet Metal Components: Steel unless otherwise indicated. Form and support to prevent warping and sagging.
- H. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit relamping without use of tools. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position.
- I. Diffusers and Globes:
 1. Acrylic Lighting Diffusers: 100 percent virgin acrylic plastic. High resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.
 - a. Lens Thickness: At least 0.125 inch minimum unless otherwise indicated.
 - b. UV stabilized.
 2. Glass: Annealed crystal glass unless otherwise indicated.
- J. Factory-Applied Labels: Comply with UL 1598. Include recommended lamps and ballasts. Labels shall be located where they will be readily visible to service personnel, but not seen from normal viewing angles when lamps are in place.
 1. Label shall include the following lamp and ballast characteristics:

- a. "USE ONLY" and include specific lamp type.
- b. Lamp diameter code (T-4, T-5, T-8, T-12, etc.), tube configuration (twin, quad, triple, etc.), base type, and nominal wattage for fluorescent and compact fluorescent luminaires.
- c. Lamp type, wattage, bulb type (ED17, BD56, etc.) and coating (clear or coated) for HID luminaires.
- d. Start type (preheat, rapid start, instant start, etc.) for fluorescent and compact fluorescent luminaires.
- e. ANSI ballast type (M98, M57, etc.) for HID luminaires.
- f. CCT and CRI for all luminaires.

2.3 BALLASTS FOR LINEAR FLUORESCENT LAMPS

A. General Requirements for Electronic Ballasts:

- 1. Comply with UL 935 and with ANSI C82.11.
- 2. Designed for type and quantity of lamps served.
- 3. Ballasts shall be designed for full light output unless another BF, dimmer, or bi-level control is indicated.
- 4. Sound Rating: Class A.
- 5. Total Harmonic Distortion Rating: Less than 10 percent.
- 6. Transient Voltage Protection: IEEE C62.41.1 and IEEE C62.41.2, Category A or better.
- 7. Operating Frequency: 42 kHz or higher.
- 8. Lamp Current Crest Factor: 1.7 or less.
- 9. BF: 0.88 or higher.
- 10. Power Factor: 0.98 or higher.
- 11. Parallel Lamp Circuits: Multiple lamp ballasts shall comply with ANSI C82.11 and shall be connected to maintain full light output on surviving lamps if one or more lamps fail.

B. Light fixtures controlled by occupancy sensors shall have programmed-start ballasts.

C. Electronic Programmed-Start Ballasts for T8, T5 and T5HO Lamps: Comply with ANSI C82.11 and the following:

- 1. Lamp end-of-life detection and shutdown circuit for T5 diameter lamps.
- 2. Automatic lamp starting after lamp replacement.

D. Ballasts for Dimmer-Controlled Lighting Fixtures: Electronic type.

- 1. Dimming Range: 100 to 1 percent of rated lamp lumens.
- 2. Ballast Input Watts: Can be reduced to 10 percent of normal.
- 3. Compatibility: Certified by manufacturer for use with specific dimming control system and lamp type indicated.

2.4 BALLASTS FOR COMPACT FLUORESCENT LAMPS

A. Description: Electronic-programmed rapid-start type, complying with UL 935 and with ANSI C 82.11, designed for type and quantity of lamps indicated. Ballast shall be designed for full light output unless dimmer or bi-level control is indicated:

1. Lamp end-of-life detection and shutdown circuit.
2. Automatic lamp starting after lamp replacement.
3. Sound Rating: Class A.
4. Total Harmonic Distortion Rating: Less than 10 percent.
5. Transient Voltage Protection: IEEE C62.41.1 and IEEE C62.41.2, Category A or better.
6. Operating Frequency: 20 kHz or higher.
7. Lamp Current Crest Factor: 1.7 or less.
8. BF: 0.95 or higher unless otherwise indicated.
9. Power Factor: 0.98 or higher.
10. Interference: Comply with 47 CFR 18, Ch. 1, Subpart C, for limitations on electromagnetic and radio-frequency interference for nonconsumer equipment.

2.5 BALLASTS FOR HID LAMPS

- A. Electromagnetic Ballast for Metal-Halide Lamps: Comply with ANSI C82.4 and UL 1029. Include the following features unless otherwise indicated:

1. Ballast Circuit: Constant-wattage autotransformer or regulating high-power-factor type.
2. Minimum Starting Temperature: Minus 22 deg F for single-lamp ballasts.
3. Rated Ambient Operating Temperature: 104 deg F.
4. Open-circuit operation that will not reduce average life.
5. Low-Noise Ballasts: Manufacturers' standard epoxy-encapsulated models designed to minimize audible fixture noise.

- B. Electronic Ballast for Metal-Halide Lamps: Include the following features unless otherwise indicated:

1. Minimum Starting Temperature: Minus 20 deg F or single-lamp ballasts.
2. Rated Ambient Operating Temperature: 130 deg F.
3. Lamp end-of-life detection and shutdown circuit.
4. Sound Rating: Class A.
5. Total Harmonic Distortion Rating: Less than 20 percent.
6. Transient Voltage Protection: IEEE C62.41.1 and IEEE C62.41.2, Category A or better.
7. Lamp Current Crest Factor: 1.5 or less.
8. Power Factor: 0.90 or higher.
9. Interference: Comply with 47 CFR 18, Ch. 1, Subpart C, for limitations on electromagnetic and radio-frequency interference for nonconsumer equipment.
10. Protection: Class P thermal cutout.

2.6 QUARTZ LAMP LIGHTING CONTROLLER

- A. General Requirements for Controllers: Factory installed by lighting fixture manufacturer. Comply with UL 1598.
- B. Standby (Quartz Restrike): Automatically switches quartz lamp on when a HID lamp in the fixture is initially energized and during the HID lamp restrike period after brief power outages.
- C. Connections: Designed for a single branch -circuit connection.

- D. Switching Off: Automatically switches quartz lamp off when HID lamp reaches approximately 60 percent light output.

2.7 DRIVERS/POWER SUPPLYS FOR LED

- A. Description: Self-contained power supply that has outputs matched to the electrical characteristics of the LED or array of LEDs.
 - 1. Driver compartment meets or exceeds IEC standard IP54.
 - 2. Located inside the housing with serviceable access for replacement.
 - 3. Housing or lenses constructed of polymers; must be UV stabilized.
 - 4. Must be current-regulated (deliver a consistent current over a range of load voltages).
 - 5. Designed for multi-current input operation.
 - 6. Must operate between -20°C and 50°C.
 - 7. Transient Voltage Protection: IEEE C62.41.1 and IEEE C62.41.2, Category A or better.
 - 8. Operating Frequency: 120 Hz or higher.
 - 9. Power Factor: 0.90 or higher.
 - 10. Dimming capability as described on drawings.

2.8 EXIT SIGNS

- A. General Requirements for Exit Signs: Comply with UL 924; for sign colors, visibility, luminance, and lettering size, comply with authorities having jurisdiction.
- B. Internally Lighted Signs:
 - 1. Lamps for AC Operation: LEDs, 50,000 hours minimum rated lamp life.

2.9 EMERGENCY LIGHTING UNITS

- A. General Requirements for Emergency Lighting Units: Self-contained units complying with UL 924.
 - 1. Battery: Sealed, maintenance-free, lead-acid type.
 - 2. Charger: Fully automatic, solid-state type with sealed transfer relay.
 - 3. Operation: Relay automatically turns lamp on when power-supply circuit voltage drops to 80 percent of nominal voltage or below. Lamp automatically disconnects from battery when voltage approaches deep-discharge level. When normal voltage is restored, relay disconnects lamps from battery, and battery is automatically recharged and floated on charger.
 - 4. Test Push Button: Push-to-test type, in unit housing, simulates loss of normal power and demonstrates unit operability.
 - 5. LED Indicator Light: Indicates normal power on. Normal glow indicates trickle charge; bright glow indicates charging at end of discharge cycle.
 - 6. Integral Self-Test: Factory-installed electronic device automatically initiates code-required test of unit emergency operation at required intervals. Test failure is annunciated by an integral audible alarm and a flashing red LED.

2.10 FLUORESCENT LAMPS

- A. T8 rapid-start lamps, rated 32 W maximum, nominal length of 48 inches, 3100 initial lumens (minimum), CRI 75 (minimum), color temperature 3500 K, and average rated life 20,000 hours unless otherwise indicated.
- B. T8 rapid-start lamps, rated 17 W maximum, nominal length of 24 inches, 1300 initial lumens (minimum), CRI 75 (minimum), color temperature 3500 K, and average rated life of 20,000 hours unless otherwise indicated.
- C. T5 rapid-start lamps, rated 28 W maximum, nominal length of 45.2 inches, 2900 initial lumens (minimum), CRI 85 (minimum), color temperature 3500 K, and average rated life of 20,000 hours unless otherwise indicated.
- D. T5HO rapid-start, high-output lamps, rated 54 W maximum, nominal length of 45.2 inches, 5000 initial lumens (minimum), CRI 85 (minimum), color temperature 4100 K, and average rated life of 20,000 hours unless otherwise indicated.
- E. Compact Fluorescent Lamps: 4-Pin, CRI 80 (minimum), color temperature 3500 K, average rated life of 10,000 hours at three hours operation per start, unless otherwise indicated.
 - 1. 13 W: T4, double or triple tube, rated 900 initial lumens (minimum).
 - 2. 18 W: T4, double or triple tube, rated 1200 initial lumens (minimum).
 - 3. 26 W: T4, double or triple tube, rated 1800 initial lumens (minimum).
 - 4. 32 W: T4, triple tube, rated 2400 initial lumens (minimum).
 - 5. 42 W: T4, triple tube, rated 3200 initial lumens (minimum).
 - 6. 57 W: T4, triple tube, rated 4300 initial lumens (minimum).
 - 7. 70 W: T4, triple tube, rated 5200 initial lumens (minimum).

2.11 HID LAMPS

- A. Metal-Halide Lamps: ANSI C78.43, with minimum CRI 65, and color temperature 4000 K.
- B. Pulse-Start, Metal-Halide Lamps: Minimum CRI 65, and color temperature 4000 K.
- C. Ceramic, Pulse-Start, Metal-Halide Lamps: Minimum CRI 85, and color temperature 4000 K.

2.12 LEDS

- A. LED Module/Array: Designed for multi-current input operation.
- B. Light Quality: CRI 65 (minimum), color temperature 3500 K.
- C. Minimum Lamp Life: L70 at 50,000 hours average rated life.

2.13 LIGHTING FIXTURE SUPPORT COMPONENTS

- A. Comply with Section 260529 "Hangers and Supports for Electrical Systems" for channel- and angle-iron supports and nonmetallic channel and angle supports.

- B. Single-Stem Hangers: 1/2-inch steel tubing with swivel ball fittings and ceiling canopy. Finish same as fixture.
- C. Twin-Stem Hangers: Two, 1/2-inch steel tubes with single canopy designed to mount a single fixture. Finish same as fixture.
- D. Wires: ASTM A 641/A 641M, Class 3, soft temper, zinc-coated steel, 12 gage.
- E. Wires for Humid Spaces: ASTM A 580/A 580M, Composition 302 or 304, annealed stainless steel, 12 gage.
- F. Rod Hangers: 3/16-inch minimum diameter, cadmium-plated, threaded steel rod.
- G. Hook Hangers: Integrated assembly matched to fixture and line voltage and equipped with threaded attachment, cord, and locking-type plug.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Lighting fixtures:
 1. Set level, plumb, and square with ceilings and walls unless otherwise indicated.
 2. Install lamps in each luminaire.
- B. Temporary Lighting: If it is necessary, and approved by Architect, to use permanent luminaires for temporary lighting, install and energize the minimum number of luminaires necessary. When construction is sufficiently complete, remove the temporary luminaires, disassemble, clean thoroughly, install new lamps, and reinstall.
- C. Remote Mounting of Ballasts: Distance between the ballast and fixture shall not exceed that recommended by ballast manufacturer. Verify, with ballast manufacturers, maximum distance between ballast and luminaire.
- D. Lay-in Ceiling Lighting Fixtures Supports: Use grid as a support element.
 1. Install ceiling support system rods or wires, independent of the ceiling suspension devices, for each fixture. Locate not more than 6 inches from lighting fixture corners.
 2. Support Clips: Fasten to lighting fixtures and to ceiling grid members at or near each fixture corner with clips that are UL listed for the application.
 3. Fixtures of Sizes Less Than Ceiling Grid: Install as indicated on reflected ceiling plans or center in acoustical panel, and support fixtures independently with at least two 3/4-inch metal channels spanning and secured to ceiling tees.
 4. Install at least one independent support rod or wire from structure to a tab on lighting fixture. Wire or rod shall have breaking strength of the weight of fixture at a safety factor of 3.
- E. Suspended Lighting Fixture Support:
 1. Pendants and Rods: Where longer than 48 inches, brace to limit swinging.

2. Stem-Mounted, Single-Unit Fixtures: Suspend with twin-stem hangers.
 3. Continuous Rows: Use tubing or stem for wiring at one point and tubing or rod for suspension for each unit length of fixture chassis, including one at each end.
 4. Do not use grid as support for pendant luminaires. Connect support wires or rods to building structure.
- F. Connect wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

3.2 IDENTIFICATION

- A. Install labels with panel and circuit numbers on concealed junction and outlet boxes. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

3.3 FIELD QUALITY CONTROL

- A. Test for Emergency Lighting: Interrupt power supply to demonstrate proper operation. Verify transfer from normal power to battery and retransfer to normal.
- B. Prepare a written report of tests, inspections, observations, and verifications indicating and interpreting results. If adjustments are made to lighting system, retest to demonstrate compliance with standards.

3.4 STARTUP SERVICE

- A. Burn-in all lamps that require specific aging period to operate properly, prior to occupancy by Owner. Burn-in fluorescent and compact fluorescent lamps intended to be dimmed, for at least 100 hours at full voltage.

3.5 ADJUSTING

- A. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting aimable luminaires to suit actual occupied conditions. Provide up to two visits to Project during other-than-normal occupancy hours for this purpose. Some of this work may be required after dark.
1. Adjust aimable luminaires in the presence of Architect.

END OF SECTION 265100

SECTION 270528 - PATHWAYS FOR COMMUNICATIONS SYSTEMS

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. Metal conduits and fittings.
2. Nonmetallic conduits and fittings.
3. Optical-fiber-cable pathways and fittings.
4. Boxes, enclosures, and cabinets.
5. Handholes and boxes for exterior underground cabling.

B. Related Requirements:

1. Section 260543 "Underground Ducts and Raceways for Electrical Systems" for exterior ductbanks, manholes, and underground utility construction.
2. Section 260533 "Raceways and Boxes for Electrical Systems" for conduits, wireways, boxes, enclosures, cabinets, handholes, and faceplate adapters serving electrical systems.

1.3 DEFINITIONS

- A. ARC: Aluminum rigid conduit.
- B. GRC: Galvanized rigid steel conduit.
- C. IMC: Intermediate metal conduit.

1.4 ACTION SUBMITTALS

- A. Product Data: For conduit, wireways and fittings, and floor boxes.

1.5 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Pathway routing plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of items involved:
 1. Structural members in paths of pathway groups with common supports.
 2. HVAC and plumbing items and architectural features in paths of conduit groups with common supports.

- B. Qualification Data: For professional engineer.
- C. Seismic Qualification Certificates: For pathway racks, enclosures, cabinets, equipment racks and their mounting provisions, including those for internal 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 certification is based and their installation requirements.
 - 4. Detailed description of conduit support devices and interconnections on which certification is based and their installation requirements.
- D. Source quality-control reports.

PART 2 - PRODUCTS

2.1 METAL CONDUITS AND FITTINGS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. AFC Cable Systems, Inc.
 - 2. Allied Tube & Conduit; a Tyco International Ltd. Co.
 - 3. Alpha Wire Company.
 - 4. Anamet Electrical, Inc.
 - 5. Electri-Flex Company.
 - 6. O-Z/Gedney; a brand of EGS Electrical Group.
 - 7. Picoma Industries; Subsidiary of Mueller Water Products, Inc.
 - 8. Republic Conduit.
 - 9. Robroy Industries.
 - 10. Southwire Company.
 - 11. Thomas & Betts Corporation.
 - 12. Western Tube and Conduit Corporation.
 - 13. Wheatland Tube Company; a division of John Maneely Company.
- B. General Requirements for Metal Conduits and Fittings:
 - 1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
 - 2. Comply with TIA-569-B.
- C. GRC: Comply with ANSI C80.1 and UL 6.
- D. ARC: Comply with ANSI C80.5 and UL 6A.
- E. IMC: Comply with ANSI C80.6 and UL 1242.
- F. PVC-Coated Steel Conduit: PVC-coated rigid steel conduit.

1. Comply with NEMA RN 1.
 2. Coating Thickness: 0.040 inch, minimum.
- G. EMT: Comply with ANSI C80.3 and UL 797.
- H. Fittings for Metal Conduit: Comply with NEMA FB 1 and UL 514B.
1. Fittings for EMT:
 - a. Material: Steel.
 - b. Type: Compression.
 2. Expansion Fittings: PVC or steel to match conduit type, complying with UL-467, rated for environmental conditions where installed, and including flexible external bonding jumper.
 3. Coating for Fittings for PVC-Coated Conduit: Minimum thickness of 0.040 inch, with overlapping sleeves protecting threaded joints.
- I. Joint Compound for IMC, GRC, or ARC: Approved, as defined in NFPA 70, by authorities having jurisdiction for use in conduit assemblies, and compounded for use to lubricate and protect threaded conduit joints from corrosion and to enhance their conductivity.

2.2 NONMETALLIC CONDUITS AND FITTINGS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. AFC Cable Systems, Inc.
 2. Allied Tube & Conduit; a Tyco International Ltd. Co.
 3. Anamet Electrical, Inc.
 4. Arcco Corporation.
 5. CANTEX Inc.
 6. CertainTeed Corp.
 7. Condux International, Inc.
 8. Electri-Flex Company.
 9. Kraloy.
 10. Lamson & Sessions; Carlon Electrical Products.
 11. Niedax-Kleinhuis USA, Inc.
 12. RACO; a Hubbell company.
 13. Thomas & Betts Corporation.
- B. General Requirements for Nonmetallic Conduits and Fittings:
1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
 2. Comply with TIA-569-B.
- C. RNC: Type EPC-40-PVC, complying with NEMA TC 2 and UL 651 unless otherwise indicated.
- D. Rigid HDPE: Comply with UL 651A.

- E. Continuous HDPE: Comply with UL 651B.
- F. RTRC: Comply with UL 1684A and NEMA TC 14.
- G. Fittings for RNC: Comply with NEMA TC 3; match to conduit or tubing type and material.

2.3 J-HOOKS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. B-Line Systems, Inc.
 - 2. Erico Fastening Products.
 - 3. Other Equivalent Manufacturer.
- B. General Requirements:
 - 1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
 - 2. Galvanized steel with zinc finish with smooth beveled edges.
 - 3. Minimum size shall be 2" diameter.

2.4 OPTICAL-FIBER-CABLE PATHWAYS AND FITTINGS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Alpha Wire Company.
 - 2. Aruco Corporation.
 - 3. Endot Industries Inc.
 - 4. IPEX.
 - 5. Lamson & Sessions; Carlon Electrical Products.
- B. Description: Comply with UL 2024; flexible-type pathway, approved for plenum, riser, or general-use installation unless otherwise indicated.
 - 1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
 - 2. Comply with TIA-569-B.

2.5 BOXES, ENCLOSURES, AND CABINETS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Adalet.
 - 2. Cooper Technologies Company; Cooper Crouse-Hinds.
 - 3. EGS/Appleton Electric.
 - 4. Erickson Electrical Equipment Company.
 - 5. Hoffman; a Pentair company.

6. Hubbell Incorporated; Killark Division.
7. Lamson & Sessions; Carlon Electrical Products.
8. Milbank Manufacturing Co.
9. Molex; Woodhead Brand.
10. Mono-Systems, Inc.
11. O-Z/Gedney; a brand of EGS Electrical Group.
12. RACO; a Hubbell company.
13. Robroy Industries.
14. Spring City Electrical Manufacturing Company.
15. Stahlin Non-Metallic Enclosures; a division of Robroy Industries.
16. Thomas & Betts Corporation.
17. Wiremold / Legrand.

B. General Requirements for Boxes, Enclosures, and Cabinets:

1. Comply with TIA-569-B.
2. Boxes, enclosures and cabinets installed in wet locations shall be listed for use in wet locations.

C. Sheet-Metal Outlet and Device Boxes: Comply with NEMA OS 1 and UL 514A.

D. Cast-Metal Outlet and Device Boxes: Comply with NEMA FB 1, ferrous alloy, Type FD, with gasketed cover.

E. Box extensions used to accommodate new building finishes shall be of same material as recessed box.

F. Metal Floor Boxes:

1. Material: Cast metal or sheet metal.
2. Type: Fully adjustable.
3. Shape: Rectangular.
4. Listing and Labeling: Metal floor boxes shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

G. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.

H. Cast-Metal Access, Pull, and Junction Boxes: Comply with NEMA FB 1 and UL 1773, cast aluminum with gasketed cover.

I. Device Box Dimensions: 4 inches square by 2-1/8 inches deep.

J. Gangable boxes are allowed.

2.6 HANDHOLES AND BOXES FOR EXTERIOR UNDERGROUND CABLING

A. General Requirements for Handholes and Boxes:

1. Boxes and handholes for use in underground systems shall be designed and identified as defined in NFPA 70, for intended location and application.

2. Boxes installed in wet areas shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
 3. Comply with TIA-569-B.
- B. Polymer-Concrete Handholes and Boxes with Polymer-Concrete Cover: Molded of sand and aggregate, bound together with polymer resin, and reinforced with steel, fiberglass, or a combination of the two.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Armorcast Products Company.
 - b. Carson Industries LLC.
 - c. CDR Systems Corporation; Hubbell Power Systems.
 - d. NewBasis.
 - e. Oldcastle Precast, Inc.; Christy Concrete Products.
 - f. Synertech Moulded Products; a division of Oldcastle Precast, Inc.
 2. Standard: Comply with SCTE 77.
 3. Configuration: Designed for flush burial with open bottom unless otherwise indicated.
 4. Cover: Weatherproof, secured by tamper-resistant locking devices and having structural load rating consistent with enclosure and handhole location.
 5. Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.
 6. Cover Legend: Molded lettering, "COMMUNICATIONS."
 7. Conduit Entrance Provisions: Conduit-terminating fittings shall mate with entering ducts for secure, fixed installation in enclosure wall.
 8. Handholes 24 Inches Wide by 36 Inches Long and 42 inches Deep and Larger: Have inserts for cable racks and pulling-in irons installed before concrete is poured.
 9. Openings/Holes: Manufactured openings in walls, arranged to match dimensions and elevations of approaching ducts and duct banks.
 - a. Three 4-inch diameter openings/holes at the bottom of each end of the handhold to receive the ducts.
 - b. The openings/holes shall be positioned to provide a minimum of 24-inches between the top of the windows and the top of the handhole.

2.7 SOURCE QUALITY CONTROL FOR UNDERGROUND ENCLOSURES

- A. Handhole and Pull-Box Prototype Test: Test prototypes of handholes and boxes for compliance with SCTE 77. Strength tests shall be for specified tier ratings of products supplied.
1. Tests of materials shall be performed by an independent testing agency.
 2. Strength tests of complete boxes and covers shall be by either an independent testing agency or manufacturer. A qualified registered professional engineer shall certify tests by manufacturer.
 3. Testing machine pressure gages shall have current calibration certification complying with ISO 9000 and ISO 10012, and traceable to NIST standards.

PART 3 - EXECUTION

3.1 PATHWAY APPLICATION

- A. Outdoors: Apply pathway products as specified below unless otherwise indicated:
1. Exposed Conduit: IMC.
 2. Concealed Conduit, Aboveground: EMT.
 3. Underground Conduit: RNC, Type EPC-40-PVC, direct buried.
 4. Boxes and Enclosures, Aboveground: NEMA 250, Type 3R.
- B. Indoors: Apply pathway products as specified below unless otherwise indicated:
1. Exposed, Not Subject to Physical Damage: EMT.
 2. Exposed, Not Subject to Severe Physical Damage: EMT.
 3. Exposed and Subject to Severe Physical Damage: GRC. Pathway locations include the following:
 - a. Apparatus Bay.
 - b. Mechanical rooms.
 4. Concealed in Non-Accessible Ceilings and Interior Walls and Partitions: EMT.
 5. Concealed in Accessible Ceilings: J-Hooks.
 6. Damp or Wet Locations: GRC.
 7. Pathways for Optical-Fiber or Communications Cable in Spaces Used for Environmental Air: Plenum-type, optical-fiber-cable pathway.
 8. Pathways for Optical-Fiber or Communications-Cable Risers in Vertical Shafts: Riser-type, optical-fiber-cable pathway.
 9. Pathways for Concealed General-Purpose Distribution of Optical-Fiber or Communications Cable: General-use, optical-fiber-cable pathway.
 10. Boxes and Enclosures: NEMA 250 Type 1, except use NEMA 250 Type 4 stainless steel in damp or wet locations.
- C. Minimum Pathway Size: 1-inch trade size. Minimum size for optical-fiber cables is 1 1/4-inch.
- D. Pathway Fittings: Compatible with pathways and suitable for use and location.
1. Rigid and Intermediate Steel Conduit: Use threaded rigid steel conduit fittings unless otherwise indicated. Comply with NEMA FB 2.10.
 2. PVC Externally Coated, Rigid Steel Conduits: Use only fittings listed for use with this type of conduit. Patch and seal all joints, nicks, and scrapes in PVC coating after installing conduits and fittings. Use sealant recommended by fitting manufacturer and apply in thickness and number of coats recommended by manufacturer.
 3. EMT: Use compression, steel fittings. Comply with NEMA FB 2.10.
- E. Do not install aluminum conduits, boxes, or fittings in contact with concrete or earth.
- F. Do not install nonmetallic conduit where ambient temperature exceeds 120 deg F.

3.2 INSTALLATION

- A. Comply with NECA 1, NECA 101, and TIA-569-B for installation requirements except where requirements on Drawings or in this article are stricter. Comply with NECA 102 for aluminum pathways. Comply with NFPA 70 limitations for types of pathways allowed in specific occupancies and number of floors.
- B. Keep pathways at least 6 inches away from parallel runs of flues and steam or hot-water pipes. Install horizontal pathway runs above water and steam piping.
- C. Complete pathway installation before starting conductor installation.
- D. Comply with requirements in Section 260529 "Hangers and Supports for Electrical Systems" for hangers and supports.
- E. Arrange stub-ups so curved portions of bends are not visible above finished slab.
- F. Install no more than the equivalent of two 90-degree bends in any pathway run. Support within 12 inches of changes in direction. Utilize long radius ells for all optical-fiber cables.
- G. Conceal conduit and EMT within finished walls, ceilings, and floors unless otherwise indicated. Install conduits parallel or perpendicular to building lines.
- H. Support conduit within 12 inches of enclosures to which attached.
- I. Pathways Embedded in Slabs:
 - 1. Run conduit larger than 1-inch trade size, parallel or at right angles to main reinforcement. Where at right angles to reinforcement, place conduit close to slab support. Secure pathways to reinforcement at maximum 10-foot intervals.
 - 2. Arrange pathways to cross building expansion joints at right angles with expansion fittings.
 - 3. Arrange pathways to keep a minimum of 1 inch of concrete cover in all directions.
 - 4. Do not embed threadless fittings in concrete unless specifically approved by Architect for each specific location.
 - 5. Change from ENT to GRC before rising above floor.
- J. Stub-ups to Above Recessed Ceilings:
 - 1. Use EMT, IMC, or RMC for pathways.
 - 2. Use a conduit bushing or insulated fitting to terminate stub-ups not terminated in hubs or in an enclosure.
- K. Threaded Conduit Joints, Exposed to Wet, Damp, Corrosive, or Outdoor Conditions: Apply listed compound to threads of pathway and fittings before making up joints. Follow compound manufacturer's written instructions.
- L. Coat field-cut threads on PVC-coated pathway with a corrosion-preventing conductive compound prior to assembly.

- M. Terminate threaded conduits into threaded hubs or with locknuts on inside and outside of boxes or cabinets. Install insulated bushings on conduits terminated with locknuts.
- N. Install pathways square to the enclosure and terminate at enclosures with locknuts. Install locknuts hand tight plus 1/4 turn more.
- O. Do not rely on locknuts to penetrate nonconductive coatings on enclosures. Remove coatings in the locknut area prior to assembling conduit to enclosure to assure a continuous ground path.
- P. Cut conduit perpendicular to the length. For conduits of 2-inch trade size and larger, use roll cutter or a guide to ensure cut is straight and perpendicular to the length.
- Q. Install pull wires in empty pathways. Use polypropylene or monofilament plastic line with not less than 200-lb tensile strength. Leave at least 12 inches of slack at each end of pull wire. Cap underground pathways designated as spare above grade alongside pathways in use.
- R. Pathways for Optical-Fiber and Communications Cable: Install pathways, metal and nonmetallic, rigid and flexible, as follows:
 - 1. 3/4-Inch Trade Size and Smaller: Install pathways in maximum lengths of 50 feet.
 - 2. 1-Inch Trade Size and Larger: Install pathways in maximum lengths of 75 feet.
 - 3. Install with a maximum of two 90-degree bends or equivalent for each length of pathway unless Drawings show stricter requirements. Separate lengths with pull or junction boxes or terminations at distribution frames or cabinets where necessary to comply with these requirements.
- S. Install pathway sealing fittings at accessible locations according to NFPA 70 and fill them with listed sealing compound. For concealed pathways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces. Install pathway sealing fittings according to NFPA 70.
- T. Install devices to seal pathway interiors at accessible locations. Locate seals so no fittings or boxes are between the seal and the following changes of environments. Seal the interior of all pathways at the following points:
 - 1. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.
 - 2. Where an underground service pathway enters a building or structure.
 - 3. Where otherwise required by NFPA 70.
- U. Comply with manufacturer's written instructions for solvent welding PVC conduit and fittings.
- V. Expansion-Joint Fittings:
 - 1. Install in each run of aboveground RNC that is located where environmental temperature change may exceed 30 deg F, and that has straight-run length that exceeds 25 feet. Install in each run of aboveground RMC and EMT conduit that is located where environmental temperature change may exceed 100 deg F and that has straight-run length that exceeds 100 feet.
 - 2. Install type and quantity of fittings that accommodate temperature change listed for each of the following locations:

- a. Outdoor Locations Not Exposed to Direct Sunlight: 125 deg F temperature change.
 - b. Outdoor Locations Exposed to Direct Sunlight: 155 deg F temperature change.
 - c. Indoor Spaces Connected with Outdoors without Physical Separation: 125 deg F temperature change.
 - d. Attics: 135 deg F temperature change.
3. Install fitting(s) that provide expansion and contraction for at least 0.00041 inch per foot of length of straight run per deg F of temperature change for PVC conduits. Install fitting(s) that provide expansion and contraction for at least 0.000078 inch per foot of length of straight run per deg F of temperature change for metal conduits.
 4. Install expansion fittings at all locations where conduits cross building or structure expansion joints.
 5. Install each expansion-joint fitting with position, mounting, and piston setting selected according to manufacturer's written instructions for conditions at specific location at time of installation. Install conduit supports to allow for expansion movement.
- W. J-hooks must be fixed to or hung from building structure and shall not be fixed to or hung from building services, i.e. ducts, pipes, electrical conduits, sprinkler pipes, etc. Install fastenings and supports at regular intervals as required and in accordance with manufacturer's installation recommendations. Provide and correctly locate all hangers and clips for the installation of cables installed by others. J-hook spacing shall be 6'-0" or less.
- X. Mount boxes at heights indicated on Drawings. If mounting heights of boxes are not individually indicated, give priority to ADA requirements. Install boxes with height measured to top of box unless otherwise indicated.
- Y. Recessed Boxes in Masonry Walls: Saw-cut opening for box in center of cell of masonry block, and install box flush with surface of wall. Prepare block surface to provide a flat surface for a raintight connection between box and cover plate or supported equipment and box.
- Z. Horizontally separate boxes mounted on opposite sides of walls so they are not in the same vertical channel.
- AA. Support boxes of three gangs or more from more than one side by spanning two framing members or mounting on brackets specifically designed for the purpose.
- BB. Fasten junction and pull boxes to or support from building structure. Do not support boxes by conduits.
- CC. Set metal floor boxes level and flush with finished floor surface.
- DD. Set nonmetallic floor boxes level. Trim after installation to fit flush with finished floor surface.

3.3 INSTALLATION OF UNDERGROUND CONDUIT

A. Direct-Buried Conduit:

1. Excavate trench bottom to provide firm and uniform support for conduit. Prepare trench bottom as specified in Section 312000 "Earth Moving" for pipe less than 6 inches in nominal diameter.

2. Install backfill as specified in Section 312000 "Earth Moving."
3. After installing conduit, backfill and compact. Start at tie-in point, and work toward end of conduit run, leaving conduit at end of run free to move with expansion and contraction as temperature changes during this process. Firmly hand tamp backfill around conduit to provide maximum supporting strength. After placing controlled backfill to within 12 inches of finished grade, make final conduit connection at end of run and complete backfilling with normal compaction as specified in Section 312000 "Earth Moving."
4. Install manufactured duct elbows for stub-ups at poles and equipment and at building entrances through floor unless otherwise indicated. Encase elbows for stub-up ducts throughout length of elbow.
5. Install manufactured rigid steel conduit elbows for stub-ups at poles and equipment and at building entrances through floor.
 - a. Couple steel conduits to ducts with adapters designed for this purpose, and encase coupling with 3 inches of concrete for a minimum of 12 inches on each side of the coupling.
 - b. For stub-ups at equipment mounted on outdoor concrete bases and where conduits penetrate building foundations, extend steel conduit horizontally a minimum of 60 inches from edge of foundation or equipment base. Install insulated grounding bushings on terminations at equipment.
6. Warning Planks: Bury warning planks approximately 12 inches above direct-buried conduits, but a minimum of 6 inches below grade. Align planks along centerline of conduit.
7. Underground Warning Tape: Comply with requirements in Section 260553 "Identification for Electrical Systems."

3.4 INSTALLATION OF UNDERGROUND HANDHOLES AND BOXES

- A. Install handholes and boxes level and plumb and with orientation and depth coordinated with connecting conduits to minimize bends and deflections required for proper entrances.
- B. Unless otherwise indicated, support units on a level bed of crushed stone or gravel, graded from 1/2-inch sieve to No. 4 sieve and compacted to same density as adjacent undisturbed earth.
- C. Elevation: In paved areas, set so cover surface will be flush with finished grade. Set covers of other enclosures 1 inch above finished grade.
- D. Install removable hardware, including pulling eyes, cable stanchions, cable arms, and insulators, as required for installation and support of cables and conductors and as indicated. Select arm lengths to be long enough to provide spare space for future cables, but short enough to preserve adequate working clearances in enclosure.
- E. Field cut openings for conduits according to enclosure manufacturer's written instructions. Cut wall of enclosure with a tool designed for material to be cut. Size holes for terminating fittings to be used, and seal around penetrations after fittings are installed.

3.5 SLEEVE AND SLEEVE-SEAL INSTALLATION FOR COMMUNICATIONS PENETRATIONS

- A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies. Comply with requirements in Section 270544 "Sleeves and Sleeve Seals for Communications Pathways and Cabling."

3.6 FIRESTOPPING

- A. Install firestopping at penetrations of fire-rated floor and wall assemblies. Comply with requirements in Section 078413 "Penetration Firestopping."

3.7 PROTECTION

- A. Protect coatings, finishes, and cabinets from damage or deterioration.
 - 1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
 - 2. Repair damage to PVC coatings or paint finishes with matching touchup coating recommended by manufacturer.

END OF SECTION 270528

SECTION 31 1000 – SITE PREPARATION

1.0 GENERAL

RELATED DOCUMENTS: Attention is directed to Bidding Requirements, Contracting Requirements, and Division 1 – General Requirements, which are binding in their entirety on this portion of the work and in particular to paragraphs concerning materials, workmanship, and substitutions.

1.1 SCOPE OF WORK

1.1.1 This Section covers clearing, grubbing and stripping along the construction sites, complete as specified herein.

1.1.2 The CONTRACTOR shall clear and grub all of the area within the limits of construction or as required, which includes, but is not limited to, utility easements. The width of the area to be cleared shall be established by the ENGINEER prior to the beginning of any clearing.

1.2 RELATED WORK

(NOT USED)

2.0 PRODUCTS

(NOT USED)

3.0 EXECUTION

3.1 CLEARING

3.1.1 The surface of the ground, for the area to be cleared and grubbed, shall be completely cleared of all timber, brush, stumps, roots, grass, weeds, rubbish and all other objectionable obstructions resting on, or protruding through, the surface of the ground. However, those trees which are designated by the ENGINEER shall be preserved as hereinafter specified. Clearing operations shall be conducted so as to prevent damage to existing structures and installations, and to those under construction, and so as to provide for the safety of employees and others. Clearing for structures shall consist of topsoil and vegetation removal.

3.2 GRUBBING

3.2.1 Grubbing shall consist of the complete removal of all stumps, roots larger than 1-1/2 inches in diameter, matted roots, brush, timber, logs and any other organic or metallic debris not suitable for foundation purposes, resting on, under or protruding through the surface of the ground to a depth of 18 inches below the subgrade. All depressions excavated below the original ground surface for, or by the removal of such objects, shall be refilled with suitable materials and compacted to a density conforming to the surrounding ground surface.

3.3 STRIPPING

3.3.1 In areas so designated, topsoil shall be stockpiled. Topsoil so stockpiled shall be protected until it is placed as specified. Any topsoil remaining after all work is in place shall be disposed of by the CONTRACTOR.

3.4 DISPOSAL OF CLEARED AND GRUBBED MATERIAL

3.4.1 The CONTRACTOR shall dispose of all material and debris from the clearing and grubbing operation by hauling such material and debris away to an approved dump. Disposal by burning or burial will not be permitted. The cost of disposal (including hauling) of cleared and grubbed material and debris shall be considered a subsidiary obligation of the CONTRACTOR, the cost of which shall be included in the Contract prices.

3.4.2 If the landowner desires the timber or small trees, the CONTRACTOR shall cut and neatly pile it in four foot lengths for removal by the landowner; otherwise the CONTRACTOR shall dispose of it by hauling away from the project site.

3.5 PRESERVATION OF TREES

3.5.1 Those trees which are designated by the ENGINEER for preservation shall be carefully protected from damage. The CONTRACTOR shall erect such barricades, guards, and enclosures as may be considered necessary by him for the protection of the trees during all construction operations.

3.6 PRESERVATION OF DEVELOPED PRIVATE PROPERTY

3.6.1 The CONTRACTOR shall exercise extreme care to avoid unnecessary disturbance of developed private property as applicable. Trees, shrubbery, gardens, lawn and other landscaping, which in the opinion of the ENGINEER must be removed, shall be replaced and replanted to restore the construction easement to the condition existing prior to construction.

3.6.2 All soil preparation procedures and replanting operations shall be under the supervision of a nurseryman experienced in such operations.

3.6.3 Improvements to the land such as fences, walls, outbuildings, etc., which of necessity must be removed shall be replaced with equal quality materials and workmanship.

3.6.4 The CONTRACTOR shall clean up the construction site across developed private property directly after construction is completed, upon approval of the ENGINEER.

END OF SECTION

SECTION 31 2000 – STRUCTURAL EXCAVATION, BACKFILL & COMPACTION

1.0 GENERAL

RELATED DOCUMENTS: Attention is directed to Bidding Requirements, Contracting Requirements, and Division 1 – General Requirements, which are binding in their entirety on this portion of the work and in particular to paragraphs concerning materials, workmanship, and substitutions.

1.1 SCOPE OF WORK

1.1.1 This Section includes, except as elsewhere provided, excavation, filling and grading under and around cast in place and precast structures to the subgrades and grades indicated on the Drawings.

1.1.2 Supplemental Foundation and Site Preparation Notes may be indicated on the Structural Drawings.

1.2 RELATED WORK

1.2.1 Section 31 1000: Site Preparation.

1.3 QUALITY ASSURANCE

1.3.1 Codes and Standards: Perform excavation work in compliance with applicable requirements of governing authorities having jurisdiction.

1.3.2 Testing and Inspection Service: The CONTRACTOR will engage soil testing and inspection service for quality control testing during earthwork operations.

1.4 JOB CONDITIONS

1.4.1 The CONTRACTOR shall examine the site taking into consideration all conditions that may affect his work. The OWNER and ENGINEER will not assume responsibility for sub-soil quality or conditions.

1.4.2 Existing Utilities: Locate existing underground utilities in the areas of work. If utilities are to remain in place, provide adequate means of protection during earthwork operations.

1. Should uncharted, or incorrectly charted, piping or other utilities be encountered during excavation, consult the ENGINEER and the OWNER of such piping or utility immediately for directions.
2. Cooperate with OWNER and utility companies in keeping respective services and facilities in operation. Repair damaged utilities to satisfaction of utility OWNER.

1.4.3 Protection of Persons and Property: Barricade open excavations occurring as part of this work and post with warning lights. Operate warning lights as recommended by authorities having jurisdiction. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout and other hazards created by earthwork operations.

1.5 PROTECTION

1.5.1 Sheeting and Bracing in Excavations:

1. In connection with the construction of below grade structures, the CONTRACTOR shall construct, brace, and maintain cofferdams consisting of sheeting and bracing as required to support the sides of excavations, to prevent any movement which could in any way diminish the width of the excavation below that necessary for proper construction, and to protect adjacent structures, existing yard piping and/or foundation material from disturbance, undermining, or other damage. Care shall be taken to prevent voids outside of the sheeting, but if voids are formed they shall be immediately filled and rammed.
2. All sheeting and bracing not left in place shall be carefully removed in such a manner as not to endanger the construction or other structures, utilities, existing piping, or property. Unless otherwise approved or indicated on the Drawings or in the Specifications, all sheeting and bracing shall be removed after completion of the substructure, care being taken not to disturb or otherwise injure the finished masonry. All voids left or caused by withdrawal of sheeting shall be immediately refilled with sand by ramming with tools especially adapted to that purpose, by watering or otherwise as may be directed.
3. The right of the ENGINEER to order sheeting and bracing left in place shall not be construed as creating any obligation on his part to issue such orders, and his failure to exercise his right to do so shall not relieve the CONTRACTOR from liability for damages to persons or property occurring from or upon the Work occasioned by negligence or otherwise, growing out of a failure on the part of the CONTRACTOR to leave in place sufficient sheeting and bracing to prevent any caving or moving of the ground.
4. The CONTRACTOR shall construct the cofferdams and sheeting outside the neat lines of the foundation unless indicated otherwise to the extent he deems it desirable for his method of operation. Sheeting shall be plumb and securely braced and tied in position. Sheeting, bracing, and cofferdams shall be adequate to withstand all pressures to which the structure will be subjected. Pumping, bracing, and other work within the cofferdam shall be done in a manner to avoid disturbing any construction of the masonry enclosed. Any movement or bulging which may occur shall be corrected by the CONTRACTOR at his own expense so as to provide the necessary clearances and dimensions.
5. Drawings of the cofferdams and design computations shall be submitted to the ENGINEER for approval, and construction shall not be started until such drawings are approved. However, approval of these drawings shall not relieve the CONTRACTOR of the responsibility for the cofferdam. The drawings and computations shall be prepared and stamped by a Registered Professional Engineer in the State of South Carolina and shall be in sufficient detail to disclose the method of operation for each of the various stages of construction, if required, for the completion of the substructures.

1.5.2 Dewatering, Drainage and Flotation:

1. The CONTRACTOR shall construct and place all concrete work, structural fill, bedding rock, and gravel base course in-the-dry. In addition, the CONTRACTOR shall make the final 24 inches of excavation for this work in-the-dry, and not until the water level is a minimum of six inches below proposed bottom of excavation.
2. The CONTRACTOR shall, at all times during construction, provide and maintain proper equipment and facilities to remove prompt, and dispose of

- properly, all water entering excavations and keep such excavations dry so as to obtain a satisfactory undisturbed subgrade foundation condition until the fill and structure to be built thereon have been completed to such extent that they will not be floated or otherwise damaged by allowing water levels to return to natural elevations.
3. Dewatering shall at all times be conducted in such a manner as to preserve the natural undisturbed bearing capacity of the subgrade soils at proposed bottom of excavation.
 4. Wellpoints may be required for predrainage of the soils prior to final excavation for some of the deeper in-ground structures, and for maintaining the lowered groundwater level until construction has been completed to such an extent that the structure or fill will not be floated or otherwise damaged. Wellpoints shall be surrounded by suitable filter sand and no fines shall be removed by pumping. Pumping from wellpoints shall be continuous and standby pumps shall be provided.
 5. The CONTRACTOR shall furnish all materials and equipment and perform all work required to install and maintain the drainage systems he proposes for handling groundwater and surface water encountered during construction of structures and compacted fills.
 6. If requested by the ENGINEER, the CONTRACTOR's proposed method of dewatering shall include a minimum of two operating groundwater observation wells at each structure to be used to determine the water level during construction of the structure. Locations of the observation wells shall be at structures as approved by the ENGINEER prior to their installation. The observation wells shall be extended to six inches above finished grade, capped with screw-on caps protected by 24" x 24" wide concrete base, and left in place at the completion of this Project.
 7. During backfilling and construction, water levels shall be measured in observation wells located as directed by the ENGINEER.
 8. Continuous pumping will be required as long as water levels are required to be below natural levels.

1.6 SUBMITTALS

- 1.6.1 The CONTRACTOR shall furnish the ENGINEER, for approval, a representative sample of fill material obtained from onsite sources weighing approximately 50 pounds, at least ten calendar days prior to the date of anticipated use of such material.
- 1.6.2 For each material obtained from other than onsite sources, the CONTRACTOR shall notify the ENGINEER of the source of the material and shall furnish the ENGINEER, for approval, a representative sample weighing approximately 50 pounds, at least 10 calendar days prior to the date of anticipated use of such material.

PART 2 - PRODUCTS

2.1 MATERIALS

- 2.1.1 General: Materials for use as base, fill and backfill shall be as described below:

1. Satisfactory soil materials are defined as those complying with American Association of State Highway and Transportation Officials (AASHTO) M-145, soil classification Groups A-1, A-2-4, A-2-5 and A-3.
2. Unsatisfactory soil materials are those defined in AASHTO M-145 soil classification Groups A-2-6, A-2-7, A-4, A-5, A-6, and A-7 along with peat and other highly organic soils.
3. Materials shall be furnished as required from off site sources and hauled to the site.

2.1.2 Structural Fill: Structural fill material shall be satisfactory soil material consisting of a minimum of 60 percent clean medium to fine grain sized quartz sand, free of organic, deleterious and/or compressible material. Rock in excess of 2-1/2 inches in diameter shall not be used in the fill material. Structural fill shall not contain hardpan, stones, rocks, cobbles or other similar materials.

2.1.3 Crusher-Run Gravel:

1. The impervious aggregate base, crusher-run gravel, subbase, or shoulder course material shall be of uniform quality throughout. The material retained on the No. 10 sieve shall be composed of aggregate meeting the requirements for Class A or B coarse aggregate, except the percent of soft fragments allowed shall be as shown in the requirements below. To be used only if requested by CONTRACTOR and approved by the ENGINEER.
2. The impervious aggregate may be produced from an approved quarry source, or bank or pit deposit, which will yield a satisfactory mixture conforming to all requirements of these specifications after it has been crushed or processed as a part of the mining operations, or the material may be furnished in two sizes of such gradation that when combined in the central mix plant the resultant mixture shall conform to the required specifications. Impervious aggregate base, subbase or shoulder material shall conform to the following requirements:

<u>Gradation</u>	<u>Percent by Weight Passing Each Sieve</u>
1/2" Sieve	100
3/4" Sieve	60 - 100
No. 10 Sieve	30 - 55
No. 60 Sieve	8 - 35
No. 200 Sieve	5 - 20

Tests on Material Passing No. 10 Sieve
Volume Change, Percent 0-18

Test on Material Retained on 3/8 Sieve
Soft Fragments, Percent 0-30

Method of Tests shall be in accordance with the following:

Gradation	AASHTO: T27
Volume Change	GHO: 6

Soft Fragments AASHTO: T189

2.1.4 Limerock Base Course:

1. Limerock shall not contain cherty or other extremely hard pieces, or lumps, or balls or pockets of sand material in sufficient quantity as to be detrimental to the proper bonding, finishing or strength of the limerock base.
2. Gradation and Size Limits: At least 97 percent (by weight) of the material shall pass a 3-1/2 inch sieve and the material shall be graded uniformly down to dust. The fine material shall consist of dust and fracture. All crushing or breaking up which might be necessary in order to meet such size requirements shall be done before the material is in place.

2.1.5 Common Fill:

1. Common fill material shall be satisfactory soil material containing no more than 20 percent by weight finer than No. 200 mesh sieve. It shall be free from organic matter, muck, marl, and rock exceeding 2-1/2 inches in diameter. Common fill shall not contain broken concrete, masonry, rubble or other similar materials.
2. Material falling within the above specification, encountered during the excavation, may be stored in segregated stockpiles for reuse. All material which, in the opinion of the ENGINEER, is not suitable for reuse shall be spoiled as specified herein for disposal of unsuitable materials.

2.1.6 Bedding Rock: Bedding rock shall be 3/8" to 3/4" washed and graded stone or limerock. This rock shall be graded so that 99% will pass a 3/4" screen and 80% will be retained on a No. 8 screen.

PART 3 - EXECUTION

3.1 INSPECTION

- 3.1.1 Examine the areas and conditions under which excavating, filling, and grading are to be performed. Do not proceed with the Work until unsatisfactory conditions have been corrected.
- 3.1.2 Examine and accept existing grade of walks, pavements and steps prior to commencement of work and report to ENGINEER if elevations of existing subgrade vary from elevations shown on Drawings.

3.2 EXCAVATION

- 3.2.1 Excavation consists of removal and disposal of material encountered when establishing required grade elevations and in accordance with the drawings.
- 3.2.2 Excavation Classifications: The following classifications of excavation will be made when unanticipated rock excavation or unclassified excavation is encountered in the work. Do not perform such work until material to be excavated has been cross-sectioned and classified by ENGINEER or specialized geotechnical consultant.

1. Authorized earth excavation includes removal and disposal of pavements and other obstructions visible on ground surface, underground structures and utilities indicated to be demolished and removed, material of any classification indicated in soil boring data on subsurface conditions, and other materials encountered that are not classified as rock excavation or unauthorized excavation.
2. Unauthorized excavation consists of removal of material beyond the limits needed to establish required grade and subgrade elevations without specific direction of ENGINEER. Unauthorized excavation, as well as remedial work directed by the ENGINEER shall be at the CONTRACTOR's expense.
 - a. Under footings, foundation bases, or retaining walls, fill unauthorized excavation by extending the indicated bottom elevation of the footing or base to the excavation bottom, without altering required top elevation. Lean (unreinforced) concrete fill may be used to bring bottom elevations to proper position, when acceptable to ENGINEER. Reinforcement shall be placed as needed or directed by the ENGINEER.
 - b. Elsewhere, backfill and compact unauthorized excavations as specified for authorized excavations of same classification, unless otherwise directed by ENGINEER.

3.2.3 Additional Excavation:

1. When excavation has reached required subgrade elevations, notify the ENGINEER.
2. If unsuitable bearing materials are encountered at the required subgrade elevations, carry excavations deeper and replace the excavated material as directed by the ENGINEER.
3. Removal of unsuitable material and its replacement as directed will be at no additional charge to the OWNER.

3.2.4 Stability of Excavations:

1. Slope sides of excavations to comply with local codes and ordinances having jurisdiction or as shown on the Drawings. Shore and brace where sloping is not possible because of space restrictions or stability of material excavated.
2. Maintain sides and slopes of excavations in a safe condition until completion of backfilling.

3.2.5 Shoring and Bracing:

1. Provide materials for shoring and bracing, such as sheet piling, uprights, stringers and cross-braces, in good serviceable condition.
2. Establish requirements for trench shoring and bracing to comply with local codes and authorities having jurisdiction.
3. Maintain shoring and bracing in excavations regardless of time period excavations will be open. Carry down shoring and bracing as excavation progresses.

3.2.6 Dewatering:

1. Prevent surface water and subsurface or ground water from flowing into excavations and from flooding project site and surrounding areas. Maintain groundwater table level a minimum of one-foot below excavation level.
2. Do not allow water to accumulate in excavations. Remove water to prevent softening of foundation bottoms, undercutting footings, and soil changes detrimental to stability of subgrades and foundations. Provide and maintain pumps, well points, sumps, suction and discharge lines, and other dewatering system components necessary to convey water away from excavations.
3. Convey water removed from excavations and rain water to collecting or run-off areas. Establish and maintain temporary drainage ditches and other diversions outside excavation limits for each structure. Do not use trench excavations as temporary drainage ditches.

3.2.7 Material Storage:

1. Stockpile satisfactory excavated materials where directed, until required for backfill or fill. Place, grade, and shape stockpiles for proper drainage.
2. Locate and retain soil materials away from edge of excavations.
3. Dispose of excess soil material and waste materials as herein specified.

3.2.8 Excavation for Structures:

1. Conform to elevations and dimensions shown within a tolerance of plus or minus 0.10 feet, and extending a sufficient distance from footings and foundations to permit placing and removal of concrete formwork, installation of services, other construction, and for inspection, or as shown on the Drawings.
2. In excavating for footings and foundations, take care not to disturb bottom of excavation. Excavate by hand to final grade just before concrete reinforcement is placed. Trim bottoms to required lines and grades to leave solid base to receive concrete.
3. Do not excavate to the bearing levels designated on the drawings until surface compaction is completed.

3.2.9 Cold Weather Protection: Protect excavation bottoms against freezing when atmospheric temperature is less than 35 degrees F.

3.3 BACKFILL AND FILL

3.3.1 General:

1. Place material in layers to required subgrade elevations, for each area classification listed below.
2. Structural fill shall be used below spread footing foundations, slab-on grade floors, and other structures and as backfill within three feet of the below grade portion of structures.
3. Crusher-run gravel shall be used under and around drainage sumps. It can be used at the request of the CONTRACTOR and if approved by the ENGINEER as base material for areas approved by the ENGINEER.
4. Crusher-run base course shall be used under roadways, parking areas, and walks. Crusher-run base course may be used by the CONTRACTOR at other similar locations if approved by the ENGINEER or indicated on the Drawings.

5. Common fill shall be used at all other locations.
6. Bedding rock shall be used for pipe bedding, under and around manhole base and at other locations indicated on the Drawings or approved by the ENGINEER.

3.3.2 Backfill excavations as promptly as work permits, but not until completion of the following:

1. Acceptance by ENGINEER of construction below finish grade including, where applicable, damproofing, waterproofing and perimeter insulation.
2. Inspection, testing approval and recording locations of underground utilities.
3. Removal of concrete formwork.
4. Removal of shoring and bracing, and backfilling of voids with satisfactory materials.
5. Removal of trash and debris.
6. Permanent or temporary horizontal bracing is in place on horizontally supported walls. Layout and location of bracing shall consider loads of the structure as well as the effects of the soil and groundwater.

3.3.4 Ground Surface Preparation:

1. Remove vegetation, debris, unsatisfactory soil materials, obstructions and deleterious materials from ground surface prior to placement of fills. Plow strip, or break-up sloped surfaces steeper than one vertical to four horizontal so that fill materials will bond with existing surface.
2. When existing ground surface has a density less than that specified under "Compaction" for the particular area classification, break up the ground surface, pulverize, moisture-condition to the optimum moisture content, and compact to required depth and percentage of maximum density.

3.3.5 Fill Placement:

1. Material placed in fill areas under and around structures shall be deposited within the lines and to the grades shown on the Drawings or as directed by the ENGINEER, making due allowance for settlement of the material. Backfill shall be carried up evenly on all walls of an individual structure simultaneously with no more than a two-foot elevation variation allowed. Fill shall be placed only on properly prepared surfaces which have been inspected and approved by the ENGINEER.
2. Fill material can be obtained from cut areas within the construction project site. If sufficient satisfactory soil material is not available from excavation on site, the CONTRACTOR shall provide fill material as may be required from off-site sources at no additional cost to the OWNER.
3. Fill shall be brought up in substantially level lifts throughout the site, starting in the deepest portion of the fill. The entire surface of the work shall be maintained free from ruts, and in such condition that construction equipment can readily travel over any section. Fill shall not be placed on surfaces that are muddy, frozen, or against concrete structures until they have attained sufficient strength.
4. Fill shall be dumped and spread in layers by a bulldozer or other approved method. During the process of dumping and spreading, all roots, debris and stones greater in size than specified under "Materials", shall be removed from

- the fill areas, and the CONTRACTOR shall assign a sufficient number of men to this work to ensure satisfactory compliance with these requirements.
5. If the compacted surface of any layer of material is determined to be too smooth to bond properly with the succeeding layer, it shall be loosened by harrowing or by an other approved method before the succeeding layer is placed.
 6. All fill materials shall be placed and compacted "in-the-dry". The CONTRACTOR shall dewater excavated areas as required to perform the work and in such a manner as to preserve the undisturbed state of the natural inorganic soils.

3.4 COMPACTION

3.4.1 General: Control soil compaction during construction providing minimum percentage of density specified on the structural drawings for each area classification. It shall be the CONTRACTOR's responsibility to notify the ENGINEER in writing that penetration tests can be performed. Written notice from the CONTRACTOR shall precede completion of compaction operations by at least two working days.

3.4.2 Percentage of Maximum Density Requirements: Moisture content of soil shall be within 2% of the optimum. Compact soil to not less than the following percentages of maximum dry density in accordance with AASHTO T-180.

1. Underneath structures and five foot around perimeter of ground storage tank foundation, compact top 12-inches of subgrade and each layer of backfill or fill material at 98% maximum dry density.
2. In building slabs and footing, compact top 12-inches of subgrade and each layer of backfill or fill material at 98% maximum dry density.
3. In lawn and unpaved areas, compact top six inches of subgrade and each layer of backfill or fill material to 95% maximum density.
4. In walkways, compact top six inches of subgrade at 95% maximum dry density.
5. In pavement and steps, compact top twelve inches of subgrade at 98% standard proctor.

3.4.3 Moisture Control:

1. Where subgrade or layer of soil material must be moisture conditioned before compaction, uniformly apply clean water to surface of subgrade, or layer of soil material, to prevent free water appearing on surface during or subsequent to compaction operations.
2. Remove and replace, or scarify and air dry, soil material that is too wet to permit compaction to specified density.
3. Soil material that has been removed because it is too wet to permit compaction but is otherwise satisfactory may be stockpiled or spread and allowed to dry. Assist drying by discing, harrowing or pulverizing until moisture content is reduced to a satisfactory value.

3.4.4 Structural fill shall be placed in layers not more than nine inches loose depth for material compacted by heavy compaction equipment. Each layer shall be compacted by a minimum of six coverages with the equipment described below, to at least 98 percent of maximum dry density as determined by AASHTO-T-180. Incidental compaction due to traffic by construction equipment will not be credited toward the required minimum coverages.

- 3.4.5 Common fill consisting of other than structural fill shall be placed and compacted in a manner similar to that described above for structural fill, with the following exceptions:
1. Layer thickness prior to compaction may be increased to 12-inches in open areas.
 2. Common fill, except dike fill, required below water level in peat excavation areas may be placed as one lift, in-the-wet, to an elevation of one foot above the water level at the time of filling.
- 3.4.6 Compaction of the fill by such means shall be to the same degree of compaction as obtained by rubber-tired or vibratory roller equipment, and the ENGINEER may make the necessary tests to determine the amount of compactive effort necessary to obtain equal compaction. Large compaction equipment shall not be used within five feet of walls. Compaction equipment is subject to approval by the ENGINEER.
- 3.4.7 Place fill material in layers not more than six inches loose depth for material compacted by hand-operated tampers. Use manually operated sled-type vibratory compactors next to structures and confined areas not accessible to heavy mechanical compaction equipment.
- 3.4.8 If the ENGINEER determines that added moisture is required, water shall be applied by sprinkler tanks or other sprinkler systems, which will ensure uniform distribution of the water over the area to be treated, and give complete and accurate control of the amount of water to be used. If too much water is added, the area shall be permitted to dry before compaction is continued.
- 3.4.9 The CONTRACTOR shall supply all hose, piping, valves, sprinklers, pumps, sprinkler tanks, hauling equipment and all other materials and equipment necessary to place the water in the fill in the manner specified.

3.5 GRADING

- 3.5.1 General: Uniformly grade fill areas within limits of project including adjacent transition areas. Smooth finished surface within specified tolerances, compact with uniform levels or slopes between points where elevations are shown, or between such points and existing grades. No soft spots or uncompacted areas will be allowed in the work.
- 3.5.2 Grading Outside Building Lines: Grade areas adjacent to building lines, as shown on the Drawings, to drain away from structures and to prevent ponding. Finish surfaces free from irregular surface changes, and as follows:
1. Finish lawn or unpaved areas to within not more than 0.10 feet above or below the required elevation.
 2. Shape surface of areas under walks to line, grade and cross-section, with finish surface not more than 0.15 feet above the required subgrade and not below surrounding grade to avoid ponding water from runoff.
- 3.5.3 Grading Surface of Fill Under Building Slabs: Grade smooth and even, free of voids, compacted as specified, and to required elevation. Provide final grades within a tolerance of 1/2-inch when tested with a 10-foot straightedge.

- 3.5.4 Stones or rock fragments larger than two and one-half inches in their greatest dimension will not be permitted in the top six inches of subgrade line of all dike, fills or embankments.
- 3.5.5 All cut and fill slopes shall be uniformly dressed to the slope, cross-section and alignment shown on the Drawings, or as directed by the ENGINEER to prevent ponding water on driveways, walkways or against structures.
- 3.5.6 During grading, protect all buried valve extensions and covers, sprinklers and any other mechanical or structural object protruding from below grade.

3.6 FIELD QUALITY CONTROL

- 3.6.1 Quality Control Testing During Construction: Allow testing service to inspect and approve subgrades and fill layers before further construction work is performed.
- 3.6.2 If in the opinion of the ENGINEER, based on testing service reports and inspection, subgrade or fills which have been placed are below specified density, provide additional compaction and testing at no additional expense.

3.7 MAINTENANCE

- 3.7.1 Protection of Graded Areas: Protect newly graded areas from traffic and erosion. Keep free of trash and debris. Repair and re-establish grades in settled, eroded and rutted areas to specified tolerances.
- 3.7.2 Reconditioning Compacted Areas: Where completed compacted areas are disturbed by subsequent construction operations or adverse weather, scarify surface, reshape and compact to required density prior to further construction.

3.8 DISPOSAL OF SURPLUS AND WASTE MATERIAL

- 3.8.1 All surplus and/or unsuitable excavated material shall be disposed of in one of the following ways as directed by the ENGINEER:
 - 1. Transport to soil storage area on the OWNER's property and stockpile or spread as directed by the ENGINEER.
 - 2. Transport from the OWNER's property and legally dispose of. Any permit required for the hauling and disposing of this material beyond the OWNER's property shall be obtained prior to commencing hauling operations.
- 3.8.2 Suitable excavated material may be used for fill if it meets the specifications for satisfactory material and is approved by the ENGINEER. Excavated material so approved may be neatly stockpiled at the site where designated by the ENGINEER provided there is an area available where it will not interfere with the operation of the facility and not inconvenience traffic or adjoining property owners.
- 3.8.3 Excavated rock may be used in open fill areas only with the approval of the ENGINEER.

END OF SECTION

SECTION 31 3116 - TERMITE CONTROL

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. This Section includes the following:
 - 1. Soil treatment with termiticide.
 - 2. Metal mesh barrier system.
- B. Related Sections include the following:
 - 1. Division 06 Section "Rough Carpentry" for wood preservative treatment by pressure process.
 - 2. Division 07 Section "Sheet Metal Flashing and Trim" for custom-fabricated metal termite shields.

1.3 PERFORMANCE REQUIREMENTS

- A. Service Life of Soil Treatment: Soil treatment by use of a termiticide that is effective for not less than five years against infestation of subterranean termites.

1.4 SUBMITTALS

- A. Product Data:
 - 1. Include the EPA-Registered Label for termiticide products.
- B. Product Certificates: For termite control products, signed by product manufacturer.
- C. Qualification Data: For Installer of termite control products.
- D. Soil Treatment Application Report: After application of termiticide is completed, submit report for Owner's record information, including the following:
 - 1. Date and time of application.
 - 2. Moisture content of soil before application.
 - 3. Brand name and manufacturer of termiticide.
 - 4. Quantity of undiluted termiticide used.
 - 5. Dilutions, methods, volumes, and rates of application used.
 - 6. Areas of application.
 - 7. Water source for application.

- E. Warranty: Special warranty specified in this Section.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: A specialist who is licensed according to regulations of authorities having jurisdiction to apply termite control treatment and products in jurisdiction where Project is located.
- B. Regulatory Requirements: Formulate and apply termiticides according to the EPA-Registered Label.
- C. Source Limitations: Obtain termite control products through one source.
- D. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination" to schedule application of termiticide products.

1.6 PROJECT CONDITIONS

- A. Environmental Limitations: To ensure penetration, do not treat soil that is water saturated or frozen. Do not treat soil while precipitation is occurring. Comply with requirements of the EPA- Registered Label and requirements of authorities having jurisdiction.

1.7 COORDINATION

- A. Coordinate soil treatment application with excavating, filling, grading, and concreting operations. Treat soil under footings, grade beams, and ground-supported slabs before construction.

1.8 WARRANTY

- A. Special Warranty: Manufacturer's standard form, signed by Applicator and Contractor certifying that termite control work, consisting of applied soil termiticide treatment, will prevent infestation of subterranean termites. If subterranean termite activity or damage is discovered during warranty period, re-treat soil and repair or replace damage caused by termite infestation.
 - 1. Warranty Period: Five years from date of Substantial Completion.

1.9 MAINTENANCE SERVICE

- A. Continuing Service: Beginning at Substantial Completion, provide 12 months' continuing service including monitoring, inspection, and re-treatment for occurrences of termite activity. Provide a standard continuing service agreement. State services, obligations, conditions, and terms for agreement period; and terms for future renewal options.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Termiticides:
 - a. Aventis Environmental Science USA LP; Termidor.
 - b. Bayer Corporation; Premise 75.
 - c. Dow AgroSciences LLC; Dursban TCEquity.
 - d. FMC Corporation, Agricultural Products Group; TalstarPrevail FTTorpedo.
 - e. Syngenta; Demon TC.

2.2 SOIL TREATMENT

- A. Termiticide: Provide an EPA-registered termiticide complying with requirements of authorities having jurisdiction, in an aqueous solution formulated to prevent termite infestation. Provide quantity required for application at the label volume and rate for the maximum termiticide concentration allowed for each specific use, according to product's EPA-Registered Label.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Applicator present, for compliance with requirements for moisture content of soil, interfaces with earthwork, slab and foundation work, landscaping, and other conditions affecting performance of termite control.
1. Proceed with application only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. General: Comply with the most stringent requirements of authorities having jurisdiction and with manufacturer's written instructions for preparation before beginning application of termite control treatment. Remove all extraneous sources of wood cellulose and other edible materials such as wood debris, tree stumps and roots, stakes, formwork, and construction waste wood from soil within and around foundations.
- B. Soil Treatment Preparation: Remove foreign matter and impermeable soil materials that could decrease treatment effectiveness on areas to be treated. Loosen, rake, and level soil to be treated except previously compacted areas under slabs and footings. Termiticides may be applied before placing compacted fill under slabs if recommended in writing by termiticide manufacturer.
1. Fit filling hose connected to water source at the site with a backflow preventer, complying with requirements of authorities having jurisdiction.

3.3 APPLICATION, GENERAL

- A. General: Comply with the most stringent requirements of authorities having jurisdiction and with manufacturer's EPA-Registered Label for products.

3.4 APPLYING SOIL TREATMENT

- A. Application: Mix soil treatment termiticide solution to a uniform consistency. Provide quantity required for application at the label volume and rate for the maximum specified concentration of termiticide, according to manufacturer's EPA-Registered Label, to the following so that a continuous horizontal and vertical termiticidal barrier or treated zone is established around and under building construction. Distribute treatment evenly.
 - 1. Slabs-on-Grade and Basement Slabs: Underground-supported slab construction, including footings, building slabs, and attached slabs as an overall treatment. Treat soil materials before concrete footings and slabs are placed.
 - 2. Masonry: Treat voids.
- B. Avoid disturbance of treated soil after application. Keep off treated areas until completely dry.
- C. Protect termiticide solution, dispersed in treated soils and fills, from being diluted until ground- supported slabs are installed. Use waterproof barrier according to EPA-Registered Label instructions.
- D. Post warning signs in areas of application.
- E. Reapply soil treatment solution to areas disturbed by subsequent excavation, grading, landscaping, or other construction activities following application.

END OF SECTION 31 3116

SECTION 32 1216 - ASPHALTIC CONCRETE PAVING

1.0 GENERAL

RELATED DOCUMENTS: Attention is directed to Bidding Requirements, Contracting Requirements, and Division 1 – General Requirements, which are binding in their entirety on this portion of the work and in particular to paragraphs concerning materials, workmanship, and substitutions.

1.1 SCOPE OF WORK

- 1.1.1 Furnish all labor, materials, equipment and incidentals required and place asphaltic concrete pavement in accordance with the grades and typical sections shown on the Drawings and as specified herein.

1.2 RELATED WORK

- 1.2.1 Clearing, grubbing and stripping are included in Section 31 1000.
- 1.2.2 Walkways are included in Section 32 1313.

1.3 SUBMITTALS

- 1.3.1 Submit to the ENGINEER, as provided in the General Conditions, shop drawings showing proposed formulae for asphaltic concrete paving.

PART 2 - PRODUCTS

2.1 MATERIALS

- 2.1.1 The base shall consist of stabilized aggregate as specified in Sections 305 of the S.C. Department of Highways and Public Transportation Specifications.
- 2.1.2 The material used for the prime coat shall conform with Section 305 of the S.C. Department of Highways and Public Transportation Specifications for primer to be used on stabilized aggregate base.
- 2.1.3 The materials of the asphaltic concrete surface shall conform with applicable sections of S.C. Department of Highways and Public Transportation Specifications. Sections 407 for Type I Asphaltic Concrete Surface Course.
- 2.1.4 The paint used for parking and traffic stripes shall be white traffic paint which shall be of a type approved by the S.C. Department of Highways and Public Transportation under their Specifications for Traffic paint.

PART 3 - EXECUTION

3.1 INSTALLATION

- 3.1.1 The subgrade preparation shall comply with the requirements of Section 305 of the

S.C. Department of Highways and Public Transportation Specifications. All soft and yielding material and other portions of the subgrade which will not compact readily shall be removed and replaced with suitable material and the whole subgrade brought to line and grade and to a foundation of uniform compaction and supporting power.

- 3.1.2 The top 12 inches of the subgrade, in both cut and fill sections, shall be compacted to a density of not less than 98 percent standard proctor as determined by the AASHTO Method T-180. If shown on the Drawings, compact subgrade to a bearing value of 75 psi . Unless the subgrade material at the time of compacting contains moisture to permit proper compaction, it shall be moistened as necessary and then compacted. Subgrade material containing excess moisture shall be permitted to dry to the proper consistency before being compacted. The subgrade shall be shaped prior to making the density tests. The required density shall be maintained until the base or pavement has been laid or until the aggregate materials for the base or pavement course have been spread in place.
- 3.1.3 The minimum compacted thickness of the base shall be as shown on the drawings and applied in two layers of equal depth unless otherwise shown on the drawings. The width of the base shall be two feet wider than the pavement, one ft on each side. Provide three foot wide stabilized shoulder on each side of the road base where shown on the Drawings.
- 3.1.4 Before the prime coat is applied, all loose material, dust, dirt or other foreign material which might prevent bond with existing surface shall be moved to the shoulders to the full width of the base by means of revolving brooms, mechanical sweepers, blowers supplemented by hand sweeping or other approved methods. The glazed finish shall have been removed from the base. The prime coat shall be applied by a pressure distributor so that approximately 0.1 gallons per square yard is applied uniformly and thoroughly to a clean surface.
- 3.1.5 Prior to the application of the surface course, all loose material, dust, dirt and all foreign material which might prevent proper bond with the existing surface shall be removed to the full width of the repair by means of approved mechanical sweepers and supplemented by hand sweeping if required.
- 3.1.6 The asphaltic concrete shall be 2" in thickness.
- 3.1.7 All manhole castings, valve boxes or other utility castings within the area to be surfaced shall be adjusted to the proposed surface elevation by the CONTRACTOR. The work shall be accomplished in such manner as to leave the casting fixed permanently in its correct position.

3.2 PAVEMENT REPAIR

- 3.2.1 All damage to pavement as a result of work (construction or maintenance) under this contract shall be repaired in a manner satisfactory to the ENGINEER. Pavement shall be repaired to match the original surface material and original grade. However, the asphalt concrete thickness shall not be less than 1-1/2 inches. The repair shall include the preparation of the subgrade, the placing and compacting of the base, the

priming of the base, the placing and maintaining of the surface treatment, all as specified herein.

3.2.2 The width of all repairs shall extend at least 12 inches beyond the limit of the damage. The edge of the pavement to be left in place shall be cut to a true edge with a saw or other approved method so as to provide a clean edge to abut the repair. The line of the repair shall be reasonably uniform with no unnecessary irregularities.

3.3 TESTING

3.3.1 The CONTRACTOR shall have density, soil bearing, materials and such other tests performed as necessary. Should any test indicate that any portion of the materials or workmanship does not comply with these Specifications, a retest shall be performed at the CONTRACTOR's expense. If the retest confirms the first test, that portion of the work shall be removed and replaced or reworked at no additional cost to the OWNER until satisfactory compliance is attained.

3.4 PARKING AND TRAFFIC STRIPES

3.4.1 The CONTRACTOR shall paint the stripes indicated on the Drawings. The paint shall be applied in strict accordance with printed specifications of the MANUFACTURER of the paint being applied and the S.C. Department of Highways and Public Transportation Standard Specifications (2000 Edition). Unless otherwise indicated, the width of stripes shall be four inches.

END OF SECTION

SECTION 32 1313 - WALKWAYS AND CURB & GUTTER

1.0 GENERAL

RELATED DOCUMENTS: Attention is directed to Bidding Requirements, Contracting Requirements, and Division 1 – General Requirements, which are binding in their entirety on this portion of the work and in particular to paragraphs concerning materials, workmanship, and substitutions.

1.1 SCOPE OF WORK

- 1.1.1 Furnish all labor, materials and equipment necessary to complete all walkways, curb and gutter, and related items shown on the Drawings and specified herein.

1.2 REFERENCED SPECIFICATIONS

- 1.2.1 All materials and methods of construction shall conform to the requirements of the S.C. Department of Transportation, Standard Specifications Section 720.

1.3 SUBMITTALS

- 1.3.1 Submit to the ENGINEER shop drawings showing dimensions and layouts of curbing and sidewalks and reinforcement for concrete work.

PART 2 - PRODUCTS

2.1 MATERIALS

2.1.1 Concrete materials:

1. Concrete for work under this section shall be not less than 3000 psi at 28 days.
2. Reinforcing bars shall be deformed type bars conforming to AASHTO M31, Grade 40. All reinforcing steel shall be shop fabricated of size, cross-section and arrangement as described on approved shop drawings.
3. Welded wire fabric shall conform to all requirements of AASHTO M55.
4. Expansion joint material shall be 1/2-inch or 3/4-inch thickness, bituminous type meeting AASHTO Spec, M-213-65.
5. Joint sealant shall be hot poured rubber conforming to Fed. Spec. SS-S-164.

2.1.2 Base course material:

1. Base course material shall be graded aggregate conforming to the Referenced Standard.

PART 3 - EXECUTION

3.1 INSTALLATION

3.1.1 Sub-grade shall be thoroughly compacted as specified in Earthwork Section.

3.1.2 Forms shall conform to the shapes, lines and dimensions of the members as called for on the plans and shall be substantial and sufficiently tight to prevent leakage of mortar. They shall be properly braced or tied together so as to maintain position and shape.

3.1.3 Finishing:

1. Float concrete until 1/4-inch cement gell is brought to surface; steel trowel until Dense surface is obtained.
2. Finish with broom at right angles to alignment of walk, then round all exterior edges with 3/4-inch radius after brooming.

3.1.4 Curing:

1. Cover walks with sand, sawdust or shavings and keep wet for three days.
2. Cover walks and curb & gutter until final clean-up to prevent damage.
3. Other methods of curing may be used subject to approval of the ENGINEER prior to implementation.

3.1.5 Concrete walks shall be constructed to lines, widths, grades and thickness as shown on the Drawings, but sloped not less than 1/8-inch per foot in direction of water flow. Concrete shall be placed on thoroughly compacted subgrade, having smooth surface and kept moist until time concrete is placed.

1. Expansion joints shall be installed at all intersections with other walks, at head and bottom of steps, curbs and maximum 12 foot O.C. in runs. Expansion material shall be 1/2-inch thick but not less than 1/4-inch, by depth of concrete; 3/4-inch thick where abutting curbs and gutters, and at parking bays. Expansion material shall extend from bottom of walk slab to within 1/2-inch of top, to be filled with poured joint filler.
2. Dummy grooves shall be 1/2-inch x 1/2-inch having 1/2-inch radius, spaced the same as the width of the walkway O.C. and installed the same as expansion joints immediately following brooming.

3.1.6 Local conditions, codes and practices shall govern all drive cuts, aprons and related curbs and gutters, CONTRACTOR shall obtain permission for, coordinate with City officials, and secure and pay for all permits, fees and licenses necessary for proper execution of the work.

3.2 CLEAN UP

- 3.2.1 At the completion of the work, CONTRACTOR shall clean up all scraps, rubbish and surplus materials caused by this work and haul them away from the site and leave job in a neat, clean and orderly condition.

END OF SECTION

SECTION 32 1316 - DECORATIVE CONCRETE PAVING

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 colored and textured concrete paving.
- B. Related Sections:
 - 1. Division 03 Section "Cast-in-Place Concrete" for general building applications of concrete.
 - 2. Division 32 Section "Concrete Paving" for typical cast-in-place concrete paving.
 - 3. Division 32 Section "Unit Pavers" for unit pavers.

1.3 DEFINITIONS

- A. Cementitious Materials: Portland cement alone or in combination with one or more of blended hydraulic cement, fly ash and other pozzolans, and ground granulated blast-furnace slag.

1.4 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Samples for Initial Selection: For each type of product, ingredient, or admixture requiring color, pattern, or texture selection.
 - 1. Provide 7" x 9" color samples for Owner/Architect color selection prior to construction of mockup.
- C. Samples for Verification: For each type of exposed color, pattern, or texture indicated.
- D. Oyster Shell Samples: Provide 1-gal. samples of each type of oyster shell for Landscape Architect approval prior to fabrication of mockup.
- E. Other Action Submittals:
 - 1. Design Mixtures: For each decorative concrete paving mixture. Include alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.
- F. Qualification Data: For qualified Installer.
- G. Material Certificates: For the following, from manufacturer:
 - 1. Cementitious materials.

2. Steel reinforcement and reinforcement accessories.
3. Admixtures.
4. Curing compounds.
5. Applied finish materials.
6. Bonding agent or epoxy adhesive.
7. Joint fillers.

H. Material Test Reports: For each of the following:

1. Aggregates. Include service-record data indicating absence of deleterious expansion of concrete due to alkali-aggregate reactivity.

I. Field quality-control reports.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: An employer of workers trained and approved by manufacturer of decorative concrete paving systems.

B. Ready-Mix-Concrete Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C 94/C 94M requirements for production facilities and equipment.

1. Manufacturer certified according to NRMCA's "Certification of Ready Mixed Concrete Production Facilities" (Quality Control Manual - Section 3, "Plant Certification Checklist").

C. Testing Agency Qualifications: Qualified according to ASTM C 1077 and ASTM E 329 for testing indicated.

1. Personnel conducting field tests shall be qualified as ACI Concrete Field Testing Technician, Grade 1, according to ACI CP-1 or an equivalent certification program.

D. Source Limitations: Obtain decorative concrete paving products and each type or class of cementitious material of the same brand from same manufacturer's plant, and obtain each aggregate from single source.

E. Concrete Testing Service: Engage a qualified testing agency to perform material evaluation tests and to design concrete mixtures.

F. ACI Publications: Comply with ACI 301 unless otherwise indicated.

G. Mockups: Cast mockups of full-size sections of each type of decorative concrete pavement to demonstrate typical joints, surface finish, texture, color, and standard of workmanship.

1. Build mockups in the location and of the size as directed by Architect. Mockups shall be provided for Board Form Concrete, Oyster Shell Concrete, Fractured Earth Concrete, Compass Rose, Interactive Fountain, stamped concrete impressions and all other specially finished concrete.
2. Notify Architect seven days in advance of dates and times when mockups will be constructed.
3. Obtain Architect's approval of mockups before starting construction.
4. Maintain approved mockups during construction in an undisturbed condition as a standard for judging the completed pavement.
5. Demolish and remove approved mockups from the site when directed by Architect.

6. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.
- H. Preinstallation Conference: Conduct conference at Project site.
 1. Review methods and procedures related to decorative concrete paving, including but not limited to, the following:
 - a. Concrete mixture design.
 - b. Quality control of concrete materials and decorative concrete paving construction practices.
 2. Require representatives of each entity directly concerned with decorative concrete paving to attend, including the following:
 - a. Contractor's superintendent.
 - b. Independent testing agency responsible for concrete design mixtures.
 - c. Ready-mix concrete manufacturer.
 - d. Decorative concrete paving Installer.
 - e. Manufacturer's representative of decorative concrete paving system.

1.6 PROJECT CONDITIONS

- A. Traffic Control: Maintain access for vehicular and pedestrian traffic as required for other construction activities.

PART 2 - PRODUCTS

2.1 FORMS

- A. Form Materials: Plywood, metal, metal-framed plywood, or other approved panel-type materials to provide full-depth, continuous, straight, and smooth exposed surfaces.
 1. Use flexible or uniformly curved forms for curves of a radius of 100 feet or less.
- B. Forms for Textured Finish Concrete and Stamped Concrete Impressions: Units of face design, size, arrangement, and configuration indicated. Provide solid backing and form supports to ensure stability of textured form liners.
 1. Concrete Impression Stamps: Provide the following or Architect approved comparable:
 - a. Salmon by L.M. Scofield Co.
 - b. Blue Heron Foot by L.M. Scofield Co.
 - c. Starfish (set of 3 varying sizes) by L.M. Scofield Co.
 - d. Mollusk Shell by L.M. Scofield Co.
 - e. Crab by L.M. Scofield Co.
 - f. Palm Frond (large size) by L.M. Scofield Co.
 - g. Raccoon Feet by Matcrete.
 2. Fractured Earth Texture: Embossing skin by L.M. Scofield Co.

- C. Form-Release Agent: Commercially formulated form-release agent that will not bond with, stain, or adversely affect concrete surfaces and that will not impair subsequent treatments of concrete surfaces.

2.2 STEEL REINFORCEMENT

- A. Plain-Steel Welded-Wire Reinforcement: ASTM A 1064/A 1064M, fabricated from as-drawn steel wire into flat sheets.
 - 1. Sizes: 6 x 6 and 10 x 10, as indicated on Drawings.
- B. Deformed-Steel Welded-Wire Reinforcement: ASTM A 1064/A 1064M, flat sheet.
 - 1. Size: 6 x 12, D5 x D3.
- C. Joint Dowel Bars: ASTM A 615/A 615M, Grade 60 plain-steel bars. Cut bars true to length with ends square and free of burrs.
- D. Reinforcing Bars: ASTM A 615/A 615M, Grade 60; deformed.
- E. Tie Bars: ASTM A 615/A 615M, Grade 60, deformed.

2.3 CONCRETE MATERIALS

- A. Cementitious Material: Use the following cementitious materials, of the same type, brand, and source throughout the Project:
 - 1. Ready mixed concrete: ASTM C94, Class A 28-day compressive strength of not less than 3,000 psi and contain not less than 540 pints of cement per cubic yard of concrete.
- B. Normal-Weight Aggregates: ASTM C 33, uniformly graded. Provide aggregates from a single source that has resources to provide materials and products of consistent quality and appearance in physical properties.
- C. Rock Salt: Sodium chloride crystals, kiln dried, coarse gradation with 100 percent passing 3/8-inch sieve and 85 percent retained on a No. 8 sieve.
- D. Oyster Shell for Tabby Finish: No. 2 and 3 size gradations in 50/50 mix, applied at a rate of 1.25 lbs. per square foot.
- E. Water: ASTM C 94/C 94M.
- F. Air-Entraining Admixture: ASTM C 260.
- G. Chemical Admixtures: Provide admixtures certified by manufacturer to be compatible with other admixtures and to contain not more than 0.1 percent water-soluble chloride ions by mass of cementitious material.
- H. Colored Concrete at Board Form Concrete:
 - 1. Basis-of-Design Products:
 - a. Admixture: CHROMIX Admixture by L. M. Scofield Co.; Mesa Beige C-12.

- b. Hardener: LITHOCHROME Color Hardener by L. M. Scofield Co.; Pecan Tan A-55.
 - c. Pattern: Weathered Wood Impression
 - d. Pattern Release: LITHOCHROME Antique Release by L. M. Scofield Co.; Cordovan Brown.
 - 2. Admixture shall be a colored, water-reducing, admixture containing no calcium chloride with coloring agents that are limeproof and ultra-violet resistant.
 - 3. Colored admixture shall conform to the requirements of ACI 303.1, ASTM C979, ASTM C494 and ASSHTO M194.
- I. Colored Concrete at Compass Rose:
 - 1. Basis-of-Design Products:
 - a. Admixture: CHROMIX Admixture by L. M. Scofield Co.; Mesa Beige C-12.
 - b. Stains: Revive Exterior Stains by L. M. Scofield Co.; Platinum Grey A-57 and Shadow Slate C-31, as indicated.
 - 2. Methodology: Entire area is poured in Mesa Beige integrally colored concrete. Concrete must be allowed to fully cure for 28 days. Pattern may then be saw cut into concrete and exterior stains applied.
- J. Fractured Earth Concrete:
 - 1. Basis-of-Design Products:
 - a. Admixture: CHROMIX Admixture by L. M. Scofield Co.; Mesa Beige C-12.
 - b. Pattern Release: LITHOCHROME Antique Release by L. M. Scofield Co.; Cordovan Brown.
 - c. Pattern: Fractured Earth Embossing Skin Texture by L. M. Scofield Co.
- K. Colored Concrete at Interactive Fountain: Provide integral color and finishes as directed by Fountain Designer.

2.4 CURING AND SEALING MATERIALS

- A. Curing Paper: Nonstaining, waterproof paper, consisting of two layers of kraft paper cemented together and reinforced with fiber, and complying with ASTM C 171.
- B. Evaporation Retarder: Waterborne, monomolecular, film forming, manufactured for application to fresh concrete.
- C. Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type I, Class B, manufactured for colored concrete.
- D. Curing and Sealing Compound for Integrally Colored Concrete: Curing compound shall comply with ASTM C309 and be of same manufacturer as colored admixture, for use with integrally colored concrete.
 - 1. Basis-of-Design Product: Cureseal-VOC Matte Finish by L. M. Scofield Co.

2.5 IMPRINTING TOOLS

- A. Stamp Tools: Open-grid aluminum or rigid plastic stamp tool capable of imprinting stamped impressions on plastic concrete. Leave no sharp edges following imprinting.

2.6 RELATED MATERIALS

- A. Joint Fillers: ASTM D 1751, asphalt-saturated cellulosic fiber or ASTM D 1752, cork or self-expanding cork in preformed strips.
- B. Bonding Agent: ASTM C 1059, Type II, non-redisersible, acrylic emulsion or styrene butadiene.
- C. Epoxy Bonding Adhesive: ASTM C 881/C 881M, two-component epoxy resin capable of humid curing and bonding to damp surfaces; of class suitable for application temperature, of grade complying with requirements, and of the following types:
 - 1. Types I and II, non-load bearing, for bonding hardened or freshly mixed concrete to hardened concrete.
- D. Polyethylene Film: ASTM D 4397, 1 mil thick, clear.

2.7 CONCRETE MIXTURES

- A. Prepare design mixtures, proportioned according to ACI 301, for each type and strength of normal-weight concrete, and as determined by either laboratory trial mixtures or field experience.
 - 1. Use a qualified independent testing agency for preparing and reporting proposed concrete design mixtures for the trial batch method.
- B. Proportion mixtures to provide normal-weight concrete with the following properties:
 - 1. Compressive Strength (28 Days): 4000 psi.
 - 2. Maximum Water-Cementitious Materials Ratio at Point of Placement: 0.50.
 - 3. Slump Limit: 4 inches, plus or minus 1 inch.
- C. Add air-entraining admixture at manufacturer's prescribed rate to result in normal-weight concrete at point of placement having an air content as follows:
 - 1. Air Content: 2-1/2 to 4-1/2 percent plus or minus 1.5 percent for 3/4-inch nominal maximum aggregate size
- D. Cementitious Materials: Limit percentage, by weight, of cementitious materials other than portland cement according to ACI 301 requirements for concrete exposed to deicing chemicals.
- E. Chemical Admixtures: Use admixtures according to manufacturer's written instructions.
 - 1. Use water-reducing admixture in concrete as required for placement and workability.
 - 2. Use water-reducing and retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.

2.8 CONCRETE MIXING

- A. Ready-Mixed Concrete: Measure, batch, and mix concrete materials and concrete according to ASTM C 94/C 94M. Furnish batch certificates for each batch discharged and used in the Work.

1. When air temperature is between 85 and 90 deg F, reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F, reduce mixing and delivery time to 60 minutes.
- B. Project-Site Mixing: Measure, batch, and mix concrete materials and concrete according to ASTM C 94/C 94M. Mix concrete materials in appropriate drum-type batch machine mixer.
 1. For concrete batches of 1 cu. yd. or smaller, continue mixing at least 1-1/2 minutes, but not more than 5 minutes after ingredients are in mixer, before any part of batch is released.
 2. For concrete batches larger than 1 cu. yd., increase mixing time by 15 seconds for each additional 1 cu. yd..
 3. Provide batch ticket for each batch discharged and used in the Work, indicating Project identification name and number, date, mixture type, mixing time, quantity, and amount of water added.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine exposed subgrades and subbase surfaces for compliance with requirements for dimensional, grading, and elevation tolerances.
- B. Proof-roll prepared subbase surface below decorative concrete paving to identify soft pockets and areas of excess yielding.
 1. Completely proof-roll subbase in one direction and repeat in perpendicular direction. Limit vehicle speed to 3 mph.
 2. Proof-roll with a pneumatic-tired and loaded, 10-wheel, tandem-axle dump truck weighing not less than 15 tons.
 3. Correct subbase with soft spots and areas of pumping or rutting exceeding depth of 1/2 inch according to requirements in Division 31 Section "Earth Moving."
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Remove loose material from compacted subbase surface immediately before placing concrete.
- B. Protect adjacent construction from discoloration and spillage during application of color hardeners, release agents, curing compounds, and sealers.

3.3 EDGE FORMS AND SCREED CONSTRUCTION

- A. Set, brace, and secure edge forms, bulkheads, and intermediate screed guides to required lines, grades, and elevations. Install forms to allow continuous progress of work and so forms can remain in place at least 24 hours after concrete placement.
- B. Clean forms after each use and coat with form-release agent to ensure separation from concrete without damage.

3.4 STEEL REINFORCEMENT

- A. General: Comply with CRSI's "Manual of Standard Practice" for fabricating, placing, and supporting reinforcement.
- B. Clean reinforcement of loose rust and mill scale, earth, ice, or other bond-reducing materials.
- C. Arrange, space, and securely tie bars and bar supports to hold reinforcement in position during concrete placement. Maintain minimum cover to reinforcement.
- D. Install welded wire reinforcement in lengths as long as practicable. Lap adjoining pieces at least one full mesh, and lace splices with wire. Offset laps of adjoining widths to prevent continuous laps in either direction.
- E. Install fabricated bar mats in lengths as long as practicable. Handle units to keep them flat and free of distortions. Straighten bends, kinks, and other irregularities, or replace units as required before placement. Set mats for a minimum 2-inch overlap to adjacent mats.

3.5 JOINTS

- A. General: Form construction, isolation, and contraction joints and tool edges true to line, with faces perpendicular to surface plane of concrete. Construct transverse joints at right angles to centerline unless otherwise indicated.
 - 1. When joining existing paving, place transverse joints to align with previously placed joints unless otherwise indicated.
- B. Construction Joints: Set construction joints at side and end terminations of paving and at locations where paving operations are stopped for more than one-half hour unless paving terminates at isolation joints.
 - 1. Continue steel reinforcement across construction joints unless otherwise indicated. Do not continue reinforcement through sides of paving strips unless otherwise indicated.
 - 2. Butt Joints: Use bonding agent at joint locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
 - 3. Keyed Joints: Provide preformed keyway-section forms or bulkhead forms with keys unless otherwise indicated. Embed keys at least 1-1/2 inches into concrete.
 - 4. Dowelled Joints: Install dowel bars and support assemblies at joints where indicated. Lubricate or coat with asphalt one-half of dowel length to prevent concrete bonding to one side of joint.
- C. Isolation Joints: Form isolation joints of preformed joint-filler strips abutting concrete curbs, catch basins, manholes, inlets, structures, walks, other fixed objects, and where indicated.
 - 1. Locate expansion joints at intervals of 50 feet unless otherwise indicated.
 - 2. Extend joint fillers full width and depth of joint.
 - 3. Terminate joint filler not less than 1/2 inch or more than 1 inch below finished surface if joint sealant is indicated.
 - 4. Place top of joint filler flush with finished concrete surface if joint sealant is not indicated.
 - 5. Furnish joint fillers in one-piece lengths. Where more than one length is required, lace or clip joint-filler sections together.
 - 6. During concrete placement, protect top edge of joint filler with metal, plastic, or other temporary preformed cap. Remove protective cap after concrete has been placed on both sides of joint.

- D. Contraction Joints: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-fourth of the concrete thickness, as follows:
 - 1. Grooved Joints: Form contraction joints after initial floating by grooving and finishing each edge of joint with grooving tool to a 3/8-inch radius. Repeat grooving of contraction joints after applying surface finishes. Eliminate grooving-tool marks on concrete surfaces.
 - a. Tolerance: Ensure that grooved joints are within 3 inches either way from centers of dowels.
 - 2. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch- wide joints into concrete when cutting action will not tear, abrade, or otherwise damage surface and before developing random contraction cracks.
 - a. Tolerance: Ensure that sawed joints are within 3 inches in both directions from center of dowels.
 - 3. Doweled Contraction Joints: Install dowel bars and support assemblies at joints where indicated. Lubricate or coat with asphalt one-half of dowel length to prevent concrete bonding to one side of joint.
- E. Edging: After initial floating, tool edges of paving, gutters, curbs, and joints in concrete with an edging tool to a 3/8-inch radius. Repeat tooling of edges after applying surface finishes. Eliminate edging tool marks on concrete surfaces.

3.6 CONCRETE PLACEMENT

- A. Before placing concrete, inspect and complete formwork installation, steel reinforcement, and items to be embedded or cast-in.
- B. Remove snow, ice, or frost from subbase surface and steel reinforcement before placing concrete. Do not place concrete on frozen surfaces.
- C. Moisten subbase to provide a uniform dampened condition at time concrete is placed. Do not place concrete around manholes or other structures until they are at required finish elevation and alignment.
- D. Comply with ACI 301 requirements for measuring, mixing, transporting, and placing concrete.
- E. Do not add water to concrete during delivery or at Project site. Do not add water to fresh concrete after testing.
- F. Deposit and spread concrete in a continuous operation between transverse joints. Do not push or drag concrete into place or use vibrators to move concrete into place.
- G. Consolidate concrete according to ACI 301 by mechanical vibrating equipment supplemented by hand spading, rodding, or tamping.
 - 1. Consolidate concrete along face of forms and adjacent to transverse joints with an internal vibrator. Keep vibrator away from joint assemblies, reinforcement, or side forms. Use only square-faced shovels for hand spreading and consolidation. Consolidate with care to prevent dislocating reinforcement and joint devices.

- H. Screed paving surface with a straightedge and strike off.
- I. Commence initial floating using bull floats or darbies to impart an open-textured and uniform surface plane before excess moisture or bleed water appears on the surface. Do not further disturb concrete surfaces before beginning finishing operations or spreading surface treatments.
- J. Cold-Weather Placement: Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing, or low temperatures. Comply with ACI 306.1 and the following:
 - 1. When air temperature has fallen to or is expected to fall below 40 deg F, uniformly heat water and aggregates before mixing to obtain a concrete mixture temperature of not less than 50 deg F and not more than 80 deg F at point of placement.
 - 2. Do not use frozen materials or materials containing ice or snow.
 - 3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in design mixtures.
- K. Hot-Weather Placement: Comply with ACI 301 and as follows when hot-weather conditions exist:
 - 1. Cool ingredients before mixing to maintain concrete temperature below 90 deg F at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated in total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
 - 2. Cover steel reinforcement with water-soaked burlap so steel temperature will not exceed ambient air temperature immediately before embedding in concrete.
 - 3. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade moisture uniform without standing water, soft spots, or dry areas.

3.7 FLOAT FINISHING

- A. General: Do not add water to concrete surfaces during finishing operations.
- B. Float Finish: Begin the second floating operation when bleed-water sheen has disappeared and concrete surface has stiffened sufficiently to permit operations. Float surface with power-driven floats or by hand floating if area is small or inaccessible to power units. Finish surfaces to true planes. Cut down high spots and fill low spots. Refloat surface immediately to uniform granular texture.

3.8 INTEGRALLY COLORED CONCRETE FINISH

- A. Integrally Colored Concrete Finish: After final floating, apply the following finish:
 - 1. Light-to-Fine-Textured Broom Finish: Draw a soft-bristle broom across float-finished concrete surface, perpendicular to line of traffic, to provide a uniform, fine-line texture.

3.9 SPECIAL FINISHES

- A. Tabby Finish: Immediately after floating, broadcast No. 2 and 3 size gradations in 50/50 mix, uniformly onto the concrete surface, at a rate of 1.25 lbs. per sq.ft. Tamp seeded shell into plastic concrete to entirely embed shell with mortar cover of 1/16 inch.
 - 1. Spray-apply chemical surface retarder to concrete according to manufacturer's written instructions.

2. Cover concrete surface with plastic sheeting, sealing laps with tape, and remove when ready to continue finishing operations.
 3. Without dislodging aggregate, remove excess mortar by lightly brushing surface with a stiff, nylon bristle broom.
 4. Fine-spray surface with water and brush. Repeat water flushing and brushing cycle until cement film is removed from aggregate surfaces to depth required.
- B. Rock-Salt Finish: After initial floating, uniformly spread 5 lb/100 sq. ft. rock salt over pavement surface.
1. After placement of rock salt, discard salt which would not properly bond and becomes dislodged during exposing operations.
 2. Embed rock salt into plastic concrete, by patting it with the flat side of a strike-off board or similar tool.
 3. After embedding salt, and when surface is firm enough to support mason on knee boards, hand float with metal trowel or darby and embed all rock salt beneath surface.
 4. Edge with small ½ inch radius edger before and immediately after rock salt has been embedded.
 5. When surface mortar has set up sufficiently, begin to expose rock salt by simultaneously brushing and flushing with water without over-exposing or dislodging salt.
- C. Board Form Finish: Produce a textured surface free of pockets, streaks, and honeycombs, and of uniform appearance, color, and texture. Make wood board imprint to match approved mockup.

3.10 STAMPING CONCRETE IMPRESSIONS

- A. Tool Stamping: While initially finished concrete is plastic, cover surface with polyethylene film, stretch taut to remove wrinkles, lap sides and ends 3 inches, and secure to edge forms. Lightly broom surface to remove air bubbles. Accurately align and place stamp tools and tamp into concrete to produce required imprint pattern and depth of imprint on concrete surface. Remove stamp tools immediately. Unroll and remove polyethylene film immediately after tool stamping.

3.11 CONCRETE PROTECTION AND CURING

- A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures.
- B. Comply with ACI 306.1 for cold-weather protection.
- C. Evaporation Retarder: Apply evaporation retarder to concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete but before float finishing.
- D. Begin curing after finishing concrete but not before free water has disappeared from concrete surface.
- E. Curing and Sealing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Repeat process 24 hours later and apply a second coat. Maintain continuity of coating and repair damage during curing period.
1. Cure integrally colored concrete with a curing compound.

3.12 PAVING TOLERANCES

- A. Comply with tolerances in ACI 117 and as follows:
1. Elevation: 3/4 inch.
 2. Thickness: Plus 3/8 inch, minus 1/4 inch.
 3. Surface: Gap below 10-foot-long, unlevelled straightedge not to exceed 1/2 inch.
 4. Lateral Alignment and Spacing of Dowels: 1 inch.
 5. Vertical Alignment of Dowels: 1/4 inch.
 6. Alignment of Dowel-Bar End Relative to Line Perpendicular to Paving Edge: 1/4 inch per 12 inches of dowel.
 7. Joint Spacing: 3 inches.
 8. Contraction Joint Depth: Plus 1/4 inch, no minus.
 9. Joint Width: Plus 1/8 inch, no minus.

3.13 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
- B. Testing Services: Testing of composite samples of fresh concrete obtained according to ASTM C 172 shall be performed according to the following requirements:
1. Testing Frequency: Obtain at least one composite sample for each 100 cu. yd. or fraction thereof of each concrete mixture placed each day.
 - a. When frequency of testing will provide fewer than five compressive-strength tests for each concrete mixture, testing shall be conducted from at least five randomly selected batches or from each batch if fewer than five are used.
 2. Slump: ASTM C 143/C 143M; one test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mixture. Perform additional tests when concrete consistency appears to change.
 3. Air Content: ASTM C 231, pressure method; one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
 4. Concrete Temperature: ASTM C 1064/C 1064M; one test hourly when air temperature is 40 deg F and below and when it is 80 deg F and above, and one test for each composite sample.
 5. Compression Test Specimens: ASTM C 31/C 31M; cast and laboratory cure one set of three standard cylinder specimens for each composite sample.
 6. Compressive-Strength Tests: ASTM C 39/C 39M; test one specimen at seven days and two specimens at 28 days.
 - a. A compressive-strength test shall be the average compressive strength from two specimens obtained from same composite sample and tested at 28 days.
- C. Strength of each concrete mixture will be satisfactory if average of any three consecutive compressive-strength tests equals or exceeds specified compressive strength and no compressive-strength test value falls below specified compressive strength by more than 500 psi.
- D. Test results shall be reported in writing to Architect, concrete manufacturer, and Contractor within 48 hours of testing. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work, design compressive strength at 28 days,

concrete mixture proportions and materials, compressive breaking strength, and type of break for both 7- and 28-day tests.

- E. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Architect but will not be used as sole basis for approval or rejection of concrete.
- F. Additional Tests: Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Architect.
- G. Decorative concrete paving will be considered defective if it does not pass tests and inspections.
- H. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
- I. Prepare test and inspection reports.

3.14 REPAIRS AND PROTECTION

- A. Remove and replace decorative concrete paving that is broken or damaged or does not comply with requirements in this Section. Remove work in complete sections from joint to joint unless otherwise approved by Architect. Color and finish of replacement pavement shall match surrounding/adjacent pavement color and finish.
- B. Detailing: Grind concrete "squeeze" left from tool placement. Color ground areas with slurry of color hardener mixed with water and bonding agent. Remove excess release agent with high-velocity blower.
- C. Protect decorative concrete paving from damage. Exclude traffic from paving for at least 14 days after placement. When construction traffic is permitted, maintain paving as clean as possible by removing surface stains and spillage of materials as they occur.
- D. Maintain decorative concrete paving free of stains, discoloration, dirt, and other foreign material. Sweep paving not more than two days before date scheduled for Substantial Completion inspections.

END OF SECTION 32 1316

SECTION 32 1400 - UNIT PAVING

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. See alternates

1.2 SUMMARY

- A. Section Includes:
 - 1. Brick pavers set in mortar setting beds over aggregate base with mortared joints.

1.3 PRECONSTRUCTION TESTING

- A. Preconstruction Adhesion and Compatibility Testing: Submit to latex-additive manufacturer, for testing as indicated below, samples of paving materials that will contact or affect mortar and grout that contain latex additives.
 - 1. Use manufacturer's standard test methods to determine whether mortar and grout materials will obtain optimum adhesion with, and will be non-staining to, installed pavers and other materials constituting paver installation.

1.4 ACTION SUBMITTALS

- A. Product Data: For materials other than water and aggregates.
- B. Samples for Initial Selection: For the following:
 - 1. Each type of unit paver indicated.
 - 2. Joint materials involving color selection.
 - 3. Exposed edge restraints involving color selection.

1.5 QUALITY ASSURANCE

- A. Mockups: Build mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
 - 1. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.
- B. Preinstallation Conference: Conduct conference at Project site.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Store pavers 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.

1.7 PROJECT CONDITIONS

- A. Cold-Weather Protection: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen subgrade or setting beds. Remove and replace unit paver work damaged by frost or freezing.
- B. Weather Limitations for Mortar and Grout:
 - 1. Cold-Weather Requirements: Comply with cold-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602.
 - 2. Hot-Weather Requirements: Comply with hot-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602. Provide artificial shade and windbreaks and use cooled materials as required. Do not apply mortar to substrates with temperatures of 100 deg F and higher.
 - a. When ambient temperature exceeds 100 deg F, or when wind velocity exceeds 8 mph and ambient temperature exceeds 90 deg F, set pavers within 1 minute of spreading setting-bed mortar.

PART 2 - PRODUCTS

2.1 BRICK PAVERS

- A. Brick Pavers : To be selected. Use allowance amount provided.

2.2 CURBS AND EDGE RESTRAINTS

- A. Steel Edge Restraints: Manufacturer's standard painted steel edging 1/4 inch thick by 5 inches high with loops pressed from or welded to face to receive stakes at 36 inches o.c., and steel stakes 15 inches long for each loop.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following or prior approved equal:
 - a. Border Concepts, Inc.
 - b. Collier Metal Specialties, Inc.
 - c. J. D. Russell Company (The).
 - d. Sure-loc Edging Corporation.
 - 2. Color: As selected by Architect from manufacturer's full range.

2.3 ACCESSORIES

- A. Compressible Foam Filler: Preformed strips complying with ASTM D 1056, Grade 2A1.

2.4 MORTAR SETTING-BED MATERIALS

- A. Portland Cement: ASTM C 150, Type I or Type II.
- B. Hydrated Lime: ASTM C 207, Type S.
- C. Sand: ASTM C 144.
- D. Latex Additive: Manufacturer's standard water emulsion, serving as replacement for part or all of gaging water, of type specifically recommended by latex-additive manufacturer for use with field-mixed portland cement and aggregate mortar bed, and not containing a retarder.
- E. Water: Potable.
- F. Water: Potable.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas indicated to receive paving, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance.
- B. Proceed with installation only after unsatisfactory conditions have been corrected and waterproofing protection is in place.

3.2 PREPARATION

- A. Proof-roll prepared subgrade according to requirements to identify soft pockets and areas of excess yielding. Proceed with unit paver installation only after deficient subgrades have been corrected and are ready to receive base course for unit pavers.

3.3 INSTALLATION, GENERAL

- A. Do not use unit pavers with chips, cracks, voids, discolorations, or other defects that might be visible or cause staining in finished work.
- B. Mix pavers from several pallets or cubes, as they are placed, to produce uniform blend of colors and textures.
- C. Cut unit pavers with motor-driven masonry saw equipment to provide clean, sharp, unchipped edges. Cut units to provide pattern indicated and to fit adjoining work neatly. Use full units without cutting where possible. Hammer cutting is not acceptable.

- D. Joint Pattern: Running bond
- E. Tolerances: Do not exceed 1/32-inch unit-to-unit offset from flush (lippage) nor 1/8 inch in 10 feet from level, or indicated slope, for finished surface of paving.
- F. Expansion and Control Joints: Provide for sealant-filled joints at locations and of widths indicated. Provide compressible foam filler as backing for sealant-filled joints[unless otherwise indicated; where unfilled joints are indicated, provide temporary filler until paver installation is complete]. Install joint filler before setting pavers. Sealant materials and installation are specified in Division 07 Section "Joint Sealants."
- G. Expansion and Control Joints: Provide cork joint filler at locations and of widths indicated. Install joint filler before setting pavers. Make top of joint filler flush with top of pavers.
- H. Provide edge restraints as indicated. Install edge restraints before placing unit pavers.
 - 1. For metal edge restraints with top edge exposed, drive stakes at least 1 inch below top edge.
 - 2. Where pavers set in mortar bed are indicated as edge restraints for pavers set in aggregate setting bed, install pavers set in mortar and allow mortar to cure before placing aggregate setting bed and remainder of pavers. Cut off mortar bed at a steep angle so it will not interfere with aggregate setting bed.

3.4. AGGREGATE BASE APPLICATIONS

- 1. Compact soil subgrade uniformly to at least [95] <Insert number> percent of [ASTM D 698] [ASTM D 1557] laboratory density.
- 2. Proof-roll prepared subgrade to identify soft pockets and areas of excess yielding. Excavate soft spots, unsatisfactory soils, and areas of excessive pumping or rutting, as determined by Architect, and replace with compacted backfill or fill as directed.
- 3. Place separation geotextile over prepared subgrade, overlapping ends and edges at least 12 inches (300 mm).
- 4. Place aggregate[subbase and] base, compact by tamping with plate vibrator, and screed to depth indicated.

3.5 MORTAR SETTING-BED APPLICATIONS

- a. Mix and place only that amount of mortar bed that can be covered with pavers before initial set. Before placing pavers, cut back, bevel edge, and remove and discard setting-bed material that has reached initial set.
- b. Wet brick pavers before laying if the initial rate of absorption exceeds 30 g/30 sq. in. per minute when tested according to ASTM C 67. Allow units to absorb water so they are damp but not wet at time of laying.

3.4 REPAIRING, POINTING, AND CLEANING

- A. Remove and replace unit pavers that are loose, chipped, broken, stained, or otherwise damaged or that do not match adjoining units. Provide new units to match adjoining units and install in same manner as original units, with same joint treatment and with no evidence of replacement.
- B. Pointing: During tooling of joints, enlarge voids or holes and completely fill with grout. Point joints at sealant joints to provide a neat, uniform appearance, properly prepared for sealant application.
- C. Cleaning: Remove excess grout from exposed paver surfaces; wash and scrub clean.
 - 1. Remove temporary protective coating as recommended by coating manufacturer and as acceptable to paver and grout manufacturers.
 - 2. Do not allow protective coating to enter floor drains. Trap, collect, and remove coating material.

END OF SECTION 32 1400

SECTION 322000 - ALUMINUM FENCES AND GATES

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Ornamental Fencing.
- B. Gates and Related Hardware.

1.2 RELATED SECTIONS

- A. Division 8 – Door Hardware

1.3 REFERENCES

- A. ASTM B 221 – Specification for Aluminum Alloy Extruded Bars, Rods, Wire Shapes and Tubes.
- B. AAMA 2604 – Voluntary Specification, Performance Requirements and Test Procedures for Pigmented Organic Coatings on Aluminum Extrusions and Panels

1.4 SUBMITTALS

- A. Submit under provisions of Division 01.
- B. Manufacturer's data sheets on each product to be used, including:
 - 1. Preparation instructions and recommendations.
 - 2. Storage and handling requirements and recommendations.
 - 3. Installation methods.
- C. Shop Drawings: Indicate plan layout, spacing of components, post foundation dimensions, hardware anchorage, gates, and schedule of components.
- D. Verification Samples: For each finish product specified, two samples, minimum size 6 inches (150 mm) square representing actual product, color, and patterns.

1.5 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing Products specified in this section with minimum five years documented experience.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Transport, handle, store, and protect products so that they are in undamaged condition when installed.
- B. Store products in manufacturer's unopened packaging to protect prefinished aluminum surfaces until ready for installation.
- C. Store components off the ground in a dry covered area, protected from adverse weather conditions.

1.7 PROJECT CONDITIONS

- A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.

1.8 WARRANTY

- A. Manufacturer's Warranty:
 - 1. Provide manufacturer's 20 year warranty against defects in workmanship. The manufacturer also warrants that the powder coat finish will not chip crack or flake.

PART 2 PRODUCTS

2.1 SOURCES

- A. Sources:
 - 1. Brabham Fence Company – Heyward Brabham, 803.929.1218.
 - 2. Southeastern Architectural Sales – Mac Winget, 704.896.5805
- B. Requests for substitutions will be considered with prior approval request and in accordance with provisions of Division 01.

2.2 MATERIALS

- A. Components:
 - 1. Posts: Aluminum extrusions of 6005-T5 alloy in accordance with ASTM B 221.
 - 2. Pickets: Aluminum extrusions of 6063-T52 alloy in accordance with ASTM B 221.
 - 3. Channel: Aluminum extrusions of 6005-T5 alloy in accordance with ASTM B 221.
- B. Fasteners:
 - 1. Screws of 410 and 18-8 stainless steel conforming to ASTM A276, with self-drilling head.
 - 2. Screws painted to match the finish of fence.
- C. Accessories:
 - 1. Post caps, wall brackets, flanges and other miscellaneous hardware fabricated of aluminum or other non-ferrous metal castings.
- D. Concrete: ASTM C94/C94M, Option A; Portland Cement, minimum 2,500 psi (17 MPa) strength at 28 days.

2.3 ORNAMENTAL FENCING

- A. Ornamental Fencing: As indicated on the Drawings:
 - 1. Post: 2-inches square.
 - 2. Picket: ¾-inch square
 - 3. Rail: 1 ½-inch channel
- B. Ornamental Gate: As shown on the Drawings.
 - 1. Same material as fence.
 - 2. Weld gate connections as necessary to provide stable gate for use.
 - 3. Provide metal flat panel as indicated with powder coat finish to match fence.

4. Hardware: Coordinate with Finish Hardware provided in Division 08.

2.4 FINISH

- A. Fence and Accessory Finish:
 1. High performance polyester powder coating, medium gloss, applied to 3-4 mils thickness and complying with AAMA 2604.
- B. Color: chosen from standard color selection
- C. Performance:
 1. Meet or exceed a 4000 hour salt spray test.
 2. Polyester Powder Coating meets or exceeds a H-4H pencil hardness in accordance to ASTM D 3363.

2.5 FABRICATION

- A. Stringers, (horizontal rails) shall be punched to allow pickets to pass through the top of the rail.
- B. Pickets shall be fastened to stringers mechanically with stainless steel screws on one side of the stringer only.
- C. Posts shall be pre-punched to allow the stringers to slide in and be attached with stainless steel TEK. Cast aluminum post caps shall be affixed to all posts.
- D. Gates shall be fabricated using the same components as for the complete fencing system and as shown on the Drawings.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Do not begin installation until substrates and precast topped masonry wall have been properly prepared.
- B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.2 PREPARATION

- A. Clean surfaces thoroughly prior to installation.
- B. Prepare the grade and remove surface irregularities, if any, which may cause interference with the installation of aluminum fence.
- C. If preparation and condition is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.
- D. Verify that masonry wall and precast is set, cleaned and ready for fencing on top.

3.3 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Excavate holes for posts to diameter and spacing indicated on Drawings without disturbing underlying materials.
- C. Provide excavation for post length to suit local conditions for proper anchorage and

stability.

- D. Center and align posts in excavated holes to required depth. Place concrete around posts, and vibrate or tamp for consolidation. Re-check vertical and top alignment of posts, verify they are plumb and level. Make necessary corrections if needed before concrete hardens.
- E. For posts set in masonry wall, coordinate with mason.
- F. Insert notched stringers into pre-punched posts and fasten with stainless steel TEK screws.
- G. Support gates from gate posts.
- H. Provide concrete center drop for drop rod retainers at center of double gate openings.
- I. Install gates plumb, level and secure for full opening without interference. For double gates, install drop rod. Adjust all hardware for smooth operation.

3.4 ERECTION TOLERANCES

- A. Maximum Variation From Plumb: 1/4 inch.

3.5 CLEANING

- A. Leave immediate work area neat at end of each work day.
- B. Clean jobsite of excess materials; scatter excess material from post hole excavations uniformly away from posts. Remove excess material if required.
- C. Clean aluminum fence with mild household detergent and clean water rinse well. Mortar should be removed from exposed posts and other fencing material using a 10% solution of muriatic acid followed immediately by several rinses with clean water.
- D. Touch up scratched surfaces using materials recommended by manufacturer. Match touchup paint color to fence finish.

3.6 PROTECTION

- A. Protect installed products until completion of project.
- B. Touch-up, repair or replace damaged products before Substantial Completion.

END OF SECTION 32 2000

SECTION 323113 - CHAIN LINK FENCES AND GATES

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. Chain-link fences.
- 2. Gates: Motor operated horizontal slide.

- B. Related Sections:

- 1. Section 033000 "Cast-in-Place Concrete" for cast-in-place concrete post footings.

1.3 PERFORMANCE REQUIREMENTS

- A. Structural Performance: Chain-link fence and gate framework shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated according to ASCE/SEI 7:

- 1. Minimum Post Size and Maximum Spacing: Determine according to CLFMI WLG 2445, based on mesh size and pattern specified and on the following:
 - a. Fence Height: 6 feet.
 - b. Material Group: IA, ASTM F 1043, Schedule 40 steel pipe

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated. [Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for chain-link fences and gates.]

- 1. Fence and gate posts, rails, and fittings.
- 2. Chain-link fabric, reinforcements, and attachments.
- 3. Accessories: Barbed wire.
- 4. Gates and hardware.
- 5. Gate operators, including operating instructions.

6. Motors: Show nameplate data, ratings, characteristics, and mounting arrangements.
- B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work. Show accessories, hardware, gate operation, and operational clearances.
1. Gate Operator: Show locations and details for installing operator components, switches, and controls. Indicate motor size, electrical characteristics, drive arrangement, mounting, and grounding provisions.
 2. Wiring Diagrams: For power, signal, and control wiring.

1.5 INFORMATIONAL SUBMITTALS

- A. Product Certificates: For each type of chain-link fence, operator, and gate, from manufacturer.
- B. Warranty: Sample of special warranty.

1.6 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For the following to include in emergency, operation, and maintenance manuals:
1. Gate operator.

1.7 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. Preinstallation Conference: Conduct conference at [Project site] <Insert location>.
1. Inspect and discuss electrical roughing-in, equipment bases, and other preparatory work specified elsewhere.
 2. Review sequence of operation for each type of gate operator.
 3. Review coordination of interlocked equipment specified in this Section and elsewhere.

1.8 PROJECT CONDITIONS

- A. Field Measurements: Verify layout information for chain-link fences and gates shown on Drawings in relation to property survey and existing structures. Verify dimensions by field measurements.

1.9 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which [manufacturer] [Installer] agrees to repair or replace components of chain-link fences and gates that fail in materials or workmanship within specified warranty period.
1. Failures include, but are not limited to, the following:
 - a. Faulty operation of gate operators and controls.
 - b. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
 2. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 CHAIN-LINK FENCE FABRIC

- A. General: Provide fabric in one-piece heights measured between top and bottom of outer edge of selvage knuckle or twist. Comply with CLFMI Product Manual and with requirements indicated below:
1. Fabric Height: 6 ft..
 2. Steel Wire Fabric: Wire with a diameter of [0.192 inch] [0.148 inch] [0.120 inch] [0.113 inch] <Insert dimension>.
 - a. Mesh Size: 2 inches.
 - b. Zinc-Coated Fabric: ASTM A 392, Type II, Class 1, 1.2 oz./sq. ft. with zinc coating applied before/after weaving.

2.2 FENCE FRAMING

- A. Posts and Rails: Comply with ASTM F 1043 for framing, including rails, braces, and line; terminal; and corner posts. Provide members with minimum dimensions and wall thickness according to ASTM F 1043 [or ASTM F 1083] based on the following:
1. Fence Height: 72 inches/96 inches.
 2. Light Industrial Strength: Material Group IC-L, round steel pipe, electric-resistance-welded pipe.
 - a. Line Post: 2.875 inches in diameter.
 - b. End, Corner and Pull Post: 4.0 inches .
 3. Horizontal Framework Members: top rails complying with ASTM F 1043.
 - a. Top Rail: 1.66 inches in diameter.

4. Metallic Coating for Steel Framing:
 - a. Type A, consisting of not less than minimum 2.0-oz./sq. ft. average zinc coating per ASTM A 123/A 123M or 4.0-oz./sq. ft. zinc coating per ASTM A 653/A 653M.
 - a.

2.3

1. .

2.4 HORIZONTAL-SLIDE GATES

- A. General: Comply with ASTM F 1184 for gate posts and single sliding gate types. Provide automated vehicular gates that comply with ASTM F 2200.
 1. Classification: Type II Cantilever Slide, [Class 1 with external] [Class 2 with internal] roller assemblies.
- B. Pipe and Tubing:
 1. Zinc-Coated Steel: Protective coating and finish to match fence framing] [Manufacturer's standard protective coating and finish <Insert finish>.
 2. Gate Posts: Comply with ASTM F 1184. Provide round tubular steel posts.
- C. Frame Corner Construction: Welded or assembled with corner fittings.
- D. Extended Gate Posts and Frame Members: Extend gate posts and frame end members above top of chain-link fabric at both ends of gate frame 12 inches as indicated as required to attach barbed wire assemblies.
- E. Hardware:
 1. Latches permitting operation from both sides of gate with provision for padlocking accessible from both sides of gate.

2.5 FITTINGS

- A. General: Comply with ASTM F 626.
- B. Post Caps: Provide for each post.
- C. Barbed Wire Arms: Pressed steel or cast iron, with clips, slots, or other means for attaching strands of barbed wire, and means for attaching to posts; for each post unless otherwise indicated, and as follows:

1. Provide line posts with arms that accommodate top rail or tension wire.
2. Provide corner arms at fence corner posts, unless extended posts are indicated.
3. Type I, single slanted arm.
4. Type II, single vertical arm.

2.6 BARBED WIRE

- A. Steel Barbed Wire: Comply with ASTM A 121, for two-strand barbed wire, 0.099-inch-diameter line wire with 0.080-inch-diameter, four-point round barbs spaced not more than 5 inches o.c.
1. Zinc Coating: Type Z, Class 3.

2.7 GATE OPERATORS

- A. General: Provide factory-assembled automatic operating system designed for gate size, type, weight, and operation frequency. Provide operation control system with characteristics suitable for Project conditions, with remote-control stations, safety devices, and weatherproof enclosures; coordinate electrical requirements with building electrical system.
1. Provide operator designed so motor may be removed without disturbing limit-switch adjustment and without affecting auxiliary emergency operator.
 2. Provide operator with UL [approval] [-approved components].
 3. Provide electronic components with built-in troubleshooting diagnostic feature.
 4. Provide unit designed and wired for both right-hand/left-hand opening, permitting universal installation.
- B. Comply with NFPA 70.
- C. UL Standard: Fabricate and label gate operators to comply with UL 325.
- D. Motor Characteristics: Sufficient to start, accelerate, and operate connected loads at designated speeds, within installed environment, with indicated operating sequence, and without exceeding nameplate rating or considering service factor. Comply with NEMA MG 1 and the following:
1. Voltage: NEMA standard voltage selected to operate on nominal circuit voltage to which motor is connected.
- E. Gate Operators: Pedestal postmounted and as follows:
1. Mechanical Slide Gate Operators:
 - a. Duty: Medium duty, commercial/industrial.
 - b. Gate Speed: Minimum 45 feet per minute
 - c. Maximum Gate Weight: [600 lb]>.
 - d. Frequency of Use: 10 cycles per hour

- e. Operating Type: Roller chain with manual release.
- F. Remote Controls: Electric controls separated from gate and motor and drive mechanism, with NEMA ICS 6, Type 1 enclosure for pedestal mounting and with space for additional optional equipment. Provide the following remote-control device(s):
 - 1. Control Station: Provided by Owner's separate vendor..
 - 2.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and conditions, with Installer present, for compliance with requirements for site clearing, earthwork, pavement work, and other conditions affecting performance of the Work.
 - 1. Do not begin installation before final grading is completed unless otherwise permitted by Architect.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Stake locations of fence lines, gates, and terminal posts. Do not exceed intervals of 500 feet or line of sight between stakes. Indicate locations of utilities, lawn sprinkler system, underground structures, benchmarks, and property monuments.

3.3 INSTALLATION, GENERAL

- A. Install chain-link fencing to comply with ASTM F 567 and more stringent requirements indicated.
 - 1. Install fencing on established boundary lines inside property line.

3.4 CHAIN-LINK FENCE INSTALLATION

- A. Post Excavation: Drill or hand-excavate holes for posts to diameters and spacings indicated, in firm, undisturbed soil.
- B. Post Setting: Set Post in concrete: Set posts at indicated spacing into firm, undisturbed soil.
 - 1. Verify that posts are set plumb, aligned, and at correct height and spacing, and hold in position during setting with concrete or mechanical devices.

2. Concrete Fill: Place concrete around posts to dimensions indicated and vibrate or tamp for consolidation. Protect aboveground portion of posts from concrete splatter.
 - a. Exposed Concrete: Extend 2 inches above grade; shape and smooth to shed water.
 - b. Posts Set into Concrete in Sleeves: Use steel pipe sleeves preset and anchored into concrete for installing posts. After posts have been inserted into sleeves, fill annular space between post and sleeve with nonshrink, nonmetallic grout, mixed and placed to comply with anchoring material manufacturer's written instructions, and finished sloped to drain water away from post.

- C. Terminal Posts: Locate terminal end, corner, and gate posts per ASTM F 567 and terminal pull posts at changes in horizontal or vertical alignment of as indicated on drawings

- D. Line Posts: Space line posts uniformly

- E. Post Bracing and Intermediate Rails: Install according to ASTM F 567, maintaining plumb position and alignment of fencing. Diagonally brace terminal posts to adjacent line posts with truss rods and turnbuckles. Install braces at end and gate posts and at both sides of corner and pull posts.
 1. Locate horizontal braces at midheight of fabric 72 inches or higher, on fences with top rail and at two-third fabric height on fences without top rail. Install so posts are plumb when diagonal rod is under proper tension.

- F. Top Rail: Install according to ASTM F 567, maintaining plumb position and alignment of fencing. Run rail continuously through line post caps, bending to radius for curved runs and terminating into rail end attached to posts or post caps fabricated to receive rail at terminal posts. Provide expansion couplings as recommended in writing by fencing manufacturer.

- G. Chain-Link Fabric: Apply fabric to **outside** of enclosing framework. Leave 1 inch between finish grade or surface and bottom selvage unless otherwise indicated. Pull fabric taut and tie to posts, rails, and tension wires. Anchor to framework so fabric remains under tension after pulling force is released.

- H. Tie Wires: Use wire of proper length to firmly secure fabric to line posts and rails. Attach wire at one end to chain-link fabric, wrap wire around post a minimum of 180 degrees, and attach other end to chain-link fabric per ASTM F 626. Bend ends of wire to minimize hazard to individuals and clothing.
 1. Maximum Spacing: Tie fabric to line posts at 12 inches o.c. and to braces at 24 inches o.c.

- I. Fasteners: Install nuts for tension bands and carriage bolts on the side of the fence opposite the fabric side.

- J. Barbed Wire: Install barbed wire uniformly spaced , angled toward security side of fence. Pull wire taut, install securely to extension arms, and secure to end post or terminal arms.

3.5 GATE INSTALLATION

- A. Install gates according to manufacturer's written instructions, level, plumb, and secure for full opening without interference. Attach fabric as for fencing. Attach hardware using tamper-resistant or concealed means. Install ground-set items in concrete for anchorage. Adjust hardware for smooth operation and lubricate where necessary.

3.6 GATE OPERATOR INSTALLATION

- A. General: Install gate operators according to manufacturer's written instructions, aligned and true to fence line and grade.

3.7 ADJUSTING

- A. Gates: Adjust gates to operate smoothly, easily, and quietly, free of binding, warp, excessive deflection, distortion, nonalignment, misplacement, disruption, or malfunction, throughout entire operational range. Confirm that latches and locks engage accurately and securely without forcing or binding.
- B. Lubricate hardware, gate operator, and other moving parts.

3.8 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's personnel to adjust, operate, and maintain chain-link fences and gates.

END OF SECTION 323113

SECTION 33 0500 - TRENCHING, BEDDING & BACKFILL FOR PIPE

1.0 GENERAL

RELATED DOCUMENTS: Attention is directed to Bidding Requirements, Contracting Requirements, and Division 1 – General Requirements, which are binding in their entirety on this portion of the work and in particular to paragraphs concerning materials, workmanship, and substitutions.

1.1 SCOPE OF WORK

1.1.1 The CONTRACTOR shall furnish all labor, materials, equipment, and incidentals necessary to perform all excavation, backfill, fill, grading and slope protection required to complete the piping work shown on the Drawings and specified herein. The work shall include, but not necessarily be limited to: manholes, vaults, duct conduit, pipe, and roadways and paving; all backfilling, fill and required borrow; grading; disposal of surplus and unsuitable materials; and all related work such as sheeting, bracing, and water handling.

1.2 RELATED WORK

1.2.1 Section 31 1000: Site Preparation.

1.2.2 Section 31 2000: Structural Excavation, Backfill and Compaction.

1.3 TRENCH PROTECTION

1.3.1 The CONTRACTOR shall construct and maintain sheeting and bracing as required to support the sides of excavations, to prevent any movement which could in any way diminish the width of the excavation below that necessary for proper construction, and to protect adjacent structures, existing piping and/or foundation material from disturbance, undermining, or other damage. Care shall be taken to prevent voids outside of the sheeting, but if voids are formed they shall be immediately filled and rammed.

1.3.2 For pipe trench sheeting, no sheeting is to be withdrawn if driven below mid-diameter of any pipe, and no wood sheeting shall be cut off at a level lower than 1 foot above the top of any pipe unless otherwise directed by the ENGINEER. If during the progress of the work the ENGINEER decides that additional wood sheeting should be left in place, he may direct the CONTRACTOR in writing. If steel sheeting is used for trench sheeting, removal shall be as specified above, unless written approval is given by the ENGINEER for an alternate method of removal.

1.3.3 All sheeting and bracing not left in place shall be carefully removed in such a manner as not to endanger the construction or other structures, utilities, existing piping, or property. All voids left or caused by withdrawal of sheeting shall be immediately refilled with sand by ramming with tools especially adapted to that purpose, by watering or otherwise as may be directed.

1.3.4 The right of the ENGINEER to order sheeting and bracing left in place shall not be construed as creating any obligation on his part to issue such orders, and his failure to exercise his right to do so shall not relieve the CONTRACTOR from liability for damages to persons or property occurring from or upon the work occasioned by

negligence or otherwise, growing out of a failure on the part of the CONTRACTOR to leave in place sufficient sheeting and bracing to prevent any caving or moving of the ground.

1.4 JOB CONDITIONS

1.4.1 The CONTRACTOR shall examine the site taking into consideration all conditions that may affect his work. The OWNER and ENGINEER will not assume responsibility for sub-soil quality or conditions.

1.4.2 Existing Utilities: Locate existing underground utilities in the areas of work. If utilities are to remain in place, provide adequate means of protection during earthwork operations.

1. Should uncharted, or incorrectly charted, piping or other utilities be encountered during excavation, consult the ENGINEER and the OWNER of such piping or utility immediately for directions.
2. Cooperate with OWNER and utility companies in keeping respective services and facilities in operation. Repair damaged utilities to satisfaction of utility OWNER.
3. Demolish and completely remove from site existing underground utilities indicated on the Drawings to be removed.

1.4.3 Protection of Persons and Property: Barricade open excavations occurring as part of this work and post with warning lights. Operate warning lights as recommended by authorities having Jurisdiction. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout and other hazards created by earthwork operations.

1.5 SUBMITTALS

1.5.1 The CONTRACTOR shall furnish the ENGINEER, for approval, a representative sample of fill material obtained from onsite sources weighing approximately 50 pounds, at least ten calendar days prior to the date of anticipated use of such material.

1.5.2 For each material obtained from other than onsite sources, the CONTRACTOR shall notify the ENGINEER of the source of the material and shall furnish the ENGINEER, for approval, a representative sample weighing approximately 50 pounds, at least ten calendar days prior to the date of anticipated use of such material.

PART 2 - PRODUCTS

2.1 MATERIALS

2.1.1 General: Materials for use as base, fill and backfill shall be as described below:

1. Satisfactory soil materials are defined as those complying with American Association of State Highway and Transportation Officials (AASHTO) M-145, soil classification Groups A-1, A-2-4, A-2-5 and A-3.
2. Unsatisfactory soil materials are those defined in AASHTO M-145 soil classification Groups A-2-6, A-2-7, A-4, A-5, A-6, and A-7 along with peat and other highly organic soils.

2.1.2 Structural Fill: Structural fill material shall be satisfactory soil material consisting of a minimum of 60 percent clean medium to fine grain sized quartz sand, free of organic, deleterious and/or compressible material. Rock in excess of 2-1/2 inches in diameter shall not be used in the fill material. Structural fill shall not contain hardpan, stones, rocks, cobbles or other similar materials.

2.1.3 Common Fill:

1. Common fill material shall be satisfactory soil material containing no more than 20 percent by weight finer than No. 200 mesh sieve. It shall be free from organic matter, muck, marl, and rock exceeding 2-1/2 inches in diameter. Common fill shall not contain broken concrete, masonry, rubble or other similar materials.
2. Material falling within the above specification, encountered during the excavation, may be stored in segregated stockpiles for reuse. All material which, in the opinion of the ENGINEER, is not suitable for reuse shall be spoiled as specified herein for disposal of unsuitable materials.

2.1.4 Bedding Rock: Bedding rock shall be 3/8" to 3/4" washed and graded limerock. This rock shall be graded so that 99% will pass a 3/4" screen and 80% will be retained on a No. 8 screen.

PART 3 - EXECUTION

3.1 GENERAL

- 3.1.1 All excavation, backfill and grading necessary to complete the work shall be made by the CONTRACTOR and the cost thereof shall be included in the contract price.
- 3.1.2 Material shall be furnished as required from off site sources and hauled to the site.
- 3.1.3 The CONTRACTOR shall take all the necessary precautions to maintain the work area in a safe and workable condition.
- 3.1.4 The CONTRACTOR shall protect his work at all times by flagging, marking, lighting and barricading. It shall also be the CONTRACTOR's responsibility to preserve and protect all above and underground structures, pipe lines, conduits, cables, drains or utilities which are existing at the time he encounters them. Failure of the Drawings to show the existence of these obstructions shall not relieve the CONTRACTOR from this responsibility. The cost of repair of any damage which occurs to these obstructions during or as a result of construction shall be borne by the CONTRACTOR without additional cost to the OWNER.

3.2 TRENCH EXCAVATION

- 3.2.1 Excavation for all trenches required for the installation of pipes and electrical ducts shall be made to the depths indicated on the Drawings. Excavate trench to provide a minimum of 30-inch clear cover over the pipe bell unless otherwise noted on the Drawings. Excavate in such manner and to such widths as will give suitable room for laying the pipe or installing the ducts within the trenches, for bracing and supporting and for pumping and drainage facilities. The trench width at the top of the pipe shall

not exceed the allowable as determined by the depth of cut and indicated on the Drawings.

- 3.2.2 Rock shall be removed to a minimum eight inches clearance around the bottom and sides of all the pipe or ducts being laid.
- 3.2.3 Where pipe or ducts are to be laid in limerock bedding or encased in concrete the trench may be excavated by machinery to or just below the designated subgrade provided that the material remaining in the bottom of the trench is no more than slightly disturbed.
- 3.2.4 Where the pipe or ducts are to be laid directly on the trench bottom the lower part of the trenches shall not be excavated to the trench bottom by machinery. The last of the material being excavated shall be done manually in such a manner that will give a flat bottom true to grade so that pipe or duct can be evenly and uniformly supported along its entire length on undisturbed material or bedding rock. Bell holes shall be made as required manually so that there is no bearing surface on the bells and pipes are supported along the barrel only.
- 3.2.5 The bottom of the excavations shall be firm and dry and in all respects acceptable to the ENGINEER. Excavate any organic soil material from the bottom of the trench and replace with rock bedding, at least six inches thick.

3.3 PIPE INTERFERENCES AND ENCASEMENT

- 3.3.1 The CONTRACTOR shall abide by the following schedule of criteria concerning interferences with other utilities:
1. In no case shall there be less than 0.3 feet between any two pipe lines or between pipe lines and structures.
 2. Class I Concrete Encasement: Wherever there is more than 0.3 foot but less than 1.5 foot clearance between sewers, sewer house laterals, force mains and water mains or water services, then a concrete encasement shall be provided in accordance with the typical detail as shown on the Drawings.
 3. Class II Concrete Encasement: Wherever there is more than 0.3 foot but less than 1.0 foot clearance between any two pipe lines, or between pipe lines and structures, then a concrete encasement shall be provided in accordance with the typical detail as shown on the Drawings.
- 3.3.2 The ENGINEER shall have full authority to direct the placement of the various pipes and structures in order to facilitate construction, expedite completion and to avoid conflicts.

3.4 BACKFILLING

- 3.4.1 Backfilling over pipes shall begin as soon as practicable after the pipe has been laid, jointed, and inspected and the trench filled with suitable compacted material to the mid-diameter of the pipe.
- 3.4.2 Backfilling over ducts shall begin not less than three days after placing concrete encasement.
- 3.4.3 All backfilling shall be prosecuted expeditiously and as detailed on the Drawings.

- 3.4.4 Any space remaining between the pipe and sides of the trench shall be packed full by hand shovel with selected earth, free from stones having a diameter greater than two inches and thoroughly compacted with a tamper as fast as placed, up to a level of one foot above the top of the pipe. Compact to 95% maximum density in layers not to exceed four inches up to the centerline of the pipe from the trench bottom and in layers not to exceed six inches from the pipe centerline to 12 inches above the pipe.
- 3.4.5 The filling shall be carried up evenly on both sides with at least one man tamping for each man shoveling material into the trench.
- 3.4.6 The remainder of the trench above the compacted backfill, as just described above, shall be filled and thoroughly compacted with common fill by rolling, ramming, or puddling, as the ENGINEER may direct. Compact common fill in six inch layers to 95% maximum density.
- 3.4.7 The bedding rock in muck areas shall consist of at least six inches of washed and graded stone placed in the trench to the proposed elevation of the centerline of the pipe prior to any pipe laying. This bedding shall not be used under any circumstances as a drain for groundwater. The CONTRACTOR shall take all precautions necessary to maintain the bedding in a compacted state and to prevent washing, erosion or loosening of this bed.
- 3.4.8 In locations where pipe pass through building walls, the CONTRACTOR shall take the following precautions to consolidate the refill up to an elevation of at least one foot above the bottom of the pipes:
1. Place structural fill in such areas for a distance of not less than three feet either side of the center line of the pipe in level layers not exceeding six inches in depth.
 2. Wet each layer to the extent directed and thoroughly compact each layer with a power tamper to the satisfaction of the ENGINEER.

3.5 GRADING

- 3.5.1 Grading shall be performed at such places as are indicated on the Drawings, to the lines, grades, and elevations shown or as directed by the ENGINEER and shall be made in such a manner that the requirements for formation of embankments can be followed. All unacceptable material encountered, of whatever nature within the limits indicated, shall be removed and disposed of as directed. During the process of excavation, the grade shall be maintained in such condition that it will be well drained at all times. When directed, temporary drains and drainage ditches shall be installed to intercept or divert surface water which may affect the prosecution or condition of the work.
- 3.5.2 If at the time of excavation it is not possible to place any material in its proper section of the permanent structure, it shall be stockpiled in approved areas for later use. No extras will be considered for the stockpiling or double handling of excavated material.
- 3.5.3 The right is reserved to make minute adjustments or revisions in lines or grades if found necessary as the work progresses, due to discrepancies on the Drawings or in order to obtain satisfactory construction.

- 3.5.4 Stones or rock fragments larger than 2-1/2-inches in their greatest dimensions will not be permitted in the top six inches of the subgrade line of all dikes, fills or embankments.
- 3.5.5 All fill slopes shall be uniformly dressed to the slope, cross-section and alignment shown on the Drawings, or as directed by the ENGINEER.
- 3.5.6 In cuts, all loose or protruding rocks on the back slopes shall be barred loose or otherwise removed to line or finished grade of slope. All cut and fill slopes shall be uniformly dressed to the slope, cross-section and alignment shown on the Drawings or as directed by the ENGINEER.
- 3.5.7 No grading is to be done in areas where there are existing pipe lines that may be uncovered or damaged until such lines which must be maintained are relocated, or where lines are to be abandoned, all required valves are closed and drains plugged at manholes.
- 3.5.8 The CONTRACTOR shall replace all pavement cut or otherwise damaged during the progress of the work as specified elsewhere herein.

3.6 DISPOSAL OF UNSUITABLE AND SURPLUS MATERIAL

- 3.6.1 All surplus and/or unsuitable excavated material shall be disposed of in one of the following ways as directed by the ENGINEER.
1. Transport to soil storage area on the OWNER's property and stockpile or spread as directed by the ENGINEER.
 2. Transport from the OWNER's property and legally dispose of. Any permit required for the hauling and disposing of this material beyond the OWNER's property shall be obtained prior to commencing hauling operations.
- 3.6.2 Suitable excavated material may be used for fill if it meets the specifications for satisfactory material and is approved by the ENGINEER. Excavated material so approved may be neatly stockpiled at the site where designated by the ENGINEER provided there is an area available where it will not interfere with the operation of the facility and not inconvenience traffic or adjoining property owners.

END OF SECTION

**Asbestos Assessment Report
Lowcountry Regional Airport Terminal
Walterboro, South Carolina
S&ME Project No. 4213-17-115**

Assessment Performed by:



5-10-17

John McEathron (SCDHEC Accreditation# BI-00794) Date

Report Prepared by:



5-10-17

Don Goins (SCDHEC Accreditation# BI-01499) Date



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Walterboro, SC 29488

Prepared by:
S&ME, Inc.
620 Wando Park Boulevard
Mt Pleasant, SC 29464

May 10, 2017



May 10, 2017

Colleton County
113 Mable T. Willis Boulevard
Walterboro, South Carolina 29488

Attention: Mr. John T. Stieglitz III, Capital Projects and Purchasing Director
jstieglitz@colletoncounty.org

Reference: **Asbestos Assessment Report**
Lowcountry Regional Airport Terminal
537 Aviation Way
Walterboro, South Carolina
S&ME Project No. 4213-17-115

Dear Mr. Stieglitz:

S&ME, Inc. (S&ME) is pleased to provide the enclosed report detailing the asbestos assessment we performed at the referenced location. The purpose of the assessment was to identify asbestos containing materials (ACM) prior to the renovation of the referenced facility. Our services were performed on April 24, 2017 in general accordance with S&ME Proposal No. 42-1700464, dated April 18, 2017. The following report includes the project background, sampling and analysis procedures, findings and results, and conclusions and recommendations as necessary.

This report is provided for the sole use of Colleton County and their assignees. Use of this report by any other parties will be at such party's sole risk and S&ME disclaims liability for any such use or reliance by third parties. The results presented in this report are indicative of conditions only during the time of the assessment.

S&ME appreciates this opportunity to provide our services to you. Please call if you have questions concerning this report or any of our services.

Sincerely,

S&ME, Inc.

Terry W. Richburg
Environmental Group Leader

James L. Killingsworth, CHMM
Environmental Services Area Manager, V.P.

Attachment



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Executive Summary

An asbestos assessment was conducted by S&ME, Inc. (S&ME) on April 24, 2017, of the Lowcountry Regional Airport Terminal located at 537 Aviation Way in Walterboro, South Carolina. The purpose of the assessment was to identify the presence of asbestos-containing materials (ACM) prior to the planned renovation activities in the subject structure.

Homogeneous areas (HA) suspected of containing asbestos were identified and sampled in the referenced structure that will be impacted by the upcoming renovation activities. The suspect ACMs sampled and analyzed as part of this assessment included drywall and associated joint compound, mastic associated with ductwork, acoustical ceiling tiles, and asphaltic roof shingles and associated felt.

Based on the results of the representative bulk samples collected and analyzed, no ACMs were identified. An ACM is defined by State and Federal regulations as a building material containing greater than one percent (>1%) of one of the six asbestos minerals regulated by the Environmental Protection Agency (EPA) and the Occupational Safety and Health Administration (OSHA).

If additional suspect ACMs not addressed in this report are discovered and will be disturbed by renovation/demolition activities, bulk samples must be collected by a South Carolina Department of Health and Environmental Control (SCDHEC) licensed asbestos inspector and analyzed for asbestos content, prior to disturbance and disposal of the suspect material(s). The contractor(s) working in the subject area should be provided a copy of this report to assist with compliance with State and Federal requirements.



1.0 Introduction

S&ME, Inc. (S&ME) was contracted by Colleton County to perform an asbestos assessment of suspect asbestos containing materials (ACMs) at the Lowcountry Regional Airport located at 537 Aviation Way in Walterboro, South Carolina. The assessment was performed by John McEathron of S&ME on April 24, 2017. An ACM is defined by State and Federal regulations as a building material containing greater than one percent (>1%) of one of the six asbestos minerals regulated by the Environmental Protection Agency (EPA) and the Occupational Safety and Health Administration (OSHA).

This asbestos assessment was performed in general accordance with S&ME Proposal No. 42-1700464, dated April 18, 2017. The service was performed at the request of Mr. John T. Stieglitz of Colleton County to Terry Richburg of S&ME by telephone on April 11, 2017.

Renovation and demolition in public and commercial building is regulated by the OSHA, EPA and South Carolina Department of Health and Environmental Control (SCDHEC). The EPA and SCDHEC require asbestos assessments, conducted by licensed individuals, prior to renovation and/or demolition projects. Code 40 of Federal Regulations Part 61, Subpart M, Final Rule, National Emissions Standards for Hazardous Air Pollutants (NESHAP) and SCDHEC regulations require asbestos assessments, followed by the proper removal, and disposal of ACMs that are affected by renovation or demolition activities. The identification of ACMs will aid in the prevention of occupational exposures and/or environmental releases of airborne asbestos. Identification of ACM is also required by the OSHA 1926.1101. The OSHA regulates materials containing less than or equal to one percent asbestos.

2.0 Site and Project Description

2.1 Purpose

The purpose of the assessment was to identify the presence of ACM prior to the renovation of the subject facility. An assessment strategy believed by S&ME to be appropriate for this purpose was presented in our proposal and is described in this report.

2.2 Site Description

The subject building is one-story, approximately 1,700 square feet in size, and constructed on a concrete slab on-grade. Interior finishes were comprised of drywall walls, suspended ceiling with acoustical ceiling tiles, and carpeting. Exterior finishes were comprised of stucco walls, and a pitched shingled roof. The building was occupied on the day of the assessment.

3.0 Assessment Methods

3.1 Sampling and Analysis

A visual assessment of the referenced area was performed to determine the homogeneous areas (HA) of suspect ACMs. Based on EPA definitions used in the Asbestos Hazard Emergency Response Act (AHERA), 40 CFR 763, a HA of suspect asbestos-containing building material has the same color and texture and is

thought to be installed within the same time. S&ME assessed the facility for suspect ACMs, including thermal system insulation (TSI), surfacing materials, and miscellaneous materials. Representative samples of suspect asbestos-containing building materials were collected from each HA in accordance with the EPA's AHERA protocol and applicable State regulations.

Information regarding the bulk samples of each HA was collected, recorded on a chain-of-custody record, and submitted to CEI Labs of Cary, North Carolina for analysis by Polarized Light Microscopy (PLM), coupled with dispersion staining in general accordance with the EPA 600/R-93/116 Method. Confirmation analysis of non-friable organically bound materials (NOBs) reported less than one percent via PLM (one representative sample of the negative material) was analyzed via Transmission Electron Microscopy (TEM). Typical examples of NOBs include, but are not limited to; vinyl floor tiles, mastics, vinyl sheet floorings, asphaltic roof materials, glazings, caulking, and other construction mastics/adhesives. The laboratory analysis reports the specific type of asbestos mineral identified (if any) and the percentage of asbestos present in each sample. The laboratory is accredited by the National Voluntary Laboratory Accreditation Program (NVLAP), which is administered by the National Institute of Standards and Technology (NIST).

3.2 Assessment

Identified ACMs were assessed based on the observed condition (good, damaged, or significantly damaged) and potential for disturbance due to the scheduled renovation/demolition. Identified ACMs were also categorized based on the EPA's NESHAP regulation categories. Friable ACM is classified as an ACM that can be crumbled to a powder by moderate hand pressure. Non-friable ACM is classified as either Category I Non-friable ACM or Category II Non-friable ACM. Category I and Category II Non-friable ACMs are distinguished from each other by their fiber release potential when damaged. Generally, Category I Non-friable ACM, which by definition includes intact ACM roofing materials, gaskets, packing, and resilient floor coverings, is less likely to become friable and release fibers in a damaged state. Category II Non-friable ACMs include all other non-friable ACM excluding Category I that have a high probability of being rendered friable during removal activities or renovation/demolition activities. All Friable ACM, Category I Non-friable ACM that has become friable, Category I Non-friable ACM that will be or has been subjected to sanding, grinding, cutting or abrading, or Category II Non-friable ACM that has a high probability of becoming or has become crumbled, pulverized, or reduced to powder by the forces expected to act on the material in the course of demolition or renovation operations, are considered to be a Regulated Asbestos-Containing Material (RACM). The NESHAP category for each identified ACM is provided in the summary table in Appendix I.

4.0 Results

Based on the asbestos assessment performed by S&ME on April 24, 2017, of the subject building, no ACMs were identified. An ACM is defined by State and Federal regulations as a building material containing >1% of one of the six asbestos minerals regulated by the EPA and OSHA.

The summary of asbestos results is provided in Appendix I, and exhibits the sample number, location, type of material tested, approximate quantity of the material sampled, condition of the material, and corresponding result for each sample. A diagram of bulk sample locations is provided in Appendix II, and



a copy of the inspector's SCDHEC license is provided in Appendix III. A copy of the laboratory analyses and chain-of-custody records are provided in Appendix IV.

5.0 Conclusion and Recommendations

The asbestos assessment performed on April 24, 2017, of the Lowcountry Regional Airport Terminal located at 537 Aviation Way in Walterboro, South Carolina did not identify the presence of ACMs. If additional suspect ACMs not addressed in this report are discovered and will be disturbed by renovation/demolition activities, bulk samples must be collected by a SCDHEC licensed asbestos inspector and analyzed for asbestos content, prior to disturbance and disposal of the suspect material(s). The contractor(s) working in the subject area should be provided a copy of this report to assist with compliance with State and Federal requirements.

6.0 Assumptions and Limitations

This report is provided for the sole use of the Client. Use of this report by any other parties will be at such party's sole risk, and S&ME disclaims liability for any such use or reliance by third parties. The results presented in this report are indicative of conditions only during the time of the sampling period and of the specific areas referenced. Under no circumstances is this report to be used as a bidding document, or as a project design or specification.

S&ME performed the services in accordance with generally accepted practices of reputable environmental consultants undertaking similar studies at the same time and in the same geographical area. S&ME has endeavored to meet this standard of care. No other warranty, expressed or implied, is intended or made with respect to this report or S&ME's services. Users of this report should consider the scope and limitations related to these services when developing opinions as to risks associated with the site.

The possibility exists that suspect materials were undetected in inaccessible or concealed areas such as under carpeting or multiple flooring layers, and inside pipe chases or wall voids. If additional suspect materials are discovered during the planned destructive activities, bulk samples must be collected by a SCDHEC licensed asbestos inspector and analyzed for asbestos content.

Appendices

Appendix I – Summary of Bulk Asbestos Samples



Table I: Summary of Asbestos Results

Sample No.	Location	Material	² Approx. Quantity	Asbestos Type	¹ Percent	Condition	Potential for Disturbance	Hazard Assessment
115-DW-01	Room 2	Drywall	3,500 SF	ND	NA	NA	NA	NA
115-DW-02	Men's Bathroom			ND	NA	NA	NA	NA
115-DW-03	Kitchen			ND	NA	NA	NA	NA
115-JC-01	Room 2	Joint Compound		ND	NA	NA	NA	NA
115-JC-02	Men's Bathroom			ND	NA	NA	NA	NA
115-JC-03	Kitchen			ND	NA	NA	NA	NA
115-JC-04	Storage Room			ND	NA	NA	NA	NA
115-JC-05	Room 1			ND	NA	NA	NA	NA
115-DM-01	Attic	Mastic (white) associated with ductwork insulation		150 SF	ND	NA	NA	NA
115-DM-02	Attic		ND		NA	NA	NA	NA
³ 115-DM-03	Attic		ND		NA	NA	NA	NA
115-RS-01	Roof	Asphaltic Roof Shingles Felt	1,680 SF	ND	NA	NA	NA	NA
115-RS-02	Roof			ND	NA	NA	NA	NA
³ 115-RS-03	Roof			ND	NA	NA	NA	NA
115-CT-01	Room 2	Ceiling Tile (2'x2')	690 SF	ND	NA	NA	NA	NA
115-CT-02	Men's Bathroom			ND	NA	NA	NA	NA
115-CT-03	Kitchen			ND	NA	NA	NA	NA

ND = No Asbestos Detected

NA = Not Applicable

SF = square feet

LF = linear feet

LPD = low potential for disturbance

PD = potential for disturbance

PSD = potential for significant disturbance

G = good

D = damaged

SD = significantly damaged

F= friable

NF = non-friable

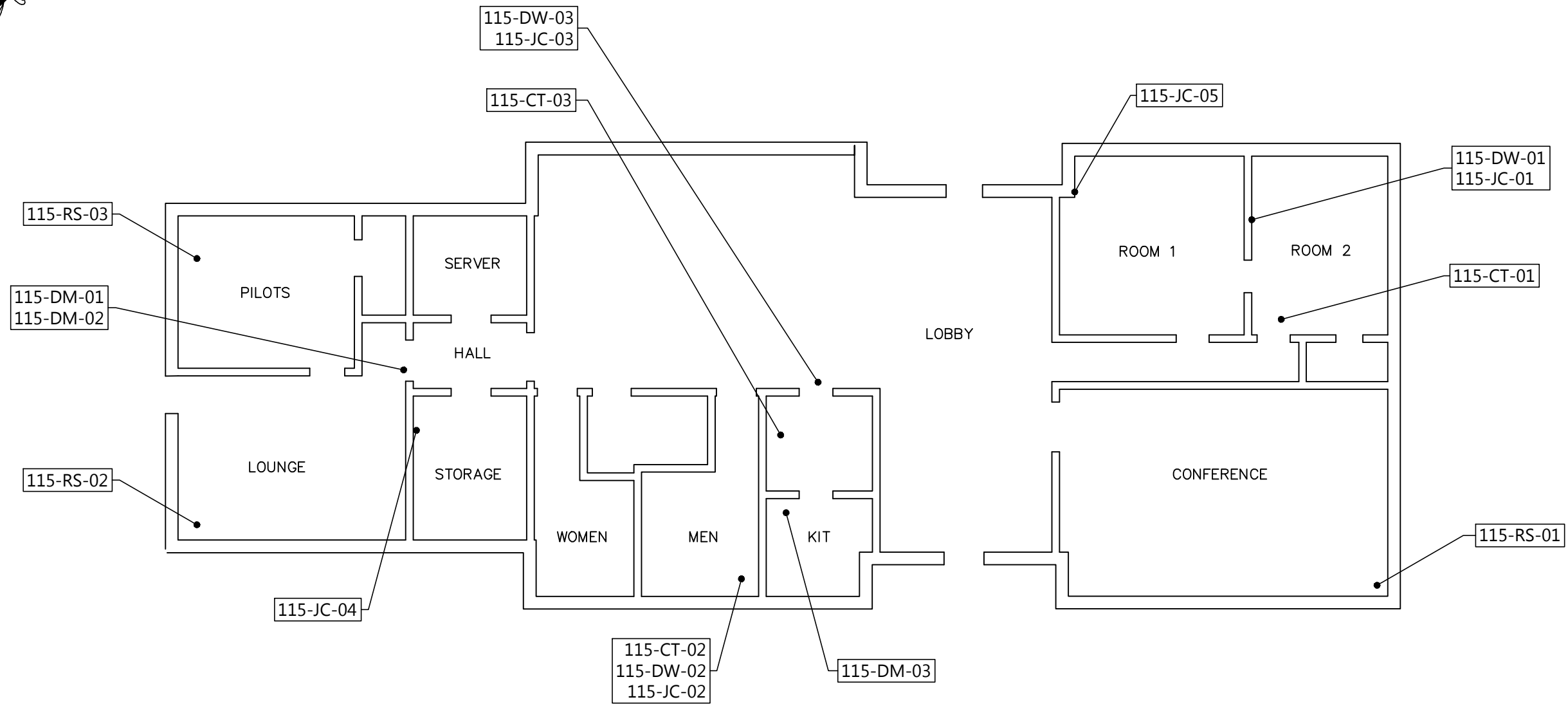
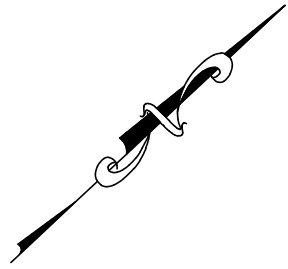
EA = each

¹EPA, SCDHEC and OSHA defines a material as asbestos containing if an asbestos content greater than one percent (>1%) is detected in a representative sample.

²Quantities are estimated, and should not be used for bidding purposes, as field conditions should be verified.

³Samples analyzed by TEM to confirm negative results reported by PLM analysis.

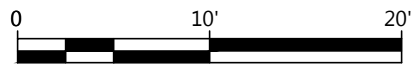
Appendix II – Diagram of Asbestos Bulk Sample Locations



LEGEND

● 115-XX-XX BULK SAMPLE LOCATION

NOTE: NO ASBESTOS WAS DETECTED IN THE BULK SAMPLES COLLECTED AND ANALYZED.



**ASBESTOS ASSESSMENT
LOWCOUNTRY REGIONAL AIRPORT TERMINAL
WALTERBORO, SOUTH CAROLINA**

SCALE: AS SHOWN	DRAWN BY: LAJ	APPROVED BY:
PROJECT NO. 4213-17-115	DATE: 5-04-2017	FIGURE NO. 1

Appendix III – Copy of Inspector’s SCDHEC License



**South Carolina
Department of Health and Environmental Control
Asbestos License**

John McEathron

SCDHEC ISSUED
Asbestos ID Card

Everett J. Mceathron

		Expiration Date
	AIR SAMPLER AS-00235	12/14/17
	CONSULT BI	BI-00794 12/15/17

*Air Sampler AS-00235
Building Inspector BI-00794*

Appendix IV– Asbestos Laboratory Reports



May 2, 2017

S&ME, Inc.
620 Wando Park Boulevard
Mt. Pleasant, SC 29464

CLIENT PROJECT: Lowcounty Regional Airport; 4213-17-115
CEI LAB CODE: A17-5984

Dear Customer:

Enclosed are asbestos analysis results for PLM Bulk samples received at our laboratory on April 25, 2017. The samples were analyzed for asbestos using polarizing light microscopy (PLM) per the EPA 600 Method.

Sample results containing >1% asbestos are considered asbestos-containing materials (ACMs) per EPA regulatory requirements. The detection limit for the EPA 600 Method is <1% asbestos by weight as determined by visual estimation.

Thank you for your business and we look forward to continuing good relations. If you have any questions, please feel free to call our office at 919-481-1413.

Kind Regards,

A handwritten signature in black ink, appearing to read "Tianbao Bai".

Tianbao Bai, Ph.D., CIH
Laboratory Director





ASBESTOS ANALYTICAL REPORT
By: Polarized Light Microscopy

Prepared for

S&ME, Inc.

CLIENT PROJECT: Lowcounty Regional Airport; 4213-17-115

CEI LAB CODE: A17-5984

TEST METHOD: EPA 600 / R93 / 116 and EPA 600 / M4-82 / 020

REPORT DATE: 05/02/17

TOTAL SAMPLES ANALYZED: 16

SAMPLES >1% ASBESTOS:

TEL: 866-481-1412

www.ceilabs.com



Asbestos Report Summary

By: POLARIZING LIGHT MICROSCOPY

PROJECT: Lowcounty Regional Airport; 4213-17-115 **CEI LAB CODE:** A17-5984

METHOD: EPA 600 / R93 / 116 and EPA 600 / M4-82 / 020

Client ID	Layer	Lab ID	Color	Sample Description	ASBESTOS %
115-CT-01		A2386318	White	Ceiling Tile	None Detected
115-CT-02		A2386319	White	Ceiling Tile	None Detected
115-CT-03		A2386320	White	Ceiling Tile	None Detected
115-DW-01		A2386321	White	Drywall	None Detected
115-DW-02		A2386322	White	Drywall	None Detected
115-DW-03		A2386323	White	Drywall	None Detected
115-JC-01		A2386324	White	Joint Compound	None Detected
115-JC-02		A2386325	White	Joint Compound	None Detected
115-JC-03		A2386326	White	Joint Compound	None Detected
115-JC-04		A2386327	White	Joint Compound	None Detected
115-JC-05		A2386328	White	Joint Compound	None Detected
115-DM-01	Layer 1	A2386329	White	Duct Mastic	None Detected
	Layer 2	A2386329	Tan, Yellow	Insulation	None Detected
115-DM-02	Layer 1	A2386330	White	Duct Mastic	None Detected
	Layer 2	A2386330	Tan, Yellow	Insulation	None Detected
115-DM-03	Layer 1	A2386331		Sample Submitted for TEM Analysis	
	Layer 2	A2386331	Tan, Yellow	Insulation	None Detected
115-RS-01	Layer 1	A2386332	Tan, Black	Shingle	None Detected
	Layer 2	A2386332	Black	Felt Paper	None Detected
115-RS-02	Layer 1	A2386333	Tan, Black	Shingle	None Detected
	Layer 2	A2386333	Black	Felt Paper	None Detected
115-RS-03		A2386334		Sample Submitted for TEM Analysis	



ASBESTOS BULK ANALYSIS

By: POLARIZING LIGHT MICROSCOPY

Client: S&ME, Inc.
620 Wando Park Boulevard
Mt. Pleasant, SC 29464

CEI Lab Code: A17-5984
Date Received: 04-25-17
Date Analyzed: 05-01-17
Date Reported: 05-02-17

Project: Lowcounty Regional Airport; 4213-17-115

ASBESTOS BULK PLM, EPA 600 METHOD

Client ID Lab ID	Lab Description	Lab Attributes	NON-ASBESTOS COMPONENTS				ASBESTOS %
			Fibrous		Non-Fibrous		
115-CT-01 A2386318	Ceiling Tile	Heterogeneous White Fibrous Loosely Bound	75%	Fiberglass	5% 20%	Paint Binder	None Detected
115-CT-02 A2386319	Ceiling Tile	Heterogeneous White Fibrous Loosely Bound	75%	Fiberglass	5% 20%	Paint Binder	None Detected
115-CT-03 A2386320	Ceiling Tile	Heterogeneous White Fibrous Loosely Bound	75%	Fiberglass	5% 20%	Paint Binder	None Detected
115-DW-01 A2386321	Drywall	Heterogeneous White Fibrous Bound	10%	Cellulose	90%	Gypsum	None Detected
115-DW-02 A2386322	Drywall	Heterogeneous White Fibrous Bound	10%	Cellulose	90%	Gypsum	None Detected
115-DW-03 A2386323	Drywall	Heterogeneous White Fibrous Bound	10%	Cellulose	90%	Gypsum	None Detected
115-JC-01 A2386324	Joint Compound	Heterogeneous White Non-fibrous Bound			60% 40%	Binder Calc Carb	None Detected



ASBESTOS BULK ANALYSIS

By: POLARIZING LIGHT MICROSCOPY

Client: S&ME, Inc.
620 Wando Park Boulevard
Mt. Pleasant, SC 29464

CEI Lab Code: A17-5984
Date Received: 04-25-17
Date Analyzed: 05-01-17
Date Reported: 05-02-17

Project: Lowcounty Regional Airport; 4213-17-115

ASBESTOS BULK PLM, EPA 600 METHOD

Client ID Lab ID	Lab Description	Lab Attributes	NON-ASBESTOS COMPONENTS			ASBESTOS %	
			Fibrous		Non-Fibrous		
115-JC-02 A2386325	Joint Compound	Heterogeneous	60%	Binder	None Detected		
		White	40%	Calc Carb			
		Non-fibrous					
		Bound					
115-JC-03 A2386326	Joint Compound	Heterogeneous	60%	Binder	None Detected		
		White	40%	Calc Carb			
		Non-fibrous					
		Bound					
115-JC-04 A2386327	Joint Compound	Heterogeneous	60%	Binder	None Detected		
		White	40%	Calc Carb			
		Non-fibrous					
		Bound					
115-JC-05 A2386328	Joint Compound	Heterogeneous	60%	Binder	None Detected		
		White	40%	Calc Carb			
		Non-fibrous					
		Bound					
115-DM-01 Layer 1 A2386329	Duct Mastic	Heterogeneous	5%	Cellulose	95%	Mastic	None Detected
		White					
		Fibrous					
		Bound					
Layer 2 A2386329	Insulation	Heterogeneous	20%	Cellulose	10%	Binder	None Detected
		Tan, Yellow	65%	Fiberglass	5%	Metal Foil	
		Fibrous					
		Loosely Bound					
115-DM-02 Layer 1 A2386330	Duct Mastic	Heterogeneous	5%	Cellulose	95%	Mastic	None Detected
		White					
		Fibrous					
		Bound					



ASBESTOS BULK ANALYSIS

By: POLARIZING LIGHT MICROSCOPY

Client: S&ME, Inc.
620 Wando Park Boulevard
Mt. Pleasant, SC 29464

CEI Lab Code: A17-5984
Date Received: 04-25-17
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Date Reported: 05-02-17

Project: Lowcounty Regional Airport; 4213-17-115

ASBESTOS BULK PLM, EPA 600 METHOD

Client ID Lab ID	Lab Description	Lab Attributes	NON-ASBESTOS COMPONENTS				ASBESTOS %
			Fibrous		Non-Fibrous		
Layer 2 A2386330	Insulation	Heterogeneous Tan, Yellow Fibrous Loosely Bound	20%	Cellulose	10%	Binder	None Detected
			65%	Fiberglass	5%	Metal Foil	
115-DM-03 Layer 1 A2386331	Sample Submitted for TEM Analysis						
Layer 2 A2386331	Insulation	Heterogeneous Tan, Yellow Fibrous Loosely Bound	20%	Cellulose	10%	Binder	None Detected
			65%	Fiberglass	5%	Metal Foil	
115-RS-01 Layer 1 A2386332	Shingle	Heterogeneous Tan, Black Fibrous Bound	20%	Fiberglass	45%	Tar	None Detected
					35%	Silicates	
Layer 2 A2386332	Felt Paper	Heterogeneous Black Fibrous Bound	75%	Cellulose	25%	Tar	None Detected
115-RS-02 Layer 1 A2386333	Shingle	Heterogeneous Tan, Black Fibrous Bound	20%	Fiberglass	45%	Tar	None Detected
					35%	Silicates	
Layer 2 A2386333	Felt Paper	Heterogeneous Black Fibrous Bound	75%	Cellulose	25%	Tar	None Detected
115-RS-03 A2386334	Sample Submitted for TEM Analysis						



LEGEND: Non-Anth = Non-Asbestiform Anthophyllite
 Non-Trem = Non-Asbestiform Tremolite
 Calc Carb = Calcium Carbonate

METHOD: EPA 600 / R93 / 116 and EPA 600 / M4-82 / 020

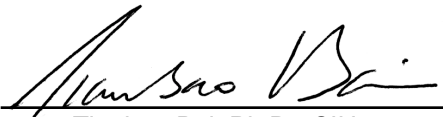
REPORTING LIMIT: <1% by visual estimation

REGULATORY LIMIT: >1% by weight

Due to the limitations of the EPA 600 method, nonfriable organically bound materials (NOBs) such as vinyl floor tiles can be difficult to analyze via polarized light microscopy (PLM). EPA recommends that all NOBs analyzed by PLM, and found not to contain asbestos, be further analyzed by Transmission Electron Microscopy (TEM). Please note that PLM analysis of dust and soil samples for asbestos is not covered under NVLAP accreditation. Estimated measurement of uncertainty is available on request.

This report relates only to the samples tested or analyzed and may not be reproduced, except in full, without written approval by CEI Labs, Inc. CEI Labs makes no warranty representation regarding the accuracy of client submitted information in preparing and presenting analytical results. Interpretation of the analytical results is the sole responsibility of the client. Samples were received in acceptable condition unless otherwise noted. This report may not be used by the client to claim product endorsement by NVLAP or any other agency of the U.S. Government.

ANALYST: 
Greg Ruff

APPROVED BY: 
Tianbao Bai, Ph.D., CIH
Laboratory Director



(17) A17-5984
A2386318-
A2386334



730 SE Maynard Road, Cary, NC 27511
Tel: 866-481-1412; Fax: 919-481-1442

ASBESTOS CHAIN OF CUSTODY

LAB USE ONLY:
CEI Lab Code:
CEI Lab I.D. Range:

COMPANY INFORMATION	PROJECT INFORMATION
CEI CLIENT #:	Job Contact: <i>TERRY RICHBURG</i>
Company: <i>SOME</i>	Email / Tel: <i>TRICHBURG@SMEINC.COM</i>
Address: <i>620 WANDO PARK BLVD</i>	Project Name: <i>LOWCOUNTY REGIONAL AIRPORT</i>
<i>MT. PLEASANT SC 299 29464</i>	Project ID#: <i>4213-17-115</i>
Email: <i>TRICHBURG@SMEINC.COM</i>	PO #: <i>40878</i>
Tel: <i>847-884-0005</i> Fax:	STATE SAMPLES COLLECTED IN: <i>SC</i>

IF TAT IS NOT MARKED STANDARD 3 DAY TAT APPLIES.

ASBESTOS	METHOD	TURN AROUND TIME					
		4 HR	8 HR	24 HR	2 DAY	3 DAY	5 DAY
PLM BULK	EPA 600	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
PLM POINT COUNT (400)	EPA 600	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
PLM POINT COUNT (1000)	EPA 600	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
PLM GRAV w POINT COUNT	EPA 600	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
PLM BULK	CARB 435	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
PCM AIR	NIOSH 7400	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
TEM AIR	EPA AHERA	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
TEM AIR	NIOSH 7402	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
TEM AIR	ISO 10312	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
TEM AIR	ASTM 6281-09	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
TEM BULK	CHATFIELD	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
TEM DUST WIPE	ASTM D6480-05 (2010)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
TEM DUST MICROVAC	ASTM D5755-09 (2014)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
TEM SOIL	ASTM D7521-13	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
TEM VERMICULITE	CINCINNATI METHOD	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
OTHER:		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

REMARKS / SPECIAL INSTRUCTIONS: *POS. STOP*

Accept Samples
 Reject Samples

Relinquished By:	Date/Time	Received By:	Date/Time
<i>Jh m'cob</i>	<i>4/24/17 1800</i>	<i>DC</i>	<i>4-25 12:00</i>

Samples will be disposed of 30 days after analysis



May 5, 2017

S&ME, Inc.
620 Wando Park Boulevard
Mt. Pleasant, SC 29464

CLIENT PROJECT: Lowcounty Regional Airport; 4213-17-115
CEI LAB CODE: T17-0823

Dear Customer:

Enclosed are asbestos analysis results for TEM bulk samples received at our laboratory on May 2, 2017. The samples were analyzed for asbestos using transmission electron microscopy (TEM) per Chatfield Method.

Sample results containing > 1% asbestos are considered asbestos-containing materials (ACMs) per the EPA regulatory requirements. The detection limit for the TEM Chatfield method is <1% depending on the processed weight and constituents of the sample.

Thank you for your business and we look forward to continuing good relations. If you have any questions, please feel free to call our office at 919-481-1413.

Kind Regards,

A handwritten signature in black ink, appearing to read "Tianbao Bai".

Tianbao Bai, Ph.D., CIH
Laboratory Director



ASBESTOS ANALYTICAL REPORT
By: Transmission Electron Microscopy

Prepared for

S&ME, Inc.

CLIENT PROJECT: Lowcounty Regional Airport; 4213-17-115

CEI LAB CODE: T17-0823

TEST METHOD: Bulk Chatfield
EPA 600 / R93 / 116

REPORT DATE: 05/05/17

TEL: 866-481-1412

www.ceilabs.com



ASBESTOS BULK ANALYSIS

By: TRANSMISSION ELECTRON MICROSCOPY

Client: S&ME, Inc.
620 Wando Park Boulevard
Mt. Pleasant, SC 29464

CEI Lab Code: T17-0823
Date Received: 05-02-17
Date Analyzed: 05-03-17
Date Reported: 05-05-17

Project: Lowcounty Regional Airport; 4213-17-115

TEM BULK CHATFIELD / EPA 600 / R93 / 116

Client ID Lab ID	Material Description	Sample Weight (g)	Organic Material %	Acid Soluble Material %	Acid Insoluble Material %	Asbestos %
115-DM-03 T61921	White Duct Mastic	0.151	50.3	22.5	27.2	None Detected
115-RS-03 T61922	Tan, Black Shingle	0.533	19.1	45.8	35.1	None Detected
115-RS-03 T61923	Black Felt Paper	0.34	95	4.1	.9	None Detected



LEGEND: None

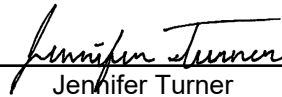
METHOD: CHATFIELD & EPA/600/R-93/116

LIMIT OF DETECTION: Varies with the weight and constituents of the sample (<1%)

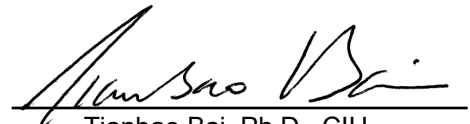
REGULATORY LIMIT: >1% by weight

This report relates only to the samples tested or analyzed and may not be reproduced, except in full, without written approval by CEI Labs, Inc. CEI Labs makes no warranty representation regarding the accuracy of client submitted information in preparing and presenting analytical results. Interpretation of the analytical results is the sole responsibility of the client. Estimated measurement of uncertainty is available on request. Samples were received in acceptable condition unless otherwise noted.

ANALYST:


Jennifer Turner

APPROVED BY:


Tianbao Bai, Ph.D., CIH
Laboratory Director



730 SE Maynard Road, Cary, NC 27511
 Tel: 866-481-1412; Fax: 919-481-1442

ASBESTOS CHAIN OF CUSTODY

(17) A17-5984
 A2386318-
 A2386334

LAB USE ONLY:	
CEI Lab Code:	117 0823
CEI Lab I.D. Range:	T01921-923 (3)

COMPANY INFORMATION	PROJECT INFORMATION
CEI CLIENT #:	Job Contact: TRIPP RICHBURG
Company: SOME	Email / Tel: TRICHBURG@SMEINC.COM
Address: 620 WANDOO PARK BLVD MT. PLEASANT SC 299 29464	Project Name: Low County Regional Airport
Email: TRICHBURG@SMEINC.COM	Project ID#: 4213-17-115
Tel: 847-884-0005 Fax:	PO #: 40878
	STATE SAMPLES COLLECTED IN: SC

IF TAT IS NOT MARKED STANDARD 3 DAY TAT APPLIES.

ASBESTOS	METHOD	TURN AROUND TIME					
		4 HR	8 HR	24 HR	2 DAY	3 DAY	5 DAY
PLM BULK	EPA 600	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
PLM POINT COUNT (400)	EPA 600	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
PLM POINT COUNT (1000)	EPA 600	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
PLM GRAV w POINT COUNT	EPA 600	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
PLM BULK	CARB 435	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
PCM AIR	NIOSH 7400	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
TEM AIR	EPA AHERA	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
TEM AIR	NIOSH 7402	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
TEM AIR	ISO 10312	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
TEM AIR	ASTM 6281-09	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
TEM BULK	CHATFIELD	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
TEM DUST WIPE	ASTM D6480-05 (2010)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
TEM DUST MICROVAC	ASTM D5755-09 (2014)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
TEM SOIL	ASTM D7521-13	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
TEM VERMICULITE	CINCINNATI METHOD	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
OTHER:		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

REMARKS / SPECIAL INSTRUCTIONS:		<input checked="" type="checkbox"/> Accept Samples <input type="checkbox"/> Reject Samples	
Relinquished By:	Date/Time	Received By:	Date/Time
JM m'cob	4/24/17 18:00	DC	4-25 12:00
Giselle	5/2/17 10:00		

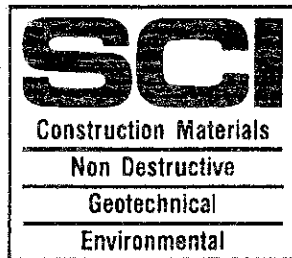
pos. stop

Samples will be disposed of 30 days after analysis

FOUNDATION EXPLORATION ENGINEERING STUDIES AND ANALYSES FOR

PROPOSED ADDITIONS TO TERMINAL BUILDING
COLLETON COUNTY AIRPORT, AVIATION WAY
WALTERBORO, SOUTH CAROLINA

SCI PROJECT 160018
MARCH 9, 2016



SOIL CONSULTANTS, INC.
ENGINEERS AND GEOLOGISTS
SINCE 1951



SOIL CONSULTANTS, INC.
ENGINEERS & GEOLOGISTS
Since 1951

P.O. Drawer 698 • Charleston, South Carolina 29402 • 843/723-4539 • Fax 843/723-3648

March 9, 2016

Colleton County, South Carolina
113 Mable T. Willis Boulevard
Walterboro, South Carolina 29488

Attention: Mr. John Stieglitz, III, Capital Projects & Purchasing Director

SCI Project 160018

Dear Mr. Stieglitz:

The following analysis is given for the subsurface exploration performed at the site of the proposed additions to the existing terminal building located on Aviation Way at the Colleton County Airport in Walterboro, South Carolina. The exploration was performed in general accordance with Soil Consultants, Inc. (SCI) Proposal No. 14-16-008, dated January 26, 2016 and Colleton County Purchase Order No. 22615, dated February 8, 2016. This report provides a general discussion of the planned development, the exploration procedures used, subsurface conditions encountered, seismic analysis, and recommendations for site preparation and foundation design.

SCOPE OF PROJECT

We have been provided Topographical Survey drawing, prepared by Fowler Land Surveying, dated January 4, 2016, which shows the existing conditions at the site, selected tree locations, and spot elevations and topographic contours of the existing ground and pavement surfaces. In addition, the footprint area of the proposed building additions have been sketched by others on the survey drawing. Based on project information provided, we understand that the proposed project includes the construction of two new 1-story additions to the existing building at the location referenced above. In addition, we understand that one addition with plan dimensions of approximately 16 feet by 30 feet is located on the southwest side of the existing



building, and the other addition with plan dimensions of approximately 32 feet by 35 feet is located to the east and southeast of the existing building.

We have not been provided detailed information regarding the construction of the proposed building or structural loadings for the proposed construction. However, for the purposes of this report, we assume that the proposed building additions will be constructed of either wood or structural steel framing with brick veneer. In addition, we assume that the first floor of the building additions will be concrete slabs supported at grade. Based on our previous experience with similar structures, we anticipate that maximum column loads will likely be on the order of 20 to 40 kips, and maximum wall loads will likely be on the order of 2 to 3 kips per linear foot.

Based on observations of the existing ground surface elevations at the site and the topographic information shown on the provided survey drawing, we have assumed that no more than 2 feet of fill material will be placed on or adjacent to the proposed building footprint to raise the grade in this area of the site. The fill height discussed here refers to the net fill height above the existing ground surface or pavement elevation prior to construction, neglecting any fill that is placed where existing soils (such as topsoil) will be removed.

SITE DESCRIPTION

The site of the proposed building additions is part of the existing terminal property. At the time of our investigation, the site was developed and contained the existing terminal building. The areas immediately surrounding the existing building were mostly cleared with a few trees and landscape plantings. The ground surfaces in these were covered with grass, and the ground surfaces along the routes taken to access the borehole locations were noted to be firm. The remainder of the balance of the site consisted of asphalt-paved driveway and parking areas and concrete-paved taxiway and apron areas.

Based on observations at the site, the ground/pavement surface is relatively flat, sloping down generally to the southeast toward Aviation Way. In addition, the ground/pavement surface elevations are similar to the surrounding areas. Based on spot elevations and topographic



contour lines shown on the survey drawing provided, the ground/pavement surface elevations at the site range from approximately 90 feet at the southeastern property boundary to approximately 93 feet in the concrete-paved areas northwest of the existing building. The provided survey drawing indicates that the ground surface elevations are referenced to the North American Vertical Datum of 1988 (NAVD 88). The provided drawing also indicates that the property is located in Flood Zone X in accordance with Federal Emergency Management Agency (FEMA) Flood Insurance Rate Maps, dated November 7, 2001.

FIELD EXPLORATION

On February 19, 2016, we performed three soil borings, designated B-1 through B-3, using mud-rotary drilling procedures at selected locations within the proposed building addition footprints at the project site. Boring B-1 was advanced to a depth of approximately 40 feet below the existing ground surface, and Borings B-2 and B-3 were advanced to depths of approximately 20 feet.

The borings were performed using adverse terrain vehicle (ATV)-mounted drilling equipment with split-spoon sampling and Standard Penetration Testing (SPT) performed at selected intervals. The boring locations were staked at the site by our firm using a tape to measure distances and estimating right angles with reference to existing site features using the conceptual site plan drawing provided. Approximate boring locations are shown on the attached Boring Location Plan.

SPT field exploratory procedures are explained on enclosed Plate Nos. 1 and 2, and the classification of the soils encountered under the Unified Soil Classification System is explained on Plate No. 3. Soil samples from this exploration will be retained for a period of three months from the date of this report. Unless other arrangements are made, they will be disposed of following this period.

SCI's geotechnical engineer developed the final log for each soil boring using SPT data and visual descriptions recorded during the field exploration and using visual classification of the

recovered soils after return to the SCI laboratory. The boring logs attached to this report represent SCI's interpretation of stratigraphy and groundwater conditions at the explored locations based on visual classification of recovered samples. Transition boundaries between soil types noted on the boring logs are approximate.

SUBSURFACE CONDITIONS

Subsurface conditions encountered in the borings were generally similar at the explored locations. All references to depth are approximate and are made with respect to the existing ground surface at the time that the borings were performed.

Below a surficial layer of topsoil and roots, visually estimated to be approximately 6 to 12 inches thick, the borings generally encountered very loose to dense, fine-grained sands with varying amounts of silt to depths of 21½ feet (termination of Borings B-2 and B-3) and 41½ feet (termination of Boring B-1). SPT resistance (N) values obtained in the sands ranged from less than 1 to 40 blows per foot (bpf).

Shovel samples were taken adjacent to the boring locations to depths of about 1 foot for the purpose of estimating the extent of root content in the surface soils. These samples showed varying root content to depths of 3 inches. Although this data is an indication of the depths of root content at the site, it should be noted that the depth of roots and organic material can be expected to vary across the site and will likely be more significant within more heavily vegetated portions or low lying areas of the site. The actual depth to which roots of significant size and quantity will be encountered will best be determined by visual inspection during site stripping operations.

The depths to the groundwater table were measured on the same day after completion of the borings. The groundwater table depth measurements ranged from 4¾ feet to 5¼ feet. It must be noted that fluctuations in the level of the groundwater table may occur due to variations in ground elevation, rainfall, drainage, types of soil encountered, temperature, and other factors not evident at the time measurements were made. Since the probability of such variations is

anticipated, design drawings and specifications should accommodate such possibilities, and construction planning should be based on such assumptions of variation. If excavation is required below the groundwater table during construction, dewatering should be anticipated.

SEISMIC CONSIDERATIONS

The South Carolina coastal area is a well documented area of high seismicity. The destructive Charleston, South Carolina, earthquake of August 31, 1886, is estimated to have a moment magnitude of approximately 7.25 to 7.5. Earthquakes of much lesser magnitude occur on a relatively frequent basis. Due to the unconsolidated nature of the near surface soils in the coastal region, damage due to even a relatively modest intensity earthquake is anticipated to be relatively great. Concerns related to earthquake occurrence include liquefaction of the relatively clean, submerged loose sands due to shaking as well as subsequent ground movements associated with shearing or consolidation of the liquefied soils.

Earthquake Ground Motions

Earthquake ground motion parameters for this site were obtained from the U.S. Geological Survey (USGS) Earth Quake Hazards Program – National Seismic Hazard Mapping Project website database. The ground motion values, expressed as a percent of the gravitational force (g), obtained for an earthquake having a 2% probability of exceedence in a 50-year period are as follows:

Short Periods (0.2 sec) $S_s = 76.9 \%g$

1-Second Periods $S_1 = 24.4 \%g$

Site Classification and Response Spectrum

Because potentially liquefiable soils were encountered in the soil borings, this site would best be categorized as Site Class "F" with reference to Table 1613.5.2 of the International

Building Code, 2012 Edition (IBC). It should be noted; for sites classified as "F", the IBC requires that a site-specific dynamic site response analysis, as outlined in the American Society of Civil Engineers Standard, "Minimum Design Loads for Buildings and Other Structures" (ASCE 7), be performed in order to determine spectral response. However, Section 20.3.1 of ASCE 7 states that the calculated site class can be used without regard to liquefaction for structures with periods of vibration less than or equal to 0.5 seconds. Because we assume that the period of vibration for the proposed structure is less than 0.5 second, **Site Class "E"** was used to determine the design spectral response data provided below. If the structure has a fundamental period in excess of 0.5 second, or if a site specific analysis is desired for another reason, please contact us. The determination for Site Class E was based on the N values from the soil boring data and the procedures outlined in the IBC. We have provided a Design Response Curve below for your use based on this site classification.

In accordance with the general procedures outlined in Sections 1613.5.3 and 1613.5.4 of the IBC and neglecting the potential for liquefaction, design parameters were calculated for an earthquake having a 2% probability of exceedance in a 50-year period using values of $F_a = 1.18$ and $F_v = 3.03$. The results of these calculations, expressed as a percent of the gravitational force (g), are as follows:

Five-Percent Damped Design Spectral Response Acceleration Parameters

Short Periods (0.2 sec)	$S_{Ds} = 60.3 \%g$
1-Second Periods	$S_{D1} = 49.2 \%g$
Peak Ground Acceleration	$PGA = 24.0 \%g$

Chapter 11.8.3 of ASCE 7 states that for structures assigned to Seismic Design Category D, E, or F, the potential for liquefaction and soil strength loss should be evaluated for site peak ground acceleration (PGA), earthquake magnitude, and source characteristics consistent with the Maximum Considered Geometric Mean (MCE_G) PGA. In addition, ASCE 7 defines PGA_M as

the MCE_G PGA adjusted for site class effects. Using the procedures outlined in ASCE 7, the $PGA_M = 41.3\%$ for this site.

We wish to point out that the borings for this project were performed to a maximum depth of approximately 41½ feet, and the IBC requires soil information to a depth of 100 feet be used in site classification. However, ASCE 7 as referenced in Section 1613 of the IBC, states that appropriate soil properties can be estimated by a registered design professional if site-specific data is not available. Data available in our files from previous projects near this site was used for this purpose.

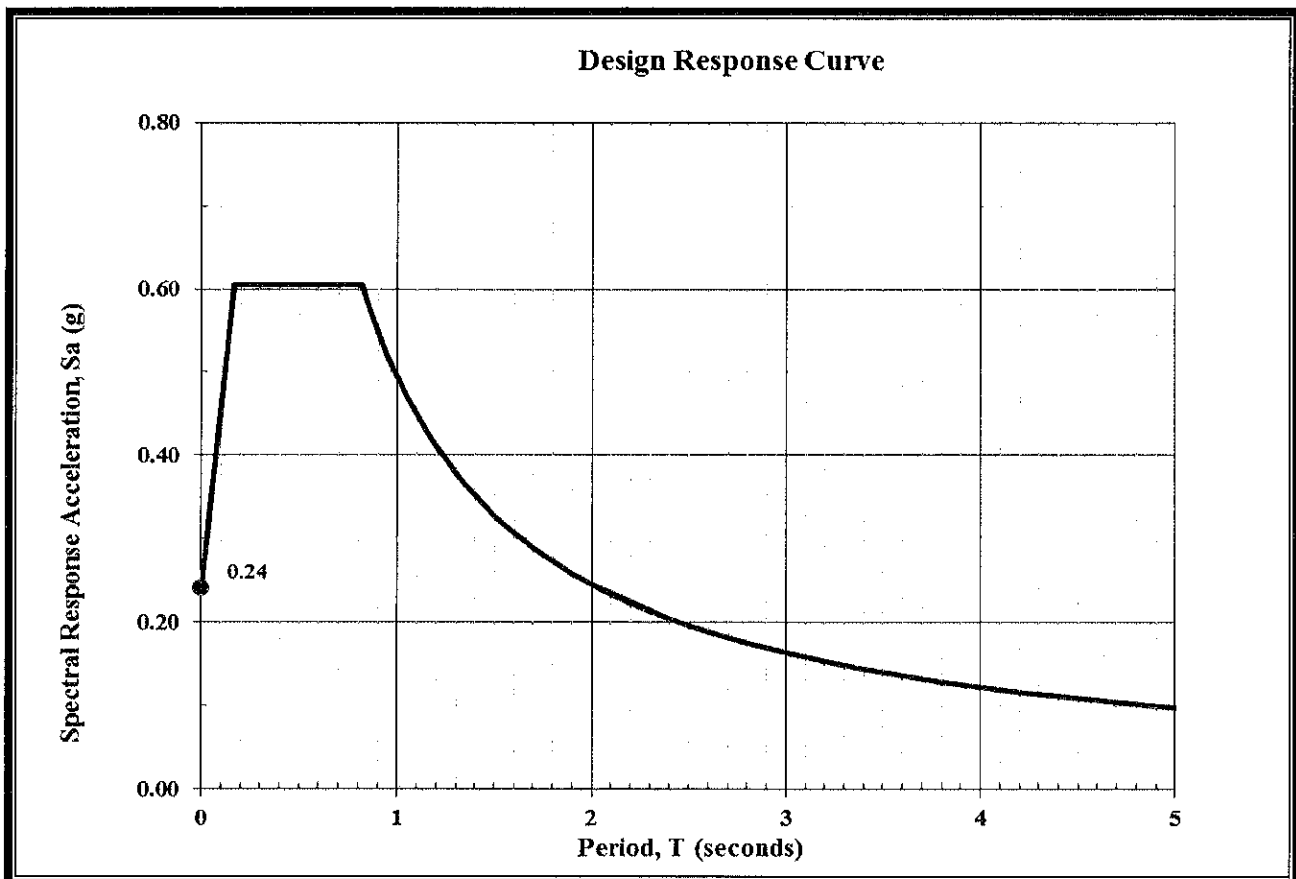


Figure 1 – Design Response Spectrum for the Proposed Additions to Terminal Building, Colleton County Airport, Aviation Way, Walterboro, SC

Liquefaction

Liquefaction is a deformation condition caused by repeated disturbance of a saturated cohesionless soil (sand). Essentially, under cyclic loading, such as that resulting from a seismic event, the soil tends to lose its shear strength and attain a semi-fluid like state. A study of earthquakes in the last century showed a range of liquefaction-induced damage, including failure of slopes, foundation failures and even flotation of buried structures.

When potentially liquefiable soils exist near the ground surface, as they do at this site, surface disruptions such as sand boils are possible. Such disruptions beneath structures supported at grade or on shallow foundations could result in a bearing capacity failure. In addition, densification of relatively loose soils can result in significant amounts of settlement under constructed facilities and subsequent structural damage.

A liquefaction analysis was performed considering the soil types encountered below the groundwater table in the soil borings and the MCE_G PGA. Seed's simplified procedure, as updated and documented by Youd et al (2001), which relates liquefaction potential to the standard penetration test resistance blow counts (based on the actual performance of soil deposits during earthquakes), was used to define potentially liquefiable zones of sand. The results of this analysis, based on a design earthquake with a magnitude of 7.3 and a maximum ground acceleration of 0.41g, indicate that potentially liquefiable layers of sands exist below the groundwater table and extend to a depth of approximately 28 feet below the ground surface.

Further analysis indicated that approximately 8 to 9 inches of liquefaction-induced total settlement could occur at this site as a result of the design seismic event. If the risks of liquefaction-induced settlement are not acceptable, they can generally be mitigated by performing ground modifications (e.g. vibro-compaction or vibro-replacement), by installing earthquake drains, or alternatively by supporting the proposed structure on deep foundations. If you desire additional information regarding these mitigation techniques, please contact us.



RECOMMENDATIONS

A study of the subsurface conditions encountered in the soil borings indicates that sands of reasonable density exist to depths of at least 20 feet at this site. However, as discussed in the Seismic Considerations section of this report, the seismic analysis indicated potential for liquefaction-induced settlement during the design seismic event due to the relatively loose sands at this site. Therefore, we recommend that the calculated potential liquefaction settlements be evaluated by the project structural engineer. If the risks of liquefaction-induced settlement are acceptable, the use of conventional shallow foundations should be suitable for support of the proposed structures. In addition, concrete floor slabs could be placed on controlled fill as described later in this report. Site preparation, controlled fill, and foundation recommendations are provided below.

If the calculated potential liquefaction settlements are not acceptable for this project, please contact us to discuss liquefaction mitigation alternatives or alternative foundation designs for this project.

Grading and Drainage

As previously indicated, the groundwater table was encountered in the borings at depths of approximately 4¾ feet to 5¼ feet below the existing ground surface. While excavating below the groundwater table, dewatering should be anticipated. Safety precautions must be taken to maintain the side slopes and bottoms of deeper excavations. With the potential for shallow groundwater conditions, significant consideration should be given to site drainage.

Before site work begins, the installation of additional or temporary drainage ditches will help control shallow groundwater conditions. If site work takes place during extended periods of dry weather, the need for extensive drainage improvements may be less critical. However, if site work takes place during wet weather conditions, more extensive drainage improvements will be required. Even during dry weather conditions, ditches and drainage improvements should be in place to handle any heavy rainfall that might occur during construction.



Temporary and permanent site drainage should be established to facilitate drainage away from the proposed structures and the existing structure. This will prevent soils beneath floor slabs and foundation elements from becoming saturated and minimize fluctuations in moisture contents. Positive site drainage is one of the most important factors influencing the long term performance of structural foundation elements and pavements.

Site Preparation

Site preparation should begin with the demolition and removal of any existing facilities that are not planned to remain within the proposed construction areas. In addition, any existing underground utilities within the proposed construction areas should be removed or relocated. Following the removal of existing facilities, proposed construction areas should be cleared and stripped of trees, stumps, roots, topsoil, and other organic debris. Any topsoil and organic material encountered within the project limits should be removed from the site or stored on site away from controlled fill if re-use for non-structural fill is desired. Stripping and undercutting should extend at least 5 feet beyond the proposed building addition footprints, where practicable.

After any organic material has been stripped and prior to placement of fill material, the remaining surface soils beneath the proposed building areas should be thoroughly and uniformly compacted in place. Recommendations for subgrade and backfill compaction are presented below. Following compaction, the proposed building areas should be proofrolled with a loaded dump truck or other similar rubber-tired, heavy construction equipment. A geotechnical engineer should monitor the proofrolling operations. Areas that pump, rut, or perform poorly during the proofrolling operations should be undercut and replaced with controlled fill as described below. After proofrolling and subsequent repairs, controlled fill can be placed in uniform lifts to bring the proposed building areas to finished grade. Please note that fill placement within the proposed building footprints should be performed as far in advance of settlement-sensitive construction as possible.

It is important to note that the site is currently developed. Our experience with developed sites indicates that unexpected conditions not encountered during subsurface exploration may be encountered during construction. Unexpected conditions may include active or abandoned utility lines, foundations or remnants of foundations from previous structures, areas of poorly compacted fill, subsurface debris, etc. Unexpected conditions, if encountered, can best be handled by on-site engineering evaluations.

Please note that care should be taken when performing excavation operations and compacting in-situ soils or backfill and fill adjacent to existing structures. If excavation operations are necessary adjacent to any existing structure that will not be demolished, sheeting or shoring may be necessary to ensure that the existing foundations are not undermined. In addition, large vibrating compaction equipment should not be used immediately adjacent to existing structures. Hand operated compaction equipment may be used to compact soils in these areas.

Backfill and Controlled Fill

Backfill and controlled fill should be non-plastic and granular in nature with a maximum of 15% passing the No. 200 sieve. Backfill and controlled fill soils should be as approved by the project geotechnical engineer and should generally consist of sands classified as SP, SP-SC, SC, SP-SM, or SM soils according to the Unified Soil Classification System. In addition, backfill and controlled fill should be free of roots, organics, and debris.

Backfill and controlled fill should be placed in thin successive layers 8 to 10 inches thick loose measurement, and each layer should be compacted to at least 95% of its maximum laboratory dry density, within $\pm 2\%$ of its optimum moisture content, in accordance with ASTM D1557 (Modified Proctor). However, large vibrating compaction equipment should not be used immediately adjacent to existing or recently constructed facilities or structures. Hand operated compaction equipment may be used to compact soils in these areas. If hand-operated

compaction equipment is used, the layer thickness should be reduced to approximately 6 inches thick loose measure.

In-place field density tests should be performed as backfill or controlled fill is being placed and compacted to ensure that required density and moisture conditions are being achieved. Since these testing services are within the scope of services we routinely provide for our clients, we urge that our firm be retained to provide testing services during the earthwork phase of this project.

Shallow Foundations

Based on the assumed maximum structural loads and fill heights, we recommend that shallow foundation systems be used to support the proposed structure if the risks of liquefaction-induced settlement are considered acceptable. If the site preparation procedures described in this report are followed, a maximum allowable soil contact pressure of 2,000 pounds per square foot (psf) can be used to design the foundations. To prevent punching failure of the foundations, minimum widths of 24 and 36 inches should be used for sizing of wall and column foundations, respectively. All foundations should bear at a minimum depth of 18 inches below the proposed ground surface.

Based on the assumed maximum structural loads and fill heights, total settlement of the proposed structure is expected to be on the order of 1 inch or less, approximately 50% of which is expected to be differential in nature. This estimated settlement is based on the static structural loading and is separate from the estimated settlement from seismic events previously discussed.

The final foundation bearing elevations should be evaluated by SCI personnel to verify that the bearing soils are capable of supporting the recommended maximum soil contact pressure and are suitable for foundation construction. These evaluations should include visual observations, hand rod probing, and dynamic cone penetrometer (DCP) testing among other methods deemed appropriate by the geotechnical engineer at the time of construction. These evaluations should be performed within each foundation excavation, and hand rod probing and DCP testing should



be performed in continuous foundation excavations at intervals not greater than 5 feet and 50 feet, respectively.

Exposure to the environment may weaken the soils at the foundation bearing level if the foundation excavations remain open for too long. Therefore, foundation concrete should be placed the same day that excavations are dug and compacted, if possible. If the bearing soils are softened by surface water intrusion or exposure, the softened soils must be either removed from the foundation excavation bottom or re-compacted prior to placement of concrete. Groundwater levels should be maintained at least 1 foot below the foundation subgrade to prevent softening and destabilization during construction. If necessary, dewatering may be accomplished by pumping from sumps located within the foundation excavations.

Soil-Supported Concrete Floor Slabs

Concrete slabs constructed on properly prepared and compacted existing site soils or properly prepared and compacted controlled fill material may be designed using a modulus of subgrade reaction (K_s) of 200 pounds per cubic inch (pci). The slabs should be designed utilizing the requirements for construction joints, expansion joints, and saw cuts as recommended by the American Concrete Institute (ACI) and should include a vapor barrier.

To avoid deterioration of the final subgrade soils during construction, the slab area should be graded to at least 1 foot above surrounding grade areas to promote positive drainage from the grade slab area. The slab-on-grade area should be placed with a slight crown in the middle to minimize standing or ponding water in the grade slab area. This crown should be maintained until grade slab construction is ready to proceed.

LIMITATIONS OF REPORT

This report was prepared as an instrument of service exclusively for Colleton County and the project design team in preparation of the foundation design, construction drawings, and construction specifications for the proposed additions to the existing terminal building located at the Colleton County Airport on Aviation Way in Walterboro, South Carolina. Recommendations and comments given in this report are based on the results of the soil borings, combined with interpolation of the subsurface conditions between borings, and the provided and assumed design data. In the event that any changes occur in the design concept or if conditions are encountered during construction that appear to be different from those represented, the conclusions and recommendations contained in this report shall not be considered valid until the changes are reviewed by SCI and the conclusions verified in writing.

SCI should be given the opportunity to review the design and construction documents. The purpose of this review is to verify that our recommendations are properly interpreted into the project plans and specifications. Review of design and construction documents is not within the scope of authorized services outlined in our proposal for this project; therefore, additional fees would apply.

SCI's report has been prepared in accordance with generally accepted geotechnical engineering practice with a degree of care and skill ordinarily exercised by reputable geotechnical engineers practicing in this area and the area of the site. Verification of subsurface conditions for the purpose of determining the difficulty of excavation, dewatering, and other construction issues is the responsibility of others specializing in those areas.

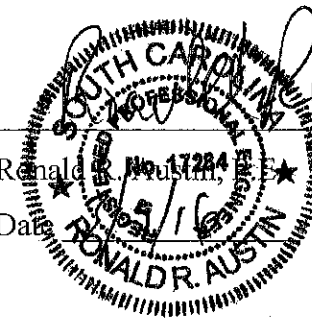
Proposed Building Additions, Colleton County Airport, Aviation Way, Walterboro, SC
SCI Project 160018
March 9, 2016
Page 15

We appreciate the opportunity to be of service to you during the design phase of this project.
If we may be of further assistance during design or as construction proceeds, please call.

Reviewed by:

Studies and analyses by:


A. Talbot Henderson
Date 3/9/2016


Ronald R. Austin
Date 3/5/16

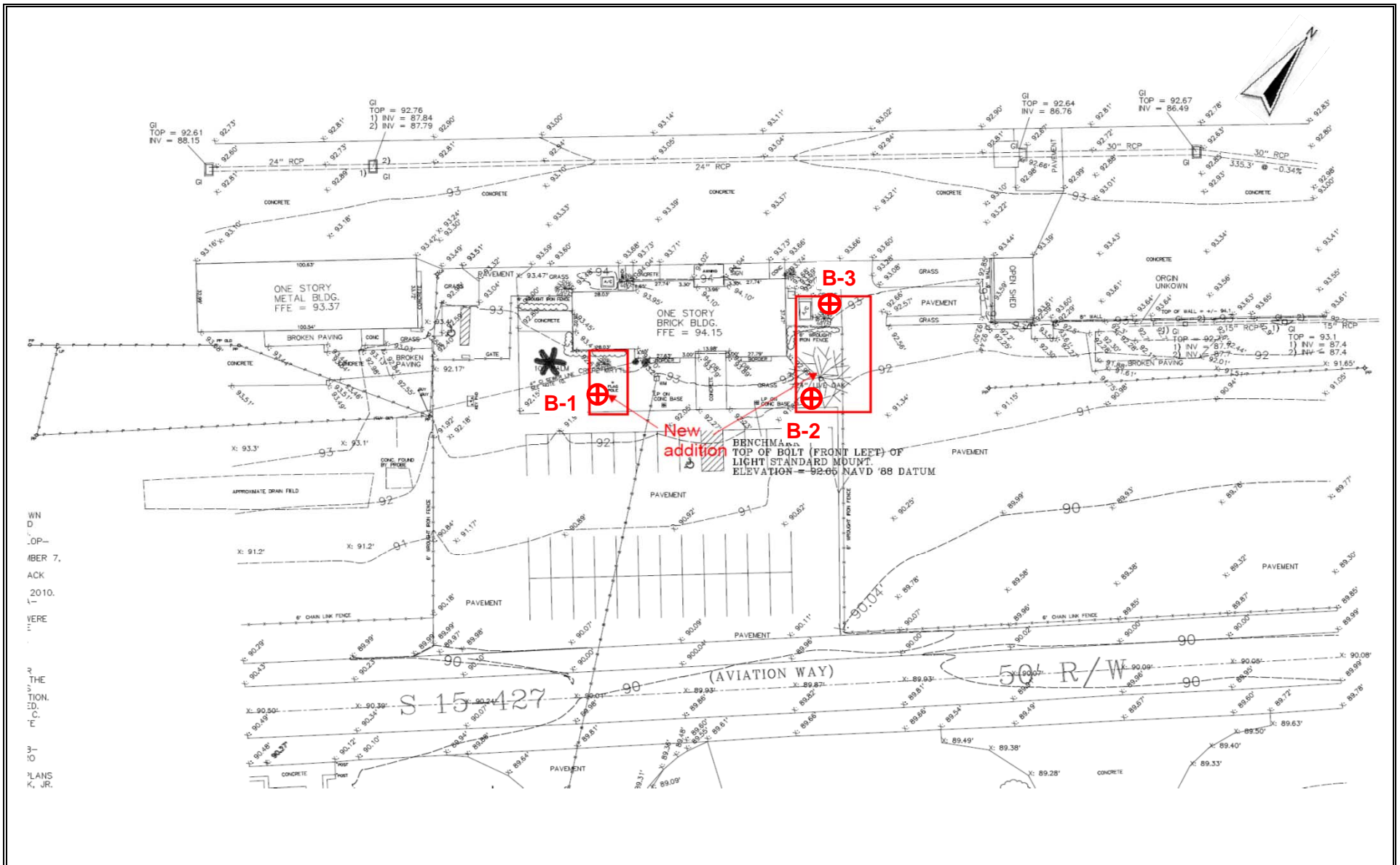
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Enclosures



SCI

SOIL CONSULTANTS, INC.



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LEGEND	
⊕	Soil Test Boring Location (B)
BORING LOCATION PLAN	
Proposed Additions to Terminal Building Colleton County Airport, Aviation Way Walterboro, South Carolina	

Reference: Site plan provided by client and adapted by Soil Consultants, Inc.		Boring locations are approximate.	
SOIL CONSULTANTS, INC.		SCALE: Not to Scale	PROJECT NO.: 160018
ENGINEERS AND GEOLOGISTS		DRAWN BY: RRA	DATE: March 8, 2016
SINCE 1951		CHECKED BY: ATH	FIGURE NO.: 1



LOG OF BORING B-1

Project: PROPOSED ADDITIONS TO TERMINAL BUILDING,
COLLETON COUNTY AIRPORT, AVIATION WAY

Location: WALTERBORO, SOUTH CAROLINA

SCI No.: 160018

Datum: Ground Surface

Elevation: Unknown

Date: 2/19/2016

GWT (ft): 5.2

Strata	Sample	Depth (feet)	Visual Description (Unified Soil Classification System)	Actual Blows/6"	Corrected "N" Values			
					0	25	50	75
	1		MEDIUM DENSE BROWN FINE SAND WITH SILT AND ROOTS (SP-SM)	1-3-5		15		
	2		MEDIUM DENSE BROWN FINE SAND WITH SILT (SP-SM)	5-7-6		23		
	3	5	MEDIUM DENSE TAN FINE SAND WITH SILT (SP-SM)	3-4-5		15		
	4		VERY LOOSE BROWN FINE SAND WITH SILT (SP-SM)	2-1-1	3			
	5	10	LOOSE REDDISH-BROWN FINE SAND WITH SILT (SP-SM)	1-2-2	7			
	6		MEDIUM DENSE REDDISH-BROWN FINE SAND WITH SILT (SP-SM)	3-5-5		17		
	7	15	MEDIUM DENSE BROWN FINE SAND WITH SILT (SP-SM)	6-7-9		27		
	8		MEDIUM DENSE BROWN FINE SAND WITH SILT (SP-SM)	3-6-8		26		
	9	20	MEDIUM DENSE TAN FINE SAND WITH SILT (SP-SM)	3-4-7		20		
	10	25	VERY LOOSE TAN FINE SAND WITH SILT (SP-SM)	2-1-1	3			
		30						

Remarks:

SHOVEL SAMPLE TAKEN ADJACENT TO BORING INDICATED VARYING ROOT CONTENT TO A DEPTH OF APPROXIMATELY 3 INCHES.

PLOTTED "N" VALUES ARE CORRECTED TO N_{60} VALUES FOR CLAYS AND $(N_1)_{60}$ VALUES FOR SANDS. BORING PERFORMED USING MUD-ROTARY.

Testing and Sampling
in accordance with
ASTM D 1586-08a

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PRIMARY CORR N 160018 PRIMARY CORR N GPJ PRIMARY GDT 3/10/16



LOG OF BORING B-1

Project: PROPOSED ADDITIONS TO TERMINAL BUILDING,
COLLETON COUNTY AIRPORT, AVIATION WAY

Location: WALTERBORO, SOUTH CAROLINA

SCI No.: 160018

Datum: Ground Surface

Elevation: Unknown

Date: 2/19/2016

GWT (ft): 5.2

Strata	Sample	Depth (feet)	Visual Description (Unified Soil Classification System)	Actual Blows/6"	Corrected "N" Values			
					0	25	50	75
	11	0	VERY LOOSE TAN SILTY FINE SAND (SM)	WOH/18"--	0			
	12	35	LOOSE GRAY AND TAN SILTY FINE SAND (SM)	1-1-3	6			
	13	40	MEDIUM DENSE GRAY AND TAN SILTY FINE SAND (SM)	4-6-7	20			
			<i>BORING B-1 TERMINATED AT A DEPTH OF 41.5 FEET</i>					
			45					
			50					
			55					
			60					

Remarks:

SHOVEL SAMPLE TAKEN ADJACENT TO BORING INDICATED VARYING ROOT CONTENT TO A DEPTH OF APPROXIMATELY 3 INCHES.

PLOTTED "N" VALUES ARE CORRECTED TO N_{60} VALUES FOR CLAYS AND $(N_1)_{60}$ VALUES FOR SANDS.
BORING PERFORMED USING MUD-ROTARY.

Testing and Sampling
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LOG OF BORING B-2

Project: PROPOSED ADDITIONS TO TERMINAL BUILDING,
COLLETON COUNTY AIRPORT, AVIATION WAY

Location: WALTERBORO, SOUTH CAROLINA

SCI No.: 160018

Datum: Ground Surface

Elevation: Unknown

Date: 2/19/2016

GWT (ft): 5

Strata	Sample	Depth (feet)	Visual Description (Unified Soil Classification System)	Actual Blows/6"	Corrected "N" Values			
					0	25	50	75
	1		MEDIUM DENSE BROWN FINE SAND WITH SILT AND ROOTS (SP-SM)	1-2-5		13		
	2		DENSE BROWN FINE SAND WITH SILT (SP-SM)	5-10-13			40	
	3	5	MEDIUM DENSE TAN FINE SAND WITH SILT (SP-SM)	3-5-6		18		
	4		LOOSE BROWN FINE SAND WITH SILT (SP-SM)	1-2-2	7			
	5	10	LOOSE BROWN FINE SAND WITH SILT (SP-SM)	1-2-2	7			
	6		DENSE BROWN FINE SAND WITH SILT (SP-SM)	3-8-14			38	
	7	15	MEDIUM DENSE TAN FINE SAND WITH SILT (SP-SM)	4-3-5		13		
	8		MEDIUM DENSE TAN FINE SAND WITH SILT (SP-SM)	4-7-9			29	
	9	20	MEDIUM DENSE TAN FINE SAND WITH SILT (SP-SM)	3-4-7			20	
			<i>BORING B-2 TERMINATED AT A DEPTH OF 21.5 FEET</i>					
		25						
		30						

Remarks:

SHOVEL SAMPLE TAKEN ADJACENT TO BORING INDICATED VARYING ROOT CONTENT TO A DEPTH OF APPROXIMATELY 3 INCHES.

PLOTTED "N" VALUES ARE CORRECTED TO N_{60} VALUES FOR CLAYS AND $(N_1)_{60}$ VALUES FOR SANDS.
BORING PERFORMED USING MUD-ROTARY.

Testing and Sampling
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PRIMARY CORR N 160018 PRIMARY CORR N.G.P.J. PRIMARY.GDT 3/8/16



LOG OF BORING B-3

Project: PROPOSED ADDITIONS TO TERMINAL BUILDING,
COLLETON COUNTY AIRPORT, AVIATION WAY

Location: WALTERBORO, SOUTH CAROLINA

SCI No.: 160018

Datum: Ground Surface

Elevation: Unknown

Date: 2/19/2016

GWT (ft): 4.8

Strata	Sample	Depth (feet)	Visual Description (Unified Soil Classification System)	Actual Blows/6"	Corrected "N" Values			
					0	25	50	75
	1		MEDIUM DENSE BROWN FINE SAND WITH SILT AND ROOTS (SP-SM)	1-3-8		21		
	2		MEDIUM DENSE BROWN FINE SAND WITH SILT (SP-SM)	5-7-7		25		
		5						
	3		MEDIUM DENSE TAN FINE SAND WITH SILT (SP-SM)	3-4-4		13		

	4		LOOSE BROWN FINE SAND WITH SILT (SP-SM)	1-2-3		9		
		10						
	5		LOOSE BROWN FINE SAND WITH SILT (SP-SM)	1-2-2		7		

	6		MEDIUM DENSE BROWN FINE SAND WITH SILT (SP-SM)	1-3-6		16		
		15						
	7		MEDIUM DENSE BROWN FINE SAND WITH SILT (SP-SM)	6-7-7		24		
	8		MEDIUM DENSE BROWN FINE SAND WITH SILT (SP-SM)	1-3-5		15		
		20						
	9		MEDIUM DENSE BROWN FINE SAND WITH SILT (SP-SM)	3-4-7		20		
			BORING B-3 TERMINATED AT A DEPTH OF 21.5 FEET					
		25						
		30						

Remarks:

SHOVEL SAMPLE TAKEN ADJACENT TO BORING INDICATED VARYING ROOT CONTENT TO A DEPTH OF APPROXIMATELY 3 INCHES.

PLOTTED "N" VALUES ARE CORRECTED TO N_{60} VALUES FOR CLAYS AND $(N_1)_{60}$ VALUES FOR SANDS.
BORING PERFORMED USING MUD-ROTARY.

Testing and Sampling
in accordance with
ASTM D 1586-08a

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PRIMARY CORR N 160018 PRIMARY CORR N.G.P.J. PRIMARY.GDT 3/8/16

Field Exploratory Procedures

Soil Boring

A soil boring is simply the process of advancing a hole in the ground by some means and obtaining samples of soil at stated intervals or at changes of stratum. In the usual procedure involving the Standard Penetration Test (SPT), the hole is advanced by augering or by use of rotary drills with various types of bits cutting the soil. The hole is cleaned with flight augers or with water being pumped to remove the cuttings.

When a sample is desired, a split-spoon sampler of 2-inch outside diameter and 1³/₈-inch inside diameter is lowered to the bottom of the hole, seated a distance of 6 inches, and driven an additional 1 foot into the soil with a standard weight (140 pounds) dropping a standard distance (30 inches). The number of blows required to drive the spoon the final foot is called the "N" value. As specified by the American Society for Testing and Materials, ASTM Designation D1586-08a, the number of blows of the standard weight required to seat the sampler as well as the number of blows required to drive the sampler the final foot (in two 6-inch increments) is recorded on the boring log. Tables showing an approximate correlation between soil strength and "N" value are shown on Plate 2.

Usually, the zone most heavily stressed by the average foundation is within the top 10-20 feet of soil. Therefore, in all borings, we perform the SPT at ground surface and at 2½-foot intervals to a depth of 20 feet, and at 5-foot intervals thereafter to the depth of the boring. After each SPT has been made, the split-spoon sampler is brought to the surface and a visual description of the soil found in the sampler is recorded on the boring log. Each sample is then placed in a container to be returned to the laboratory for verification of the field classification. Following completion of each boring, the depth to the groundwater table (GWT) below the ground surface is measured. In the case of cohesionless soil, the position of the GWT is most critical, since a high water table decreases bearing capacity and increases settlement potential.

After the soil has been returned to the laboratory, its visual description is verified and the soil is graded in accordance with the Unified Soil Classification System (USCS). A brief description of the USCS and the different classes of soil are discussed on Plate 3.

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	Proposed Additions to Terminal Building Colleton County Airport, Aviation Way Walterboro, South Carolina		
PLATE 1	DATE	PROJECT NO.	INITIALS
	March 9, 2016	160018	RRA

Standard Penetration Tests and Soil Characteristics

The "standard" penetration resistance can be used as an indication of the density of granular soils (sands and gravels) and the apparent strength of cohesive soils (silts and clays).

RELATIVE DENSITY OF GRANULAR SOILS

<i>Number of SPT Blows or "N" Value</i>	<i>Relative Density</i>
0 - 4	Very Loose
5 - 10	Loose
11 - 30	Medium Dense
31 - 50	Dense
Over 50	Very Dense

CONSISTENCY OF COHESIVE SOILS

<i>Number of SPT Blows or "N" Value</i>	<i>Consistency</i>
0 - 2	Very Soft
3 - 4	Soft
5 - 8	Medium (firm)
9 - 15	Stiff
16 - 30	Very Stiff
Over 30	Hard

While individual test boring records are considered representative of subsurface conditions at the respective boring locations on the dates the borings were performed, it is not warranted that they are representative of subsurface conditions at other locations and times.

THE ABOVE TABLES ARE BASED ON INFORMATION PRESENTED IN SOIL MECHANICS IN ENGINEERING PRACTICE BY DR. KARL TERZAGHI AND DR. RALPH B. PECK.

<p style="text-align: center;">SOIL CONSULTANTS, INC ENGINEERS AND GEOLOGISTS <i>Since 1951</i> CHARLESTON, S.C. MYRTLE BEACH, S.C.</p>	TITLE		
	Proposed Additions to Terminal Building Colleton County Airport, Aviation Way Walterboro, South Carolina		
PLATE 2	DATE	PROJECT NO.	INITIALS
	March 9, 2016	160018	RRA

Unified Soil Classification System

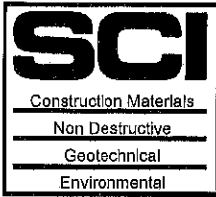
The Unified Soil Classification System (USCS) is the most widely used method for classifying soils according to their properties and characteristics. Essentially, there are two broad categories:

- **Coarse-grained soils** – soils that are gravelly and sandy in nature with less than 50% of the soil particles capable of passing through a standard No. 200 sieve (mesh openings measuring approximately 0.075 mm). The individual group symbols start with prefixes of either *G* (gravel or gravelly soil) or *S* (sand or sandy soil).
- **Fine-grained soils** – soils with more than 50% passing through a No. 200 sieve. The groups start with prefixes of *M* (inorganic silt), *C* (inorganic clay), *O* (organic silts and clays), and *Pt* (peat, muck and other highly organic soils).

Other symbols used are *W* (well-graded), *P* (poorly graded), *L* (low plasticity) and *H* (high plasticity). Some common individual groups are as follows:

Group Symbols	Soil Types
GW	Well-graded gravels or gravel sand mixtures, little or no fines
GP	Poorly graded gravels or gravel-sand mixtures, little or no fines
GM	Silty gravel, gravel-sand-silt mixtures
GC	Clayey gravels, gravel-sand-clay mixtures
SW	Well-graded or gravelly sands, little or no fines
SP	Poorly graded sands or gravelly sands, little or no fines
SM	Silty sands, sand-silt mixtures
SC	Clayey sands, sand-clay mixtures
ML	Inorganic silts and very fine sands, rock flour, silty or clayey fine sands, clayey silts with slight plasticity
CL	Inorganic clays of low to medium plasticity, gravelly clays, silty clays, lean clays
OL	Organic silts and organic silt-clays of low plasticity
MH	Inorganic silts, micaceous or diatomaceous fine, sandy or silty soils, elastic silts
CH	Inorganic clays of medium to high plasticity, fat clays
OH	Organic clays of medium to high plasticity, organic silts
Pt	Peat and other highly organic soils

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	Proposed Additions to Terminal Building Colleton County Airport, Aviation Way Walterboro, South Carolina		
PLATE 3	DATE	PROJECT NO.	INITIALS
	March 9, 2016	160018	RRA



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ENGINEERS AND GEOLOGISTS

SINCE 1951

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Acct. No: **CO182** Project No: **160018** Date Sampled: **03/23/2016**
 Report Date: **03/28/2016** Sampled By:
 Project: **Building Additions, Colleton County Airport Building,** By Order Of: **Client**
Aviation Way - Walterboro, SC
 Location: Order Number:

Client: **COLLETON COUNTY**

REPORT: **Amount of Material in Soils Finer than No. 200 (75-µm)** LAB NO: **41300-1**

Client PO: **22615** TEST RESULTS Report No: **41300-1**
 Page 1 of 1

Date Received: Received From:

Test No.	Sample Identification	Initial Dry Mass, g	Percent Finer than No. 200 Sieve, %-200
1	B-1 7.5-9.0'	293.2	13.8%
2	B-1 10.0-11.5'	270.9	14.5%
3	B-1 12.5-14.0'	286.4	9.7%
4	B-1 25.0-26.5'	280.1	16.1%
5	B-2 5.0-6.5'	330.4	3.8%
6	B-2 7.5-9.0'	347.1	8.0%
7	B-2 10.0-11.5'	362.0	11.1%
8	B-3 7.5-9.0'	310.8	11.8%
9	B-3 10.0-11.5'	286.7	7.3%
10	B-3 12.5-14.0'	319.6	8.0%

Test Method: ASTM D1140, Method A

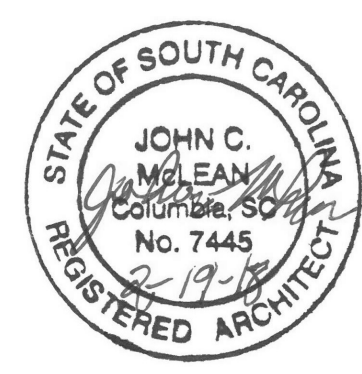
Notes:

Orig: COLLETON COUNTY Attn: MR. JOHN STIEGLITZ
 (1-cc copy)

Respectfully Submitted,
 SOIL CONSULTANTS, INC.



Ronald R. Austin
 P.E., Vice President



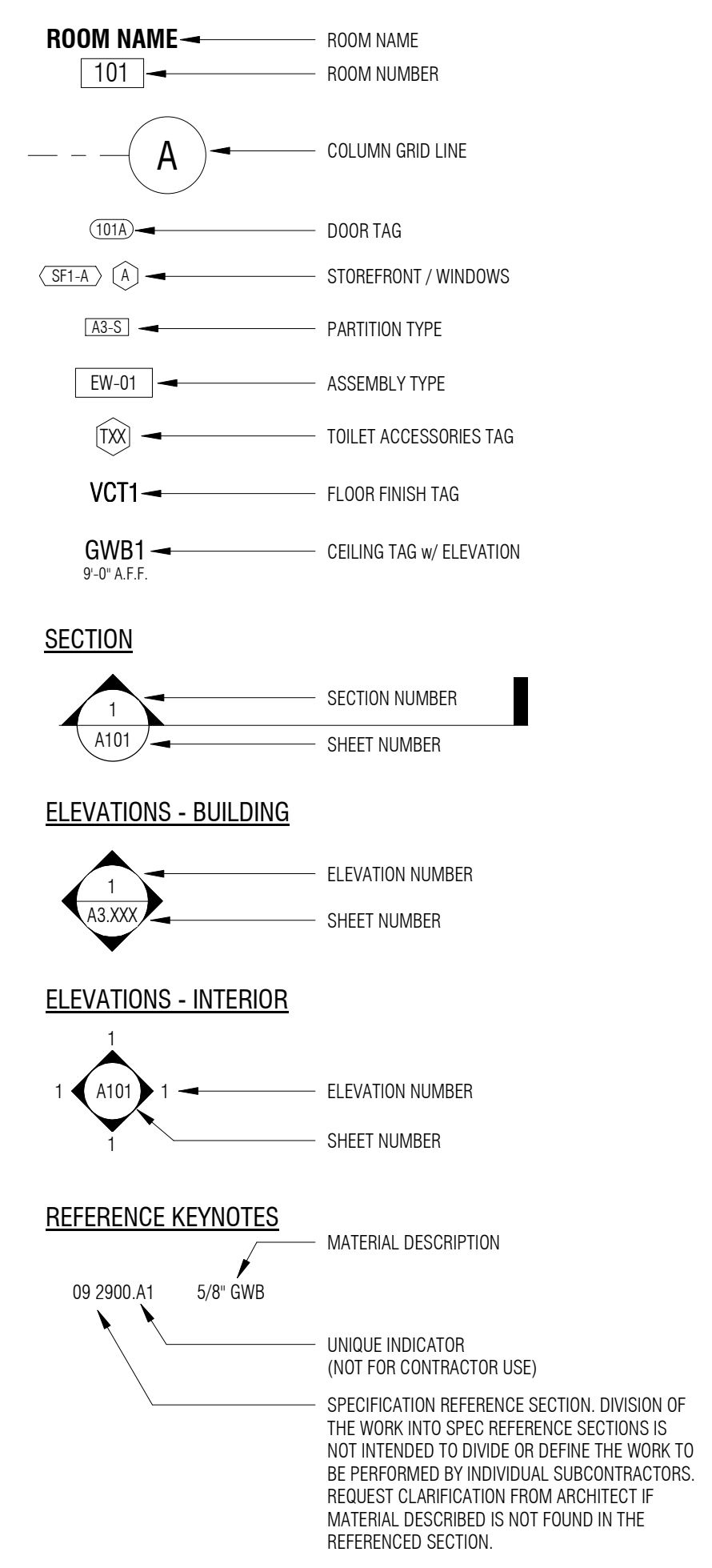
ISSUE DATE: FEBRUARY 19, 2018
PHASE: BIDDING DOCUMENTS

#	DATE	REVISION

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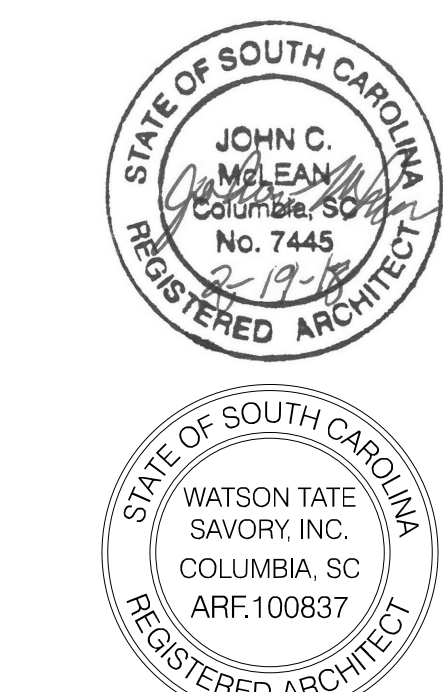
SYMBOLS:



ABBREVIATIONS

&	AND
@	AT
A.F.F.	ABOVE FINISH FLOOR
ACT	ACOUSTICAL CEILING TILE
AESS	ARCHITECTURAL EXPOSED STRUCTURAL STEEL
AWI	AMERICAN WOOD INSTITUTE
CFMF	COLD FORMED METAL FRAMING
CJ	CONTROL JOINT
CL	CENTERLINE
CONC	CONCRETE
CPT	CARPET
DIA	DIAMETER
DS	DOWNSPOUT
EA	EACH
EF	EACH FACE
EIFS	EXTERIOR INSULATION FINISH SYSTEMS
EJ	EXPANSION JOINT
EQ	EQUAL
EWC	ELECTRICAL WATER COOLER
EXST	EXISTING
F.O.	FACE OF
FE	FIRE EXTINGUISHER
FEC	FIRE EXTINGUISHER CABINET
FLU	FLUOROPOLYMER FINISH
GA	GAUGE
GWB	GYPSUM WALL BOARD
HGT	HEIGHT
HVAC	HEATING VENTILATION AIR CONDITIONING
MATL	MATERIAL
MAX	MAXIMUM
MFG	MANUFACTURER
MIN	MINIMUM
MTL	METAL
NIC	NOT IN CONTRACT
NO	NUMBER
O.C.	ON CENTER
OD	OVERFLOW DRAIN
OH	OPPOSITE HAND
PT	PAINT
RCP	REFLECTED CEILING PLAN
RD	ROOF DRAIN
SIM	SIMILAR
SPNK	SPRINKLERED
T.O.	TOP OF
TBD	TO BE DETERMINED
TEMP	TEMPORARY
TYP.	TYPICAL
U.N.O.	UNLESS NOTED OTHERWISE
VCT	VINYL COMPOSITE TILE
w/	WITH
WD	WOOD

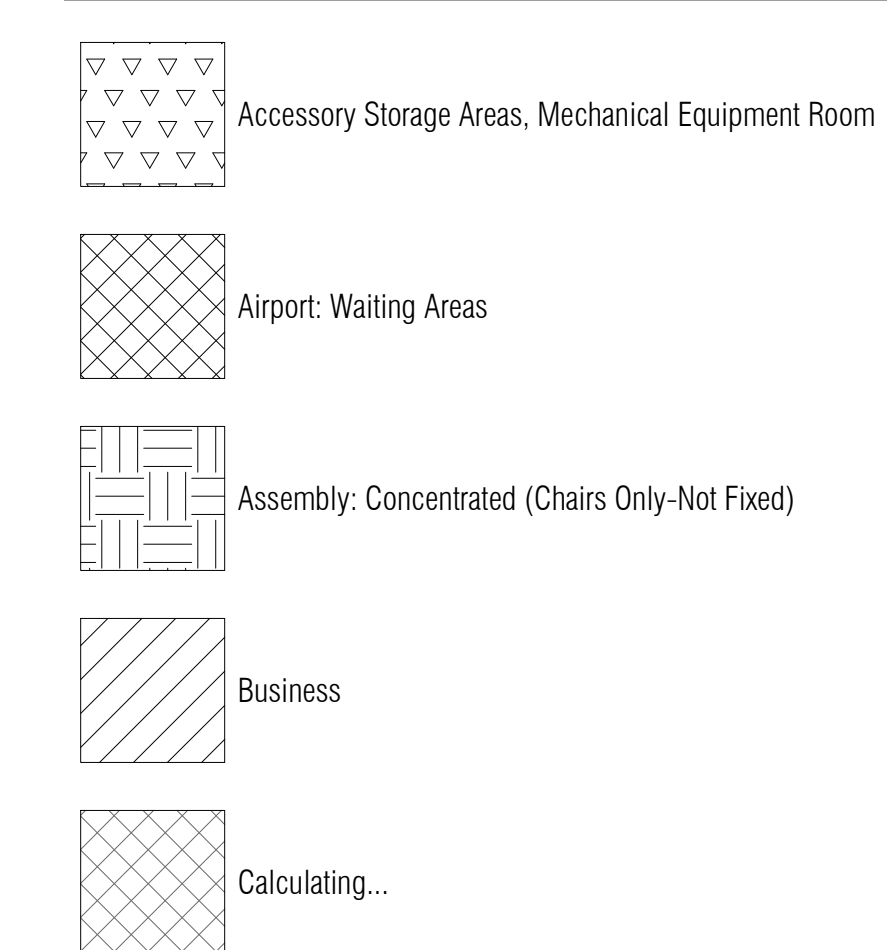
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#	DATE	REVISION

OCCUPANCY SCHEDULE				
ABBREV.	OCCUPANCY TYPE FUNCTION OF SPACE	FLOOR AREA	MAX AREA ALLOWED PER OCCUPANT	PERSONS ON FLOOR FOR THIS FUNCTION
A-3	Airport: Waiting Areas	362 SF	15 SF	25
A-3	Assembly: Concentrated (Chairs Only-Not Fixed)	1132 SF	7 SF	162
B	Business	2109 SF	100 SF	23
S-2	Accessory Storage Areas, Mechanical Equipment Room	286 SF	300 SF	4
		3888 SF (net areas only)		214

OCCUPANCY TYPE LEGEND:



CODE SUMMARY:

International Building Code 2012

Total Proposed Occupant Load: 212 people
Construction Classification: Type V-B (combustible wood)
Occupancy Group (per 303.4): Assembly Group A-3

Building Height and Area (per table 503 (for A-3 Type V-B))
Allowed: 1-story, 40'-0" tall: 6,000 S.F.
Frontage Increase 75%: 4,500 S.F.
Total Allowed: 10,500 S.F.
Proposed: 1-story, 29'-8" tall: 4,695 S.F.

Entire building is less area than allowed by most restrictive occupancy type (A-3), considered mixed, nonseparated occupancies per 508.3

No fire separation proposed at any building components

Sprinkler System
No sprinkler system is proposed per section 903.2.1.3 Group A-3:
1. no fire area of 12,000 s.f. or more
2. no fire area with occupant load of 300 or more
3. no fire area on level other than a level of exit discharge

Egress Widths
Required Exit Width: 212 persons x 0.2' = 42.4'
Provided Exit Widths:
(3) Double Doors: 68 1/2" each
(1) Single Door: 33 1/2"
Total = 239"

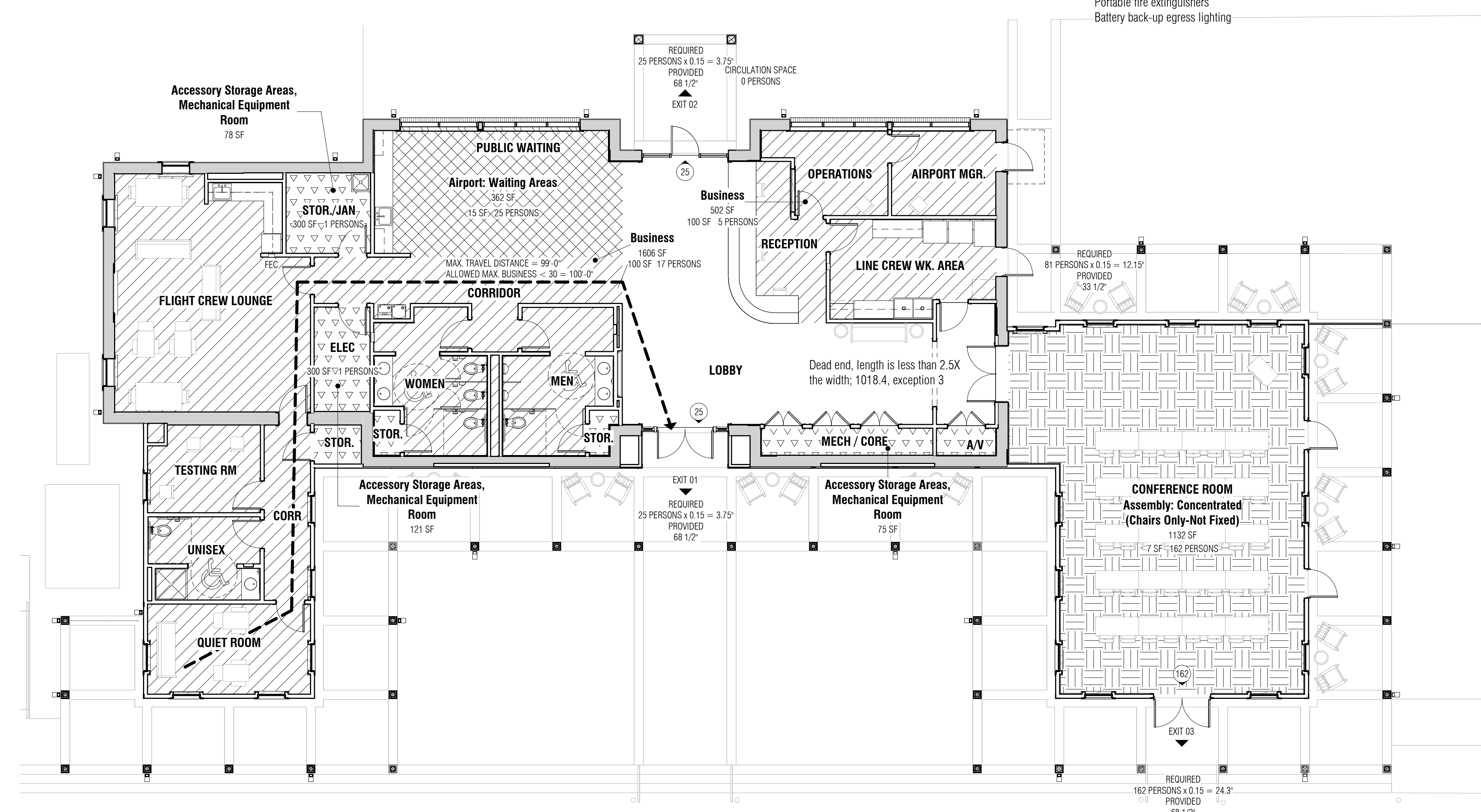
Draftstopping is required for combustable attic areas of greater than 3,000 s.f. per 718.4.3. Existing draftstopping at centerline of lobby from 2005 roof truss replacement shall be maintained to divide 4,700 s.f. attic into two roughly equal portions so there is less than 3,000 s.f. per compartment.

Cross ventilation for enclosed attics per 1203.2, exception 1: net free ventilating area = 1/300
East: 2,300 SF / 2,300/300 = 7.66 SF (1,104 SI) min. (50% high; 552 SI)
West: 2,400 SF / 2,400/300 = 8.00 SF (1,152 SI) min. (50% high; 576 SI)

Worst case: Base Bid-ventilating clearstory at east and west ridges not provided, east roof over meeting room not extended north or south.
Proposed ridge vent provides: 18 SI/LF
Coupola has (4) louvers, each providing 324 SI of free area. Coupola divided so two louvers within each of the two attic areas.
East attic area: 61 LF of ridge vent x 18 SI/LF = 1098 SI
(2) coupola louvers @ 324 SI = 648 SI
(2) triangular gable louvers @ 410 SI = 820 SI
1098 SI + 648 SI + 820 SI = 2,566 SI up high
Provide 2,566 SI min. at soffits to maintain balance
46 LF of vented soffit @ 4.5 SI/LF = 207 SI of free area
175 LF of wall vent @ 14.5 SI/LF = 2,537 SI of free area
207 SI + 2,537 SI = 2,744 SI at soffits (>2,566 SI)
Required: 1,104 SI Provided: 5,310 SI
West attic area: 60 LF of ridge vent x 18 SI/LF = 1080 SI
(2) coupola louvers @ 324 SI = 648 SI
(1) triangular gable louvers @ 410 SI = 410 SI
1080 SI + 648 SI + 410 SI = 2,138 SI up high
Provide 2,138 SI min. at soffits to maintain balance
121 LF of vented soffit @ 4.5 SI/LF = 544 SI of free area
121 LF of wall vent @ 14.5 SI/LF = 1,754 SI of free area
544 SI + 1,754 SI = 2,298 SI at soffits (>2,138 SI)
Required: 1,152 SI Provided: 4,436 SI

Proposed:
Portable fire extinguishers
Battery back-up egress lighting

MINIMUM PLUMBING FIXTURES REQUIRED/PROVIDED				per IBC Table 2902.1	
Assembly: Concentrated (Chairs Only-Not Fixed)					
Male:	Water Closets	1 per 125	162 Persons (81 Male and 81 Female)	81/125 = 0.648	
	Lavatories	1 per 200		81/200 = 0.405	
Female:	Water Closets	1 per 65		81/65 = 1.246	
	Lavatories	1 per 200		81/200 = 0.405	
	Drinking Fountain	1 per 500		162/500 = 0.324	
Airport: Waiting Areas					
Male:	Water Closets	1 per 500	25 Persons (12.5 Male and 12.5 Female)	12.5/500 = 0.025	
	Lavatories	1 per 750		12.5/750 = 0.017	
Female:	Water Closets	1 per 500		12.5/500 = 0.025	
	Lavatories	1 per 750		12.5/750 = 0.017	
	Drinking Fountain	1 per 1,000		25/1,000 = 0.025	
Business					
Male:	Water Closets	1 per 25 (1 per 50 R)	22 Persons (11 Male and 11 Female)	11/25 = 0.440	
	Lavatories	1 per 40 (1 per 80 R)		11/40 = 0.275	
Female:	Water Closets	1 per 25 (1 per 50 R)		11/25 = 0.440	
	Lavatories	1 per 40 (1 per 80 R)		11/40 = 0.275	
	Drinking Fountain	1 per 100		22/100 = 0.220	
Accessory Storage Areas, Mech. Equipment Room					
Male:	Water Closets	1 per 100	4 Persons (2 Male and 2 Female)	2/100 = 0.02	
	Lavatories	1 per 100		2/100 = 0.02	
Female:	Water Closets	1 per 100		2/100 = 0.02	
	Lavatories	1 per 100		2/100 = 0.02	
	Drinking Fountain	1 per 1000		4/1000 = 0.004	
Totals:					
Male:	Water Closets			0.648 + 0.025 + 0.440 + 0.02 = 1.133	
	Lavatories			0.405 + 0.017 + 0.275 + 0.02 = 0.717	
Female:	Water Closets			1.246 + 0.025 + 0.440 + 0.02 = 1.731	
	Lavatories			0.405 + 0.017 + 0.275 + 0.02 = 0.717	
	Drinking Fountain			0.324 + 0.025 + 0.220 + 0.004 = 0.573	
Required:					
Male:	2 Water Closet		3 Water Closet (2 Urinals)		
	1 Lavatory		2 Lavatory		
Female:	2 Water Closets		3 Water Closets		
	1 Lavatory		2 Lavatory		
Overall:	1 Drinking Fountain		2 Drinking Fountains		
	1 Service Sink		1 Service Sink		
	1 Water Closet		1 Water Closet		
	1 Shower		1 Shower		

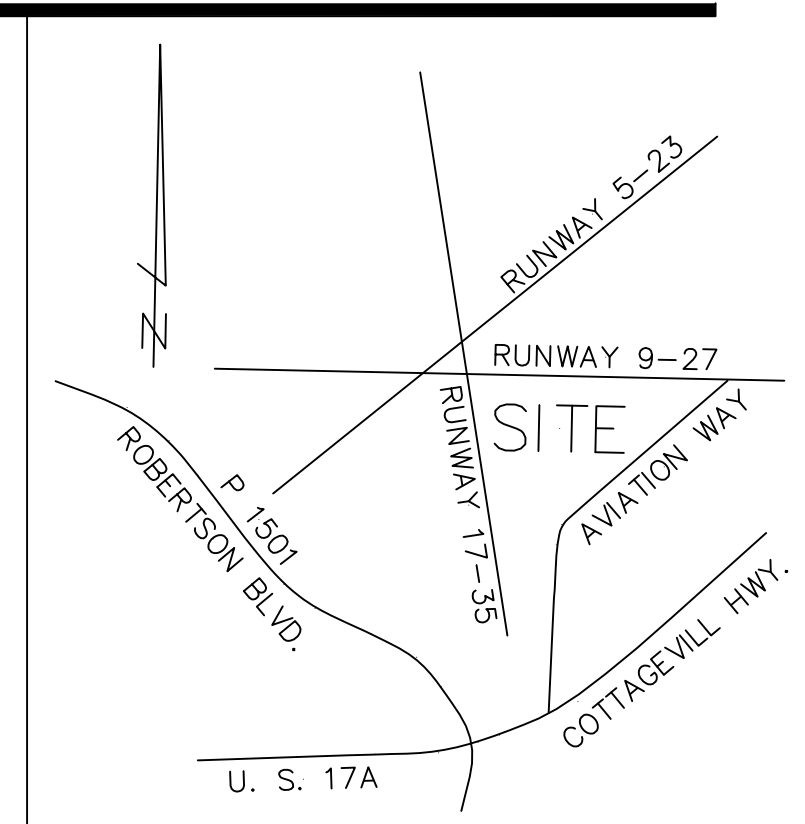


LIFE SAFETY PLAN - FIRST FLOOR
1/8" = 1'-0"

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VICINITY MAP

ARCHITECTURE
INTERIORS
PLANNING

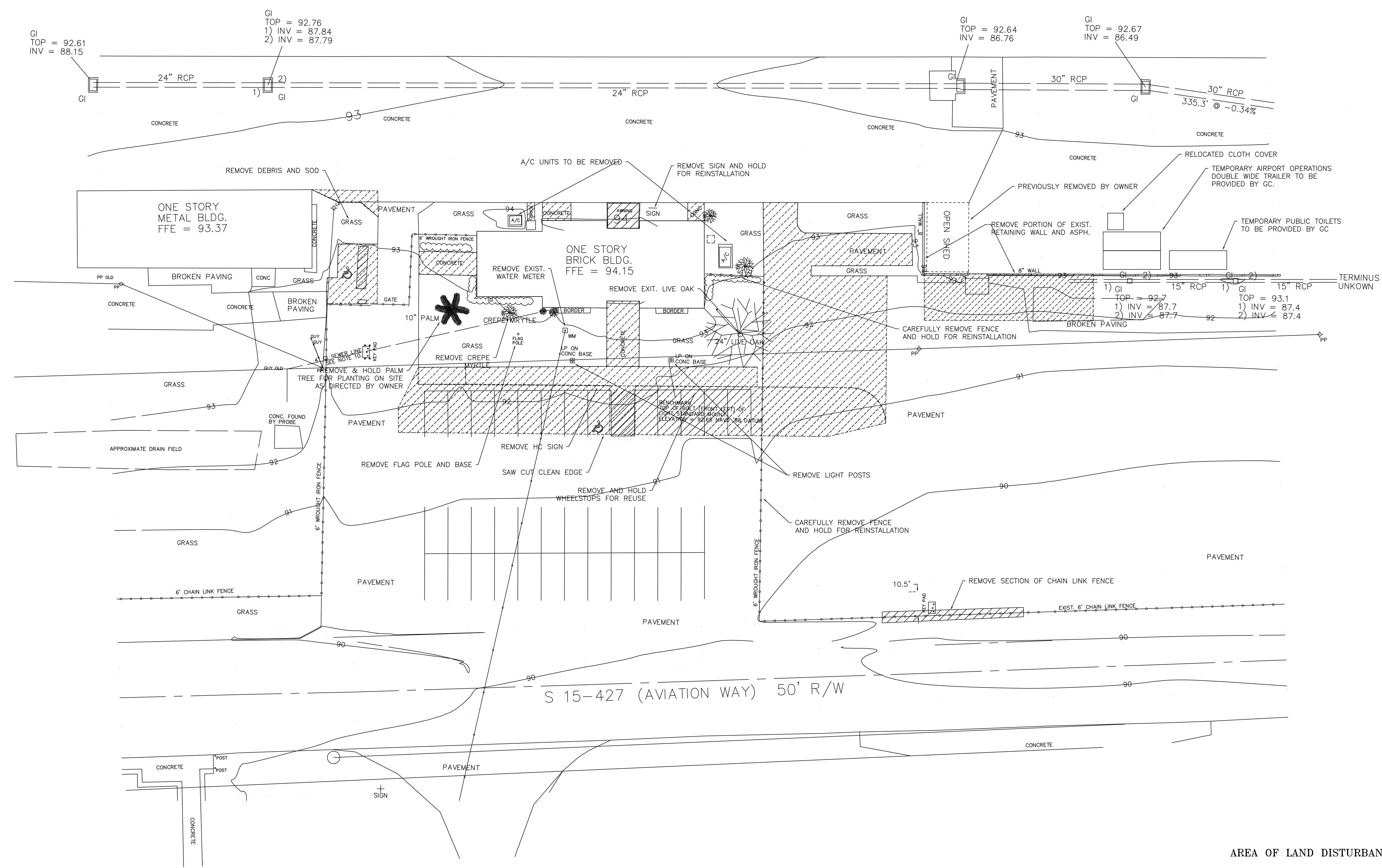
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LOWCOUNTRY REGIONAL AIRPORT TERMINAL EXPANSION
COLLETON COUNTY
WALTERBORO, SC

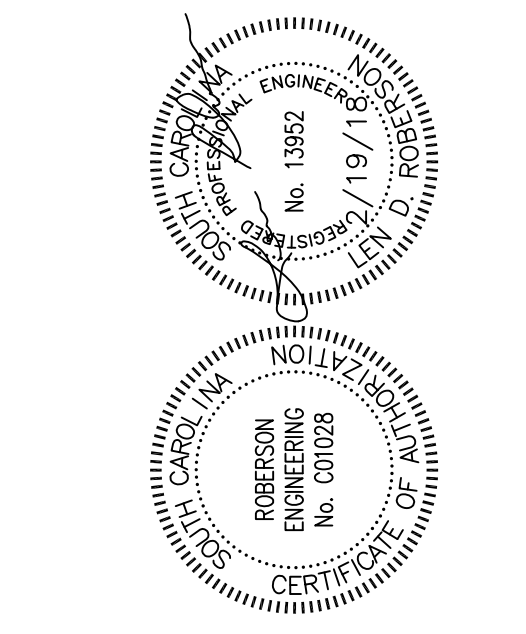
NOTES: 1. CONTRACTOR SHALL REMOVE ALL DEBRIS FROM THE SITE FOR DISPOSAL IN AN APPROVED LANDFILL.
2. REMOVE ALL PLANTS AS NEEDED FOR INSTALLATION OF NEW FACILITIES.

DENOTES AREA TO BE DEMOLISHED



AREA OF LAND DISTURBANCE = 0.3 ACS.

SCALE: 1"=20'



ISSUE DATE:	FEBRUARY 19, 2018	
PHASE:	BIDDING DOCUMENTS	
#	DATE	REVISION

ROBERSON
Engineering
P.O. Box 61198
Columbia, South Carolina 29260-1198
Phone: (803) 781-0000 • E-mail: robertsonengr@rc.com

DEMOLITION PLAN

FEBRUARY 19, 2018
ISSUE DATE
1509
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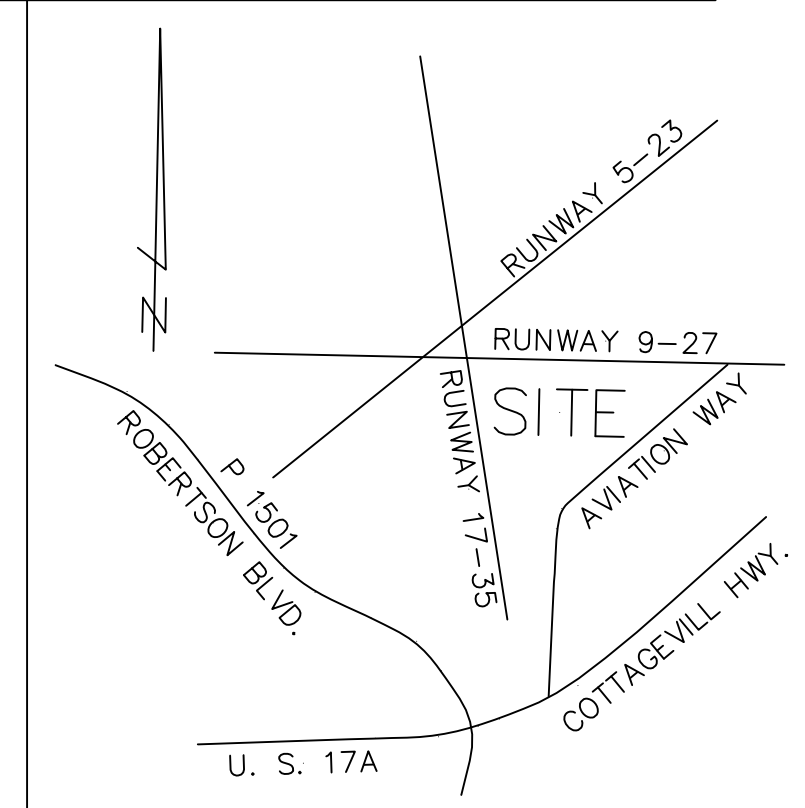
- NOTES: 1. SEE ARCHITECTURAL DRAWINGS FOR BUILDING AND SIDEWALK DIMENSIONS.
 2. SOD SHALL BE CENTIPEDE, COORDINATE WITH SUPPLIER OF SPRINKLER SYSTEM AND PLANT MATERIALS UNDER SEPARATE CONTRACT.

CONSTRUCTION SEQUENCE

- RECEIVE NPDES COVERAGE FROM DHEC.
- NOTIFY LEXINGTON COUNTY OFFICE 48 HOURS PRIOR TO BEGINNING LAND DISTURBING ACTIVITIES.
- CONDUCT THE PRECONSTRUCTION MEETING.
- INSTALL CONSTRUCTION ENTRANCE.
- CLEARING & GRUBBING ONLY AS NECESSARY FOR INSTALLATION OF PERIMETER CONTROLS.
- INSTALL PERIMETER CONTROLS.
- CLEARING & GRUBBING ONLY IN AREAS OF BASINS/TRAPS/PONDS.
- INSTALL BASINS/TRAPS/PONDS AND INSTALLATION OF DIVERSIONS TO THOSE STRUCTURES. OUTLET STRUCTURES MUST BE COMPLETELY INSTALLED AS SHOWN ON THE DETAILS BEFORE PROCEEDING TO THE NEXT STEP. AREAS DRAINING TO THESE STRUCTURES CANNOT BE DISTURBED UNTIL THE STRUCTURES AND DIVERSIONS TO THE STRUCTURES ARE COMPLETELY INSTALLED.
- CLEARING & GRUBBING OF SITE AND/OR DEMOLITION. SEDIMENT & EROSION CONTROL MEASURES FOR THESE AREAS MUST ALREADY BE INSTALLED.
- ROUGH GRADE THE SITE.
- INSTALLATION OF STORM DRAINAGE SYSTEM AND PLACEMENT OF INLET PROTECTION AS EACH INLET IS INSTALLED.
- FINE GRADING, PAVING, ETC.
- PERMANENT/FINAL STABILIZATION.
- CLEAN OUT DETENTION BASINS THAT WERE USED AS SEDIMENT CONTROL STRUCTURES AND REGRADE THE DETENTION POND BOTTOM. IF NECESSARY MODIFY SEDIMENT BASIN RISER TO CONVERT TO DETENTION BASIN OUTLET STRUCTURE.
- CONTRACTOR SHALL CONTACT ROBERSON ENGINEERING PRIOR TO REMOVAL OF TEMPORARY SEDIMENT & EROSION CONTROL MEASURES AFTER ENTIRE AREA DRAINING TO THE STRUCTURE IS FINALLY STABILIZED.
- CONTRACTOR SHALL PROVIDE AN AS-BUILT SURVEY OF ALL DETENTION STRUCTURES TO THE PROJECT ENGINEER FOR SUBMITTAL TO LEXINGTON COUNTY.
- ROBERSON ENGINEERING SHALL SUBMIT THE N.O.T TO LEXINGTON COUNTY.

- NOTES: 1. IF NECESSARY, SLOPES WHICH EXCEED EIGHT VERTICAL FEET SHOULD BE STABILIZED WITH SYNTHETIC OR VEGETATIVE MATS, IN ADDITION TO HYDROSEEDING. IT MAY BE NECESSARY TO INSTALL TEMPORARY SLOPE DRAINS DURING CONSTRUCTION. TEMPORARY BERMS MAY BE NEEDED UNTIL THE SLOPE IS BROUGHT TO GRADE.
2. STABILIZATION MEASURES SHALL BE INITIATED AS SOON AS PRACTICABLE IN PORTIONS OF THE SITE WHERE CONSTRUCTION ACTIVITIES HAVE TEMPORARILY OR PERMANENTLY CEASED, BUT IN NO CASE MORE THAN FOURTEEN DAYS AFTER WORK HAS CEASED, EXCEPT AS STATED BELOW.
- WHERE STABILIZATION BY THE 14TH DAY IS PRECLUDED BY SNOW COVER OR FROZEN GROUND CONDITIONS STABILIZATION MEASURES MUST BE INITIATED AS SOON AS PRACTICABLE.
- WHERE CONSTRUCTION ACTIVITY ON A PORTION OF THE SITE IS TEMPORARILY CEASED, AND EARTH DISTURBING ACTIVITIES WILL BE RESUMED WITHIN 14 DAYS, TEMPORARY STABILIZATION MEASURES DO NOT HAVE TO BE INITIATED ON THAT PORTION OF THE SITE.
3. ALL SEDIMENT AND EROSION CONTROL DEVICES SHALL BE INSPECTED AT LEAST ONCE EVERY CALENDAR WEEK. IF PERIODIC INSPECTION OR OTHER INFORMATION INDICATES THAT A BMP HAS BEEN INAPPROPRIATELY OR INCORRECTLY INSTALLED, THE PERMITEE MUST ADDRESS THE NECESSARY REPLACEMENT OR MODIFICATION REQUIRED TO CORRECT THE BMP WITHIN 48 HOURS OF IDENTIFICATION.
4. PROVIDE SILT FENCE AND/OR OTHER CONTROL DEVICES, AS MAY BE REQUIRED, TO CONTROL SOIL EROSION DURING UTILITY CONSTRUCTION. ALL DISTURBED AREAS SHALL BE CLEANED, GRADED AND STABILIZED WITH GRASSING IMMEDIATELY AFTER THE UTILITY INSTALLATION. FILL, COVER AND TEMPORARY SEEDING AT THE END OF EACH DAY ARE RECOMMENDED. IF WATER IS ENCOUNTERED WHILE TRENCHING, THE WATER SHOULD BE FILTERED TO REMOVE ANY SEDIMENTS BEFORE BEING PUMPED BACK INTO ANY WATERS OF THE STATE.
5. ALL EROSION CONTROL DEVICES SHALL BE PROPERLY MAINTAINED DURING ALL PHASES OF CONSTRUCTION UNTIL THE COMPLETION OF ALL CONSTRUCTION ACTIVITIES AND ALL DISTURBED AREAS HAVE BEEN STABILIZED. ADDITIONAL CONTROL DEVICES MAY BE REQUIRED DURING CONSTRUCTION IN ORDER TO CONTROL EROSION AND/OR OFFSITE SEDIMENTATION. ALL TEMPORARY CONTROL DEVICES SHALL BE REMOVED ONCE CONSTRUCTION IS COMPLETE AND THE SITE IS STABILIZED.
6. THE CONTRACTOR MUST TAKE NECESSARY ACTION TO MINIMIZE THE TRACKING OF MUD ONTO THE PAVED ROADWAY CONSTRUCTION AREAS. THE CONTRACTOR SHALL DAILY REMOVE MUD/SOIL FROM PAVEMENT, AS MAY BE REQUIRED.
7. RESIDENTIAL SUBDIVISIONS REQUIRE EROSION CONTROL FEATURES FOR INFRASTRUCTURE AS WELL AS FOR INDIVIDUAL LOT CONSTRUCTION. INDIVIDUAL PROPERTY OWNERS SHALL FOLLOW THESE PLANS DURING CONSTRUCTION OR OBTAIN APPROVAL OF AN INDIVIDUAL PLAN IN ACCORDANCE WITH S.C. REG. 72-300 ET. SEQ. AND SCD100000.
8. TEMPORARY DIVERSION BERMS AND/OR DITCHES WILL BE PROVIDED AS NEEDED DURING CONSTRUCTION TO PROTECT WORK AREAS FROM UPSLOPE RUNOFF AND/OR TO DIVERT SEDIMENT LADEN WATER TO APPROPRIATE TRAPS OR STABLE OUTLETS.
9. ALL WATERS OF THE STATE (WOS), INCLUDING WETLANDS, ARE TO BE FLAGGED OR OTHERWISE CLEARLY MARKED IN THE FIELD. A DOUBLE ROW OF SILT FENCE IS TO BE INSTALLED IN ALL AREAS WHERE A 50 FOOT BUFFER CANT BE MAINTAINED BETWEEN THE DISTURBED AREAS AND ALL WOS. A 10 FOOT BUFFER SHOULD BE MAINTAINED BETWEEN THE LAST ROW OF SILT FENCE AND ALL WOS.

- LITTER, CONSTRUCTION DEBRIS, OILS, FUELS AND BUILDING PRODUCTS WITH SIGNIFICANT POTENTIAL FOR IMPACT (SUCH AS STOCKPILES OF FRESHLY TREATED LUMBER) AND CONSTRUCTION CHEMICALS THAT COULD BE EXPOSED TO STORMWATER MUST BE PREVENTED FROM BECOMING A POLLUTANT SOURCE IN STORMWATER DISCHARGES.
- A COPY OF THE SWPPP, INSPECTION RECORDS, AND RAINFALL DATA MUST BE RETAINED AT THE CONSTRUCTION SITE OR A NEARBY LOCATION EASILY ACCESSIBLE DURING NORMAL BUSINESS HOURS, FROM THE DATE OF COMMENCEMENT OF CONSTRUCTION ACTIVITIES TO THE DATE THAT FINAL STABILIZATION IS REACHED.
- INITIATE STABILIZATION MEASURES ON ANY EXPOSED STEEP SLOPE (3:1 OR GREATER) WHERE LAND DISTURBING ACTIVITIES HAVE PERMANENTLY OR TEMPORARILY CEASED, AND WILL NOT RESUME FOR A PERIOD OF 7 CALENDAR DAYS.
- MINIMIZE SOIL COMPACTION AND, UNLESS INFEASIBLE, PRESERVE TOPSOIL.
- MINIMIZE THE DISCHARGE OF POLLUTANTS FROM EQUIPMENT AND VEHICLE WASHING, WHEEL WASH WATER, AND OTHER WASH WATERS. WASH WATERS MUST BE TREATED IN A SEDIMENT BASIN OR ALTERNATIVE CONTROL THAT EQUIVALENT OR BETTER TREATMENT PRIOR TO DISCHARGE.
- MINIMIZE THE DISCHARGE OF POLLUTANTS FROM DEWATERING OF TRENCHES AND EXCAVATED AREAS. THESE DISCHARGES ARE TO BE ROUTED THROUGH APPROPRIATE BMP'S (SEDIMENT BASIN, FILTER BAGS, ETC.).
- THE FOLLOWING DISCHARGES FROM SITES ARE PROHIBITED:
 WASTEWATER FROM WASHOUT OF CONCRETE, UNLESS MANAGED BY AN APPROPRIATE CONTROL;
 WASTEWATER FROM WASHOUT AND CLEANOUT OF STUCCO, PAINT, FORM RELEASE OILS, CURING COMPOUNDS AND OTHER CONSTRUCTION MATERIALS;
 FUELS, OILS OR OTHER POLLUTANTS USED IN VEHICLE AND EQUIPMENT OPERATION AND MAINTENANCE;
 SOAPS OR SOLVENTS USED IN VEHICLE AND EQUIPMENT WASHING.
- AFTER CONSTRUCTION ACTIVITIES BEGIN, INSPECTIONS MUST BE CONDUCTED AT A MINIMUM OF AT LEAST ONCE EVERY CALENDAR WEEK AND MUST BE CONDUCTED UNTIL FINAL STABILIZATION IS REACHED ON ALL AREAS OF THE CONSTRUCTION SITE.
- IF EXISTING BMP'S NEED TO BE MODIFIED OR IF ADDITIONAL BMP'S ARE NECESSARY TO COMPLY WITH THE REQUIREMENTS OF THIS PERMIT AND/OR SC'S WATER QUALITY STANDARDS, IMPLEMENTATION MUST BE COMPLETED BEFORE THE NEXT STORM EVENT WHENEVER PRACTICABLE. IF IMPLEMENTATION BEFORE THE NEXT STORM EVENT IS IMPRACTICABLE, THE SITUATION MUST BE DOCUMENTED IN THE SWPPP AND ALTERNATIVE BMP'S MUST BE IMPLEMENTED AS SOON AS REASONABLY POSSIBLE.
- A PRECONSTRUCTION CONFERENCE MUST BE HELD FOR EACH CONSTRUCTION SITE WITH AN APPROVED ON-SITE SWPPP PRIOR TO THE IMPLEMENTATION OF CONSTRUCTION ACTIVITIES. FOR NONLINEAR PROJECTS THAT DISTURB 10 ACRES OR MORE THIS CONFERENCE MUST BE HELD ON SITE UNLESS THE DEPARTMENT HAS APPROVED OTHERWISE.



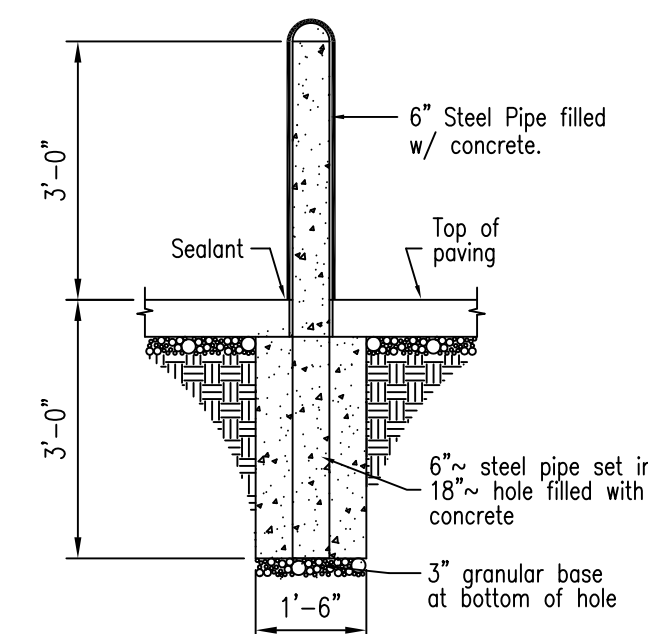
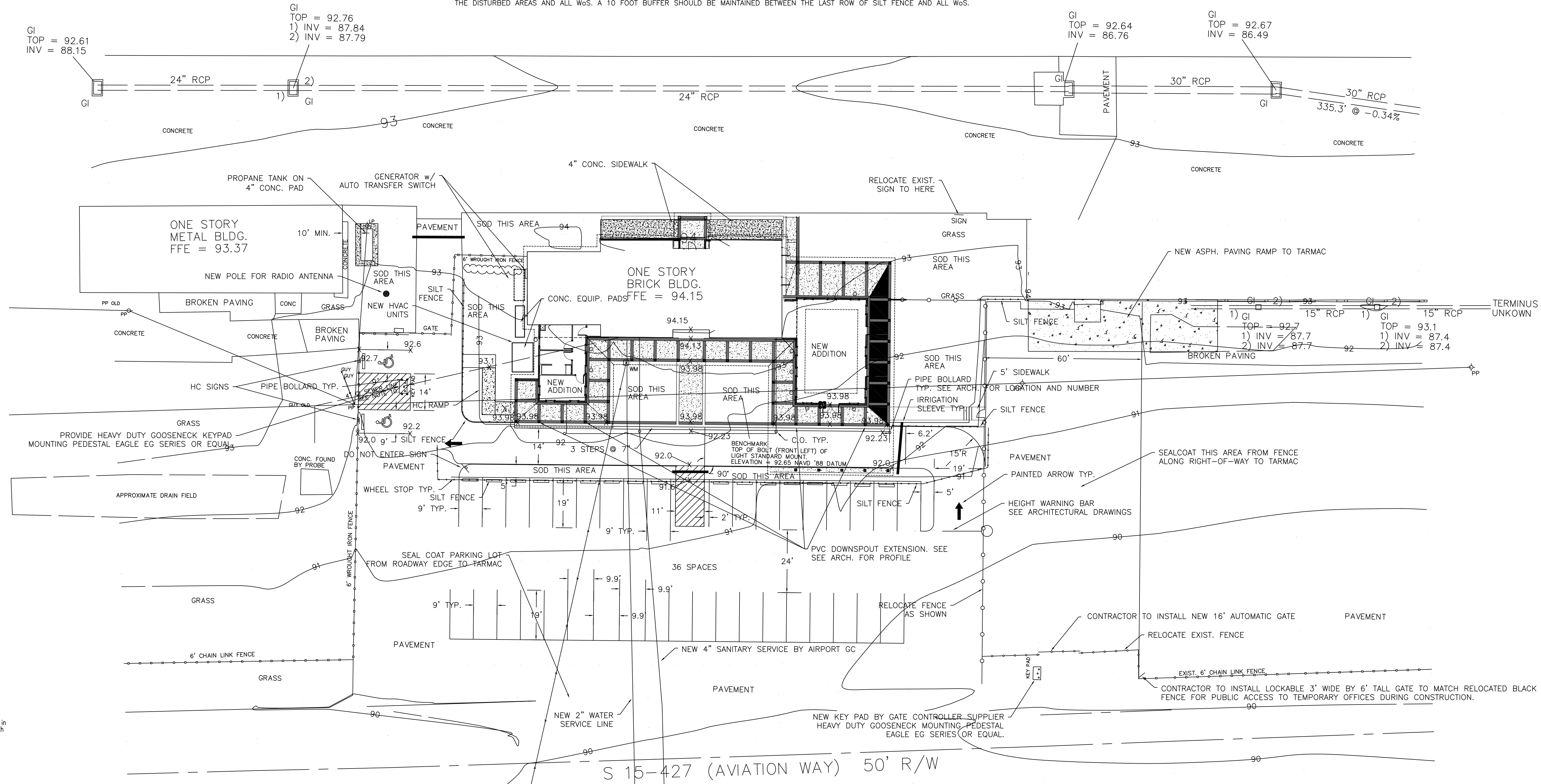
VICINITY MAP

ARCHITECTURE
INTERIORS
PLANNING

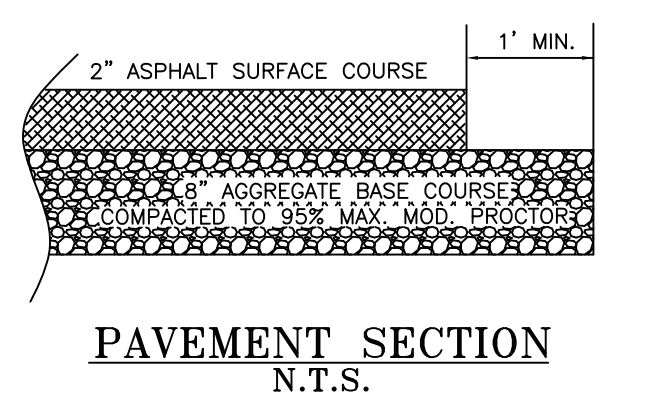
WTS
WATSON TATE SAVORY



LOWCOUNTRY REGIONAL AIRPORT TERMINAL EXPANSION
COLLETON COUNTY
WALTERBORO, SC



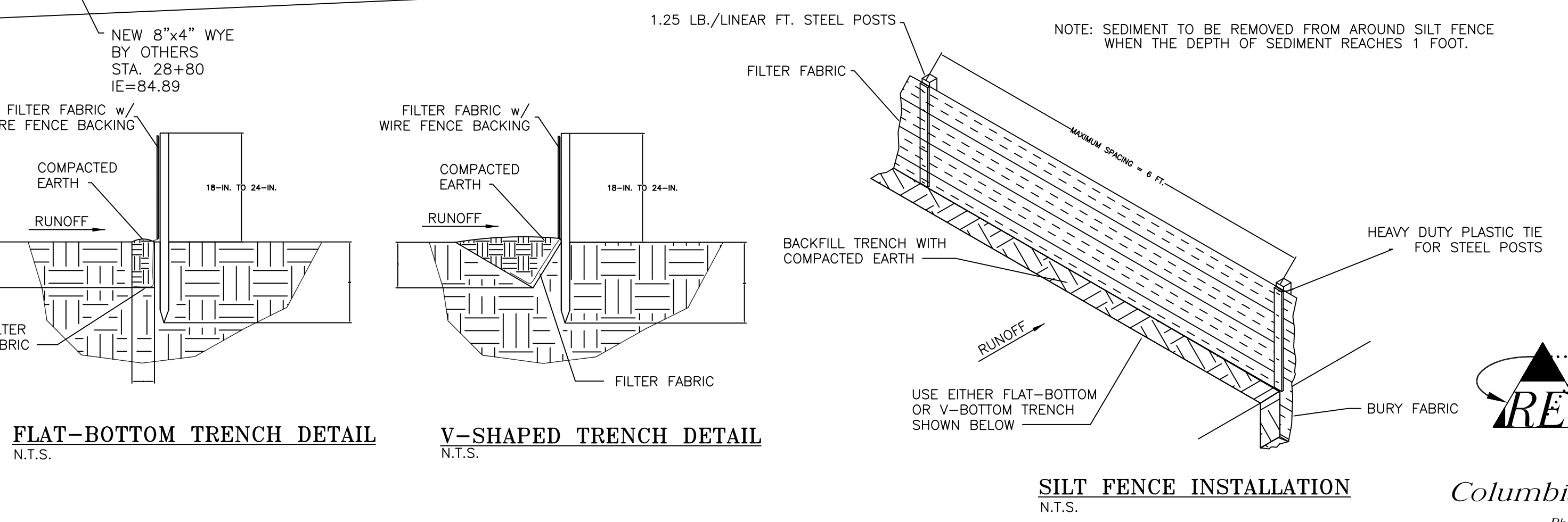
TYPICAL PIPE BOLLARD SECTION
N.T.S.



PAVEMENT SECTION
N.T.S.

S 15-427 (AVIATION WAY) 50' R/W

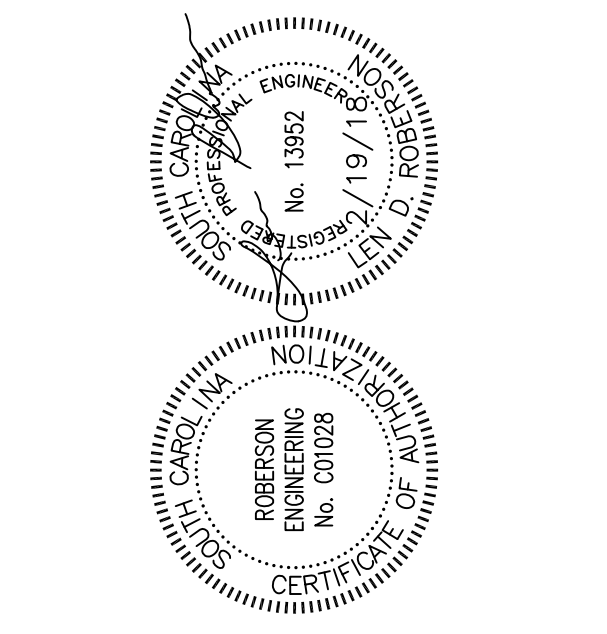
SCALE: 1"=20'



FLAT-BOTTOM TRENCH DETAIL
N.T.S.

V-SHAPED TRENCH DETAIL
N.T.S.

SILT FENCE INSTALLATION
N.T.S.



ISSUE DATE:	FEBRUARY 19, 2018	
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#	DATE	REVISION

STAKING & GRADING
PLAN

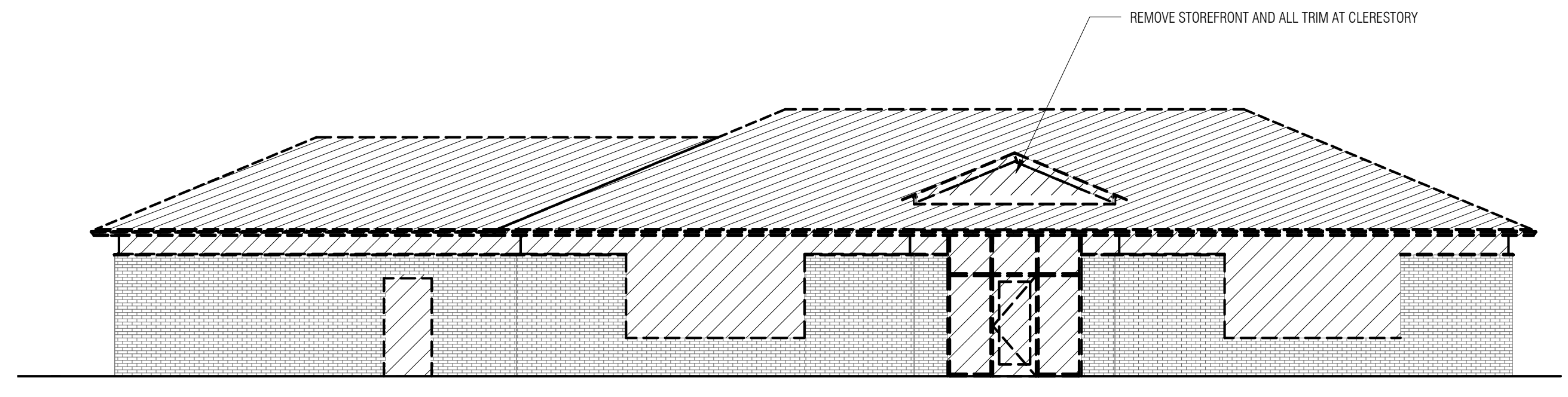
ROBERSON
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Columbia, South Carolina 29260-1198
Phone: (803) 781-0000 • E-mail: robersonengr@rc.com

FEBRUARY 19, 2018
ISSUE DATE
1509
WTS PROJECT NO. C2.01
SHEET

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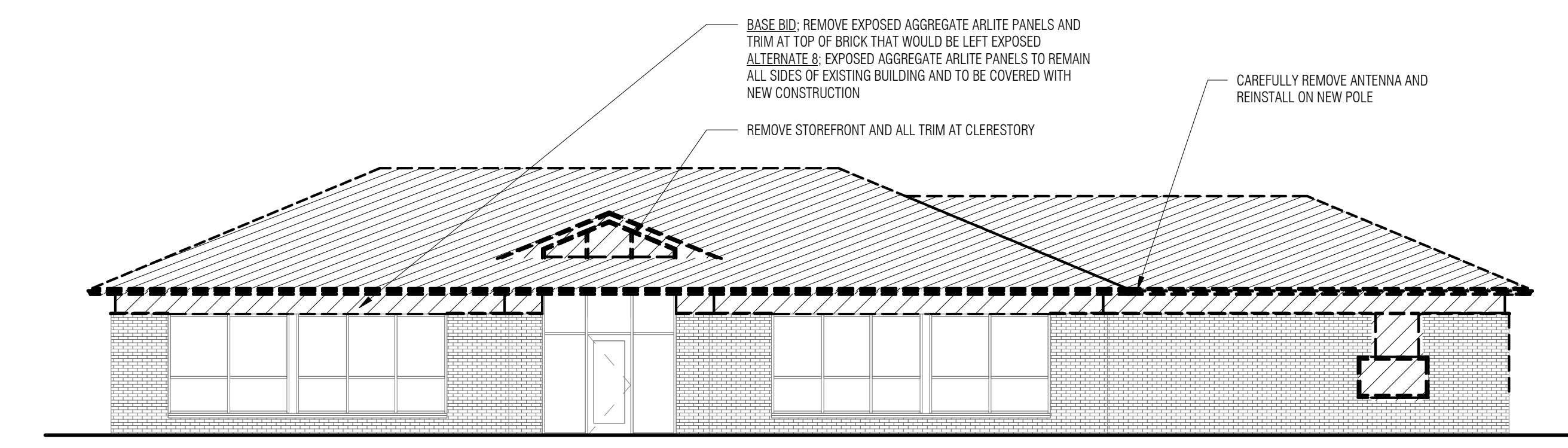
#	DATE	REVISION

- Level 11
20'-8"
- Level 9
19'-3 1/2"
- Level 10
17'-2"
- T.O. CMU
10'-0"
- T.O. BRICK
8'-5 5/16"
- FIRST FLOOR
0'-0"
- T.O. FOOTING
-2'-0"



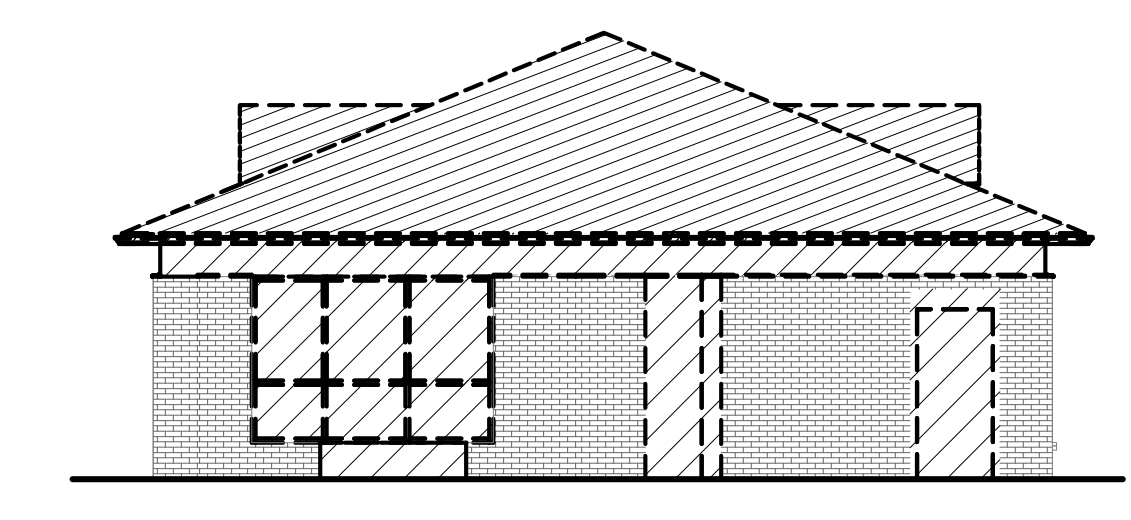
D1
D1.01
REMOVAL SOUTH ELEVATION
1/8" = 1'-0"

- T.O. CMU
10'-0"
- T.O. BRICK
8'-5 5/16"
- FIRST FLOOR
0'-0"
- T.O. FOOTING
-2'-0"



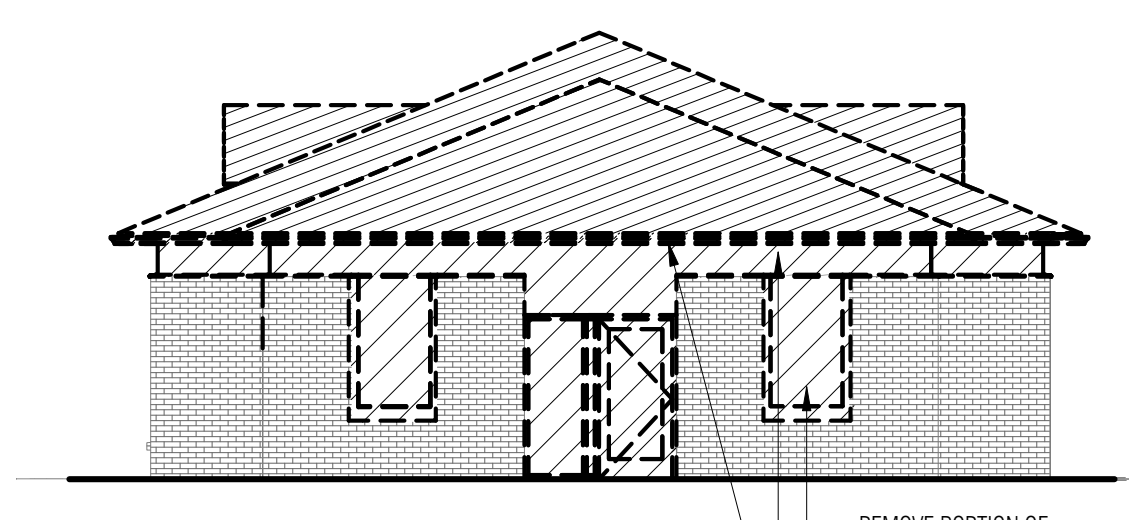
C1
D1.01
REMOVAL NORTH ELEVATION
1/8" = 1'-0"

- T.O. CMU
10'-0"
- T.O. BRICK
8'-5 5/16"
- FIRST FLOOR
0'-0"
- T.O. FOOTING
-2'-0"

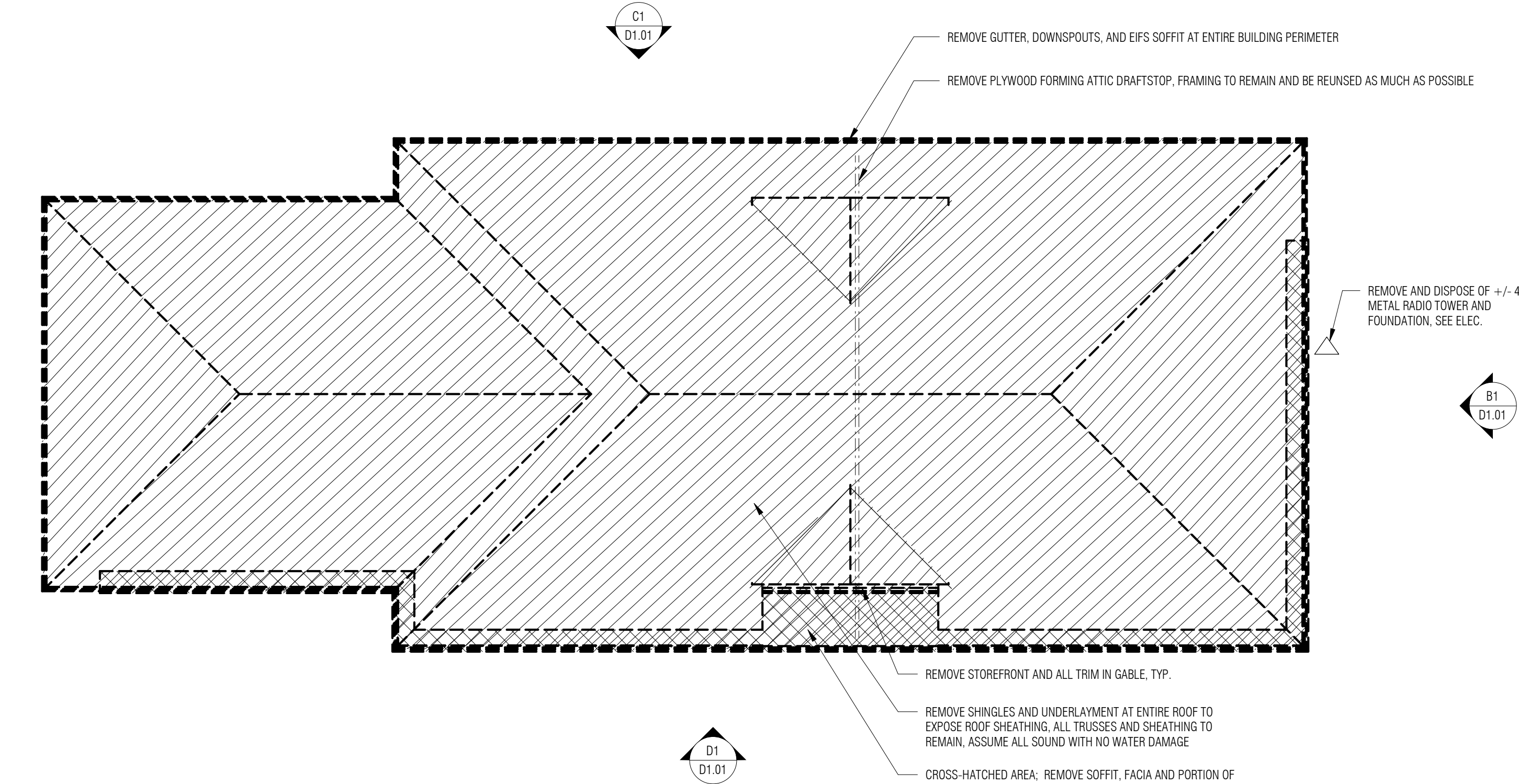


B1
D1.01
REMOVAL EAST ELEVATION
1/8" = 1'-0"

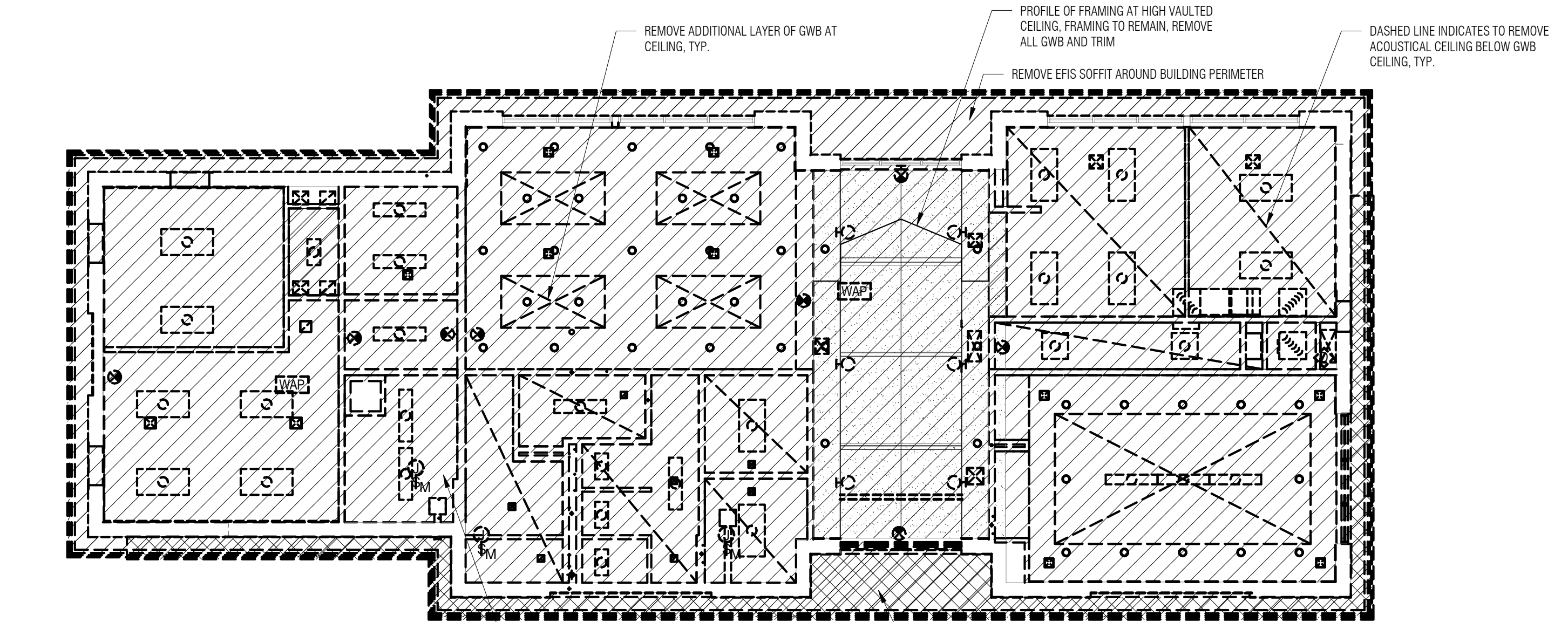
- T.O. CMU
10'-0"
- T.O. BRICK
8'-5 5/16"
- FIRST FLOOR
0'-0"
- T.O. FOOTING
-2'-0"



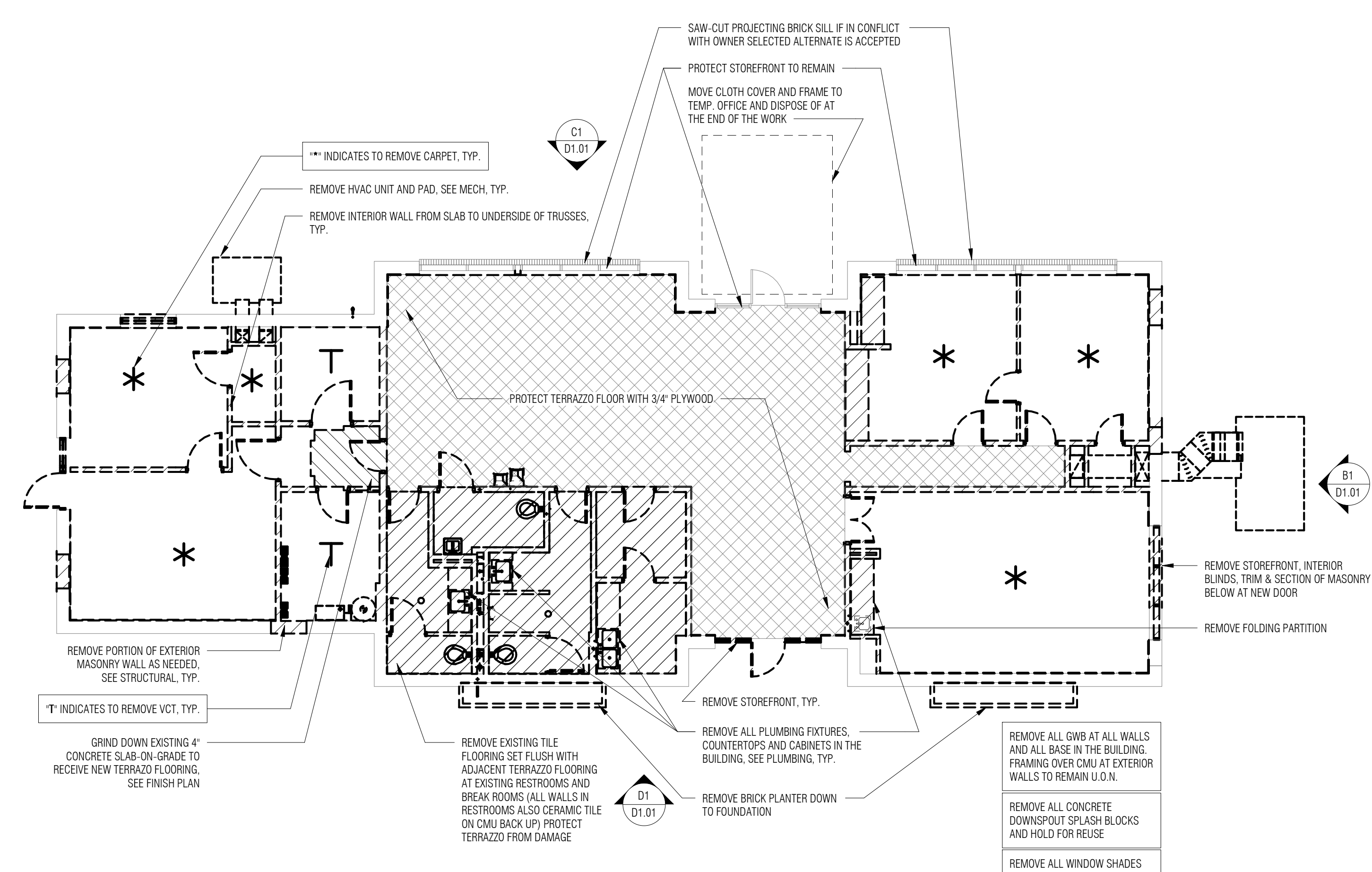
B2
D1.01
REMOVAL WEST ELEVATION
1/8" = 1'-0"



B4
D1.01
REMOVAL ROOF PLAN
1/8" = 1'-0"



A1
D1.01
REMOVAL RCP
1/8" = 1'-0"



A4
D1.01
REMOVAL FLOOR PLAN
1/8" = 1'-0"

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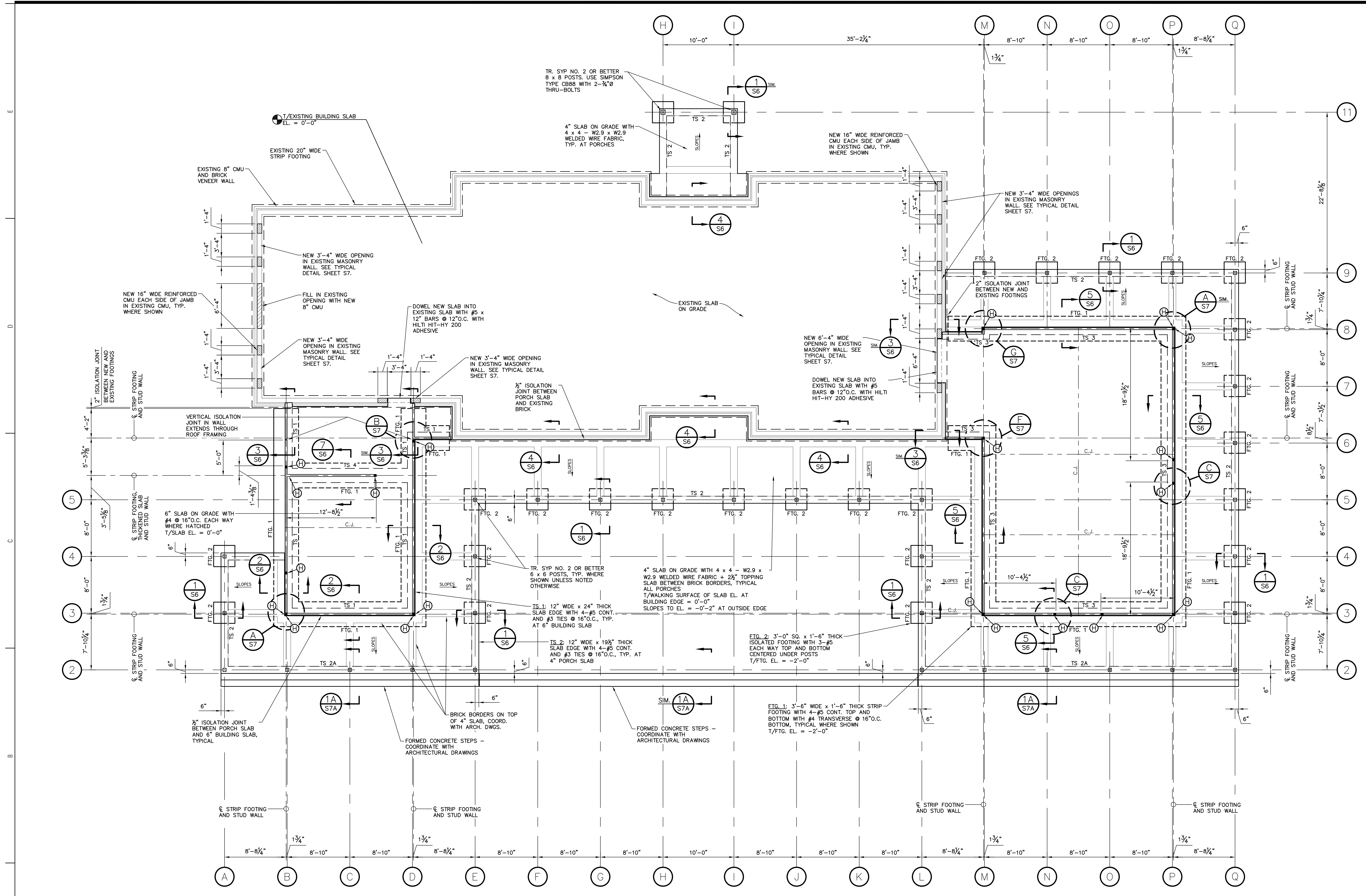
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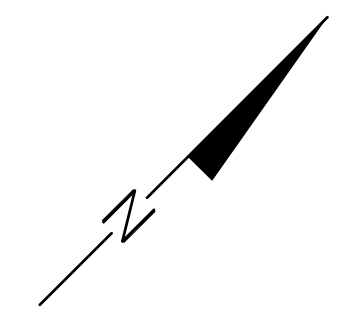
#	DATE	REVISION

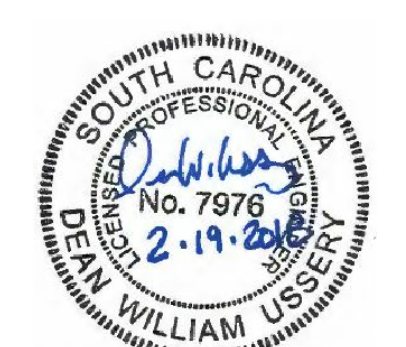
BASE BID
FOUNDATION AND
SLAB PLAN



- NOTES:
- INDICATES 2 x 4 LOAD BEARING WALL WITH 2 x 4 STUDS @ 12" O.C. INSTALL 1/2" PLYWOOD SHEATHING ON 1-SIDE WITH 8d NAILS @ 4" O.C. AT ALL PANEL EDGES (FULLY BLOCKED) AND @ 12" O.C. IN FIELD.
 - INDICATES SIMPSON TYPE HDU5-SDS2.5 HOLD-DOWN WITH 1-3/8" ANCHOR ROD + 3-2 x 4 FULL HEIGHT COMPRESSION STUDS.
 - TOP OF SLAB ELEVATION IS 94.15' AND SET AT 0'-0". COORDINATE WITH CIVIL DRAWINGS.
 - NEW INTERIOR PARTITION WALLS IN EXISTING BUILDING AND NEW ADDITIONS NOT SHOWN - SEE ARCHITECTURAL DRAWINGS.

BASE BID FOUNDATION AND
SLAB PLAN
3/16" = 1'-0"

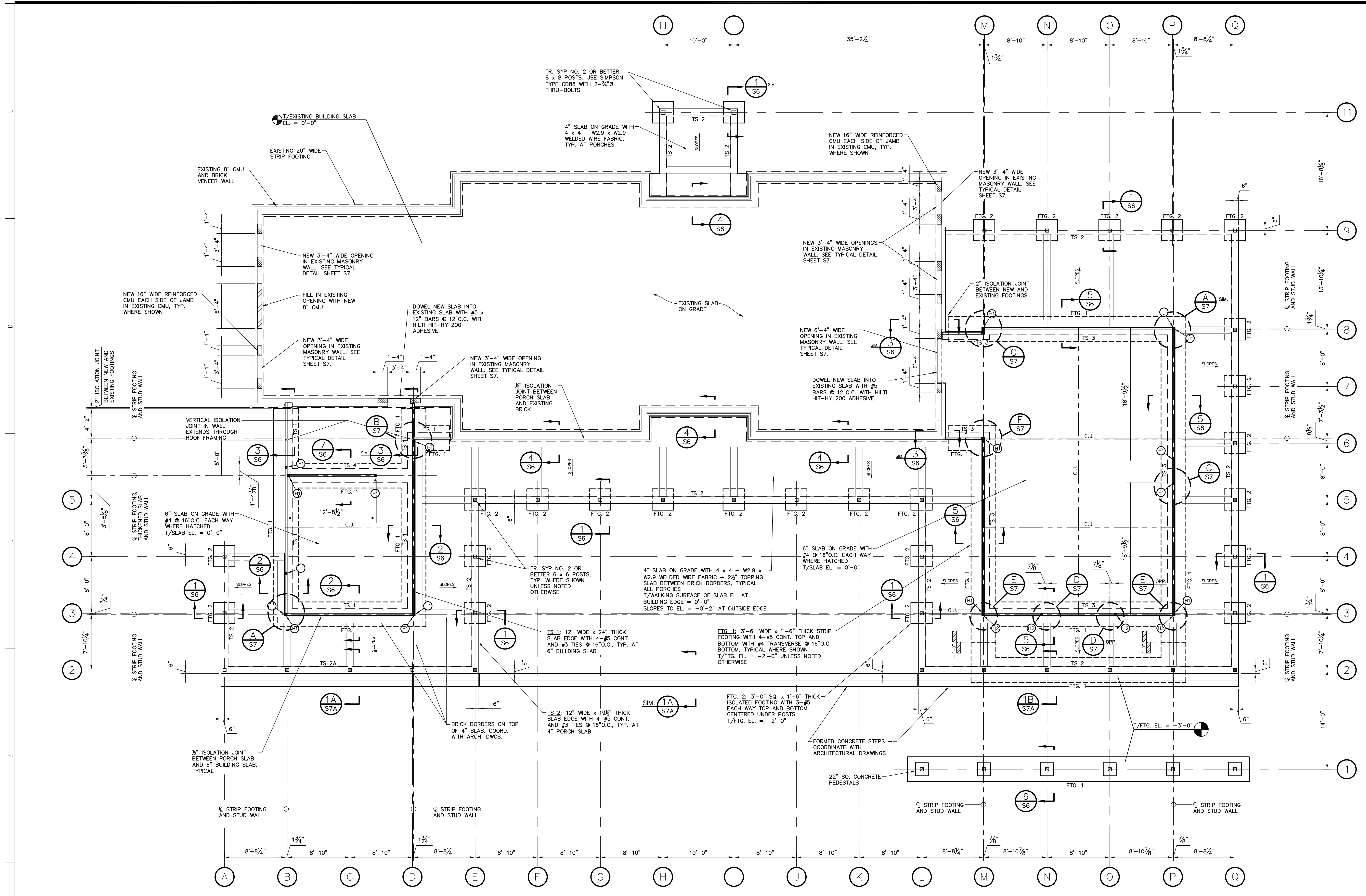




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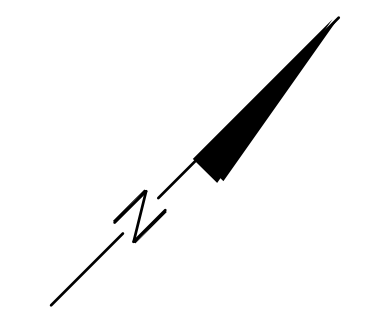
#	DATE	REVISION

BID ALTERNATE
FOUNDATION AND
SLAB PLAN



- NOTES:
- INDICATES 2 x 4 LOAD BEARING WALL WITH 2 x 4 STUDS @ 12" O.C. INSTALL 1/2" PLYWOOD SHEATHING ON 1-SIDE WITH 8d NAILS @ 4" O.C. AT ALL PANEL EDGES (FULLY BLOCKED) AND @ 12" O.C. IN FIELD.
 - (H1) INDICATES SIMPSON TYPE HDU5-SDS2.5 HOLDOWN WITH 1-3/8" ANCHOR ROD + 3-2 x 4 FULL HEIGHT COMPRESSION STUDS.
 - (H2) INDICATES SIMPSON TYPE HDU8-SDS2.5 HOLDOWN WITH 1-3/8" ANCHOR ROD + 3-2 x 4 FULL HEIGHT COMPRESSION STUDS.
- TOP OF SLAB ELEVATION IS 94.15' AND SET AT 0'-0". COORDINATE WITH CIVIL DRAWINGS.
 - NEW INTERIOR PARTITION WALLS IN EXISTING BUILDING AND NEW ADDITIONS NOT SHOWN - SEE ARCHITECTURAL DRAWINGS.

BID ALTERNATE FOUNDATION AND SLAB PLAN
3/8" = 1'-0"

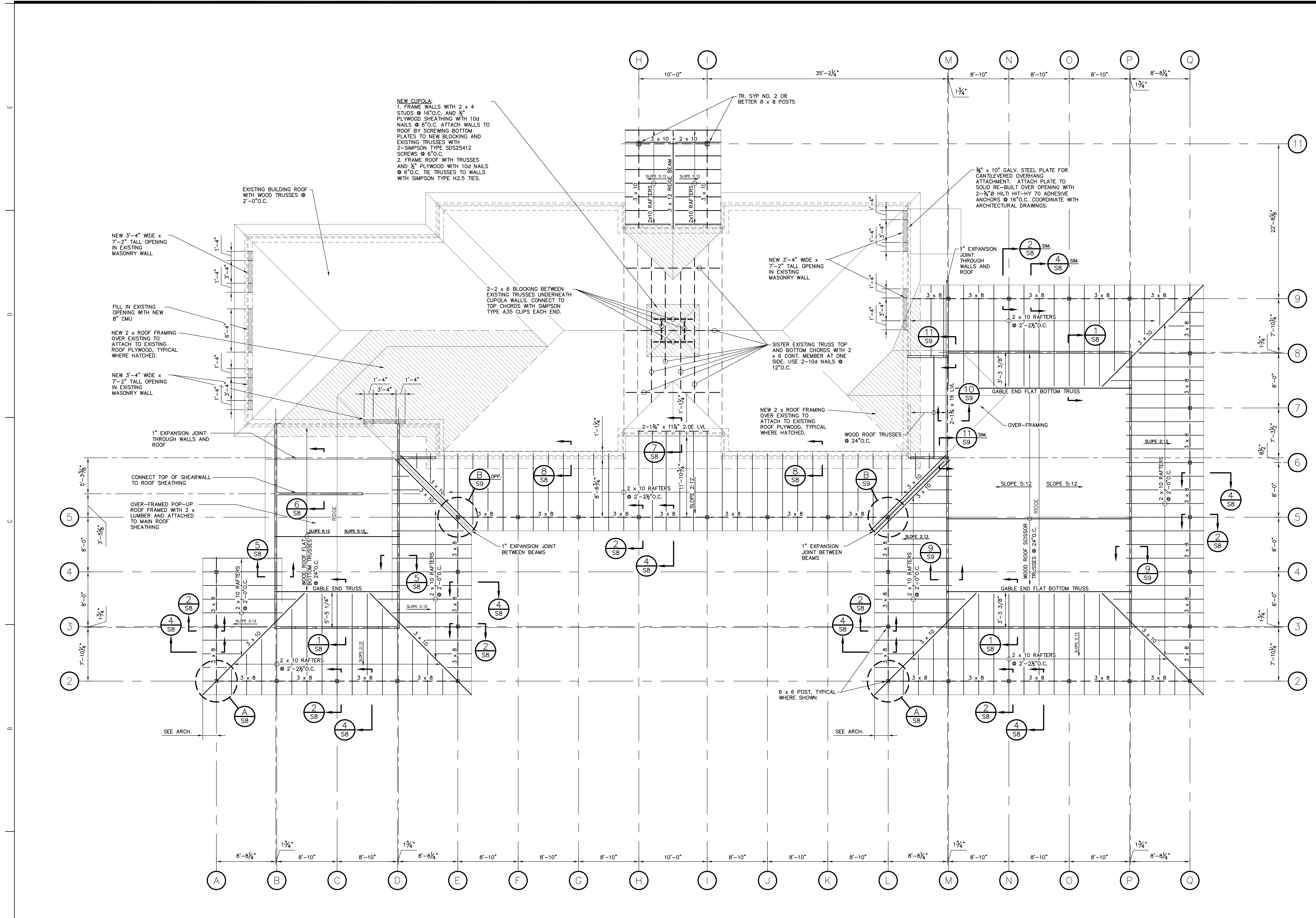




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BASE BID ROOF
FRAMING PLAN



NEW CUPOLA:
1. FRAME WALLS WITH 2 x 4 STUDS @ 16" O.C. AND 1/2" PLYWOOD SHEATHING WITH 10d NAILS @ 6" O.C. ATTACH WALLS TO ROOF BY SCREWING BOTTOM PLATES TO NEW BLOCKING AND EXISTING TRUSSES WITH 2-SIMPSON TYPE SDS25412 SCREWS @ 6" O.C.
2. FRAME ROOF WITH TRUSSES AND 1/2" PLYWOOD WITH 10d NAILS @ 6" O.C. TIE TRUSSES TO WALLS WITH SIMPSON TYPE H2.5 TIES.

EXISTING BUILDING ROOF WITH WOOD TRUSSES @ 2'-0" O.C.

NEW 3'-4" WIDE x 7'-2" TALL OPENING IN EXISTING MASONRY WALL

FILL IN EXISTING OPENING WITH NEW 8" CMU

NEW 2 x ROOF FRAMING OVER EXISTING TO ATTACH TO EXISTING ROOF PLYWOOD, TYPICAL WHERE HATCHED.

1" EXPANSION JOINT THROUGH WALLS AND ROOF

CONNECT TOP OF SHEARWALL TO ROOF SHEATHING

OVER-FRAMED POP-UP ROOF FRAMED WITH 2 x LUMBER AND ATTACHED TO MAIN ROOF SHEATHING

2-2 x 6 BLOCKING BETWEEN EXISTING TRUSSES UNDERNEATH CUPOLA WALLS. CONNECT TO TOP CHORDS WITH SIMPSON TYPE A35 CLIPS EACH END.

NEW 3'-4" WIDE x 7'-2" TALL OPENING IN EXISTING MASONRY WALL

SISTER EXISTING TRUSS TOP AND BOTTOM CHORDS WITH 2 x 6 CONT. MEMBER AT ONE SIDE. USE 2-10d NAILS @ 12" O.C.

NEW 2 x ROOF FRAMING OVER EXISTING TO ATTACH TO EXISTING ROOF PLYWOOD, TYPICAL WHERE HATCHED.

WOOD ROOF TRUSSES @ 24" O.C.

3/4" x 10" GALV. STEEL PLATE FOR CANTILEVERED OVERHANG ATTACHMENT. ATTACH PLATE TO SOLID RE-BUILT OVER OPENING WITH 2-3/8" HILTI HIT-HY 70 ADHESIVE ANCHORS @ 16" O.C. COORDINATE WITH ARCHITECTURAL DRAWINGS.

1" EXPANSION JOINT THROUGH WALLS AND ROOF

OVER-FRAMING

WOOD ROOF SCISSOR TRUSSES @ 24" O.C.

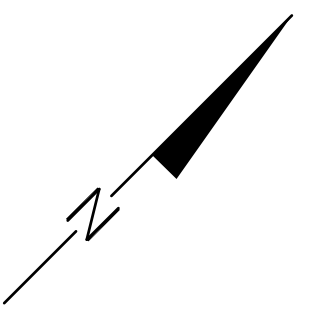
GABLE END FLAT BOTTOM TRUSS

6 x 6 POST, TYPICAL WHERE SHOWN

SEE ARCH.

NOTE:
1. AT ALL PORCH FRAMING: COORDINATE WITH ARCHITECTURAL DRAWINGS SO THAT ELECTRICAL FIXTURES ARE CENTERED BETWEEN COLUMNS.

BASE BID ROOF
FRAMING PLAN
3/16" = 1'-0"

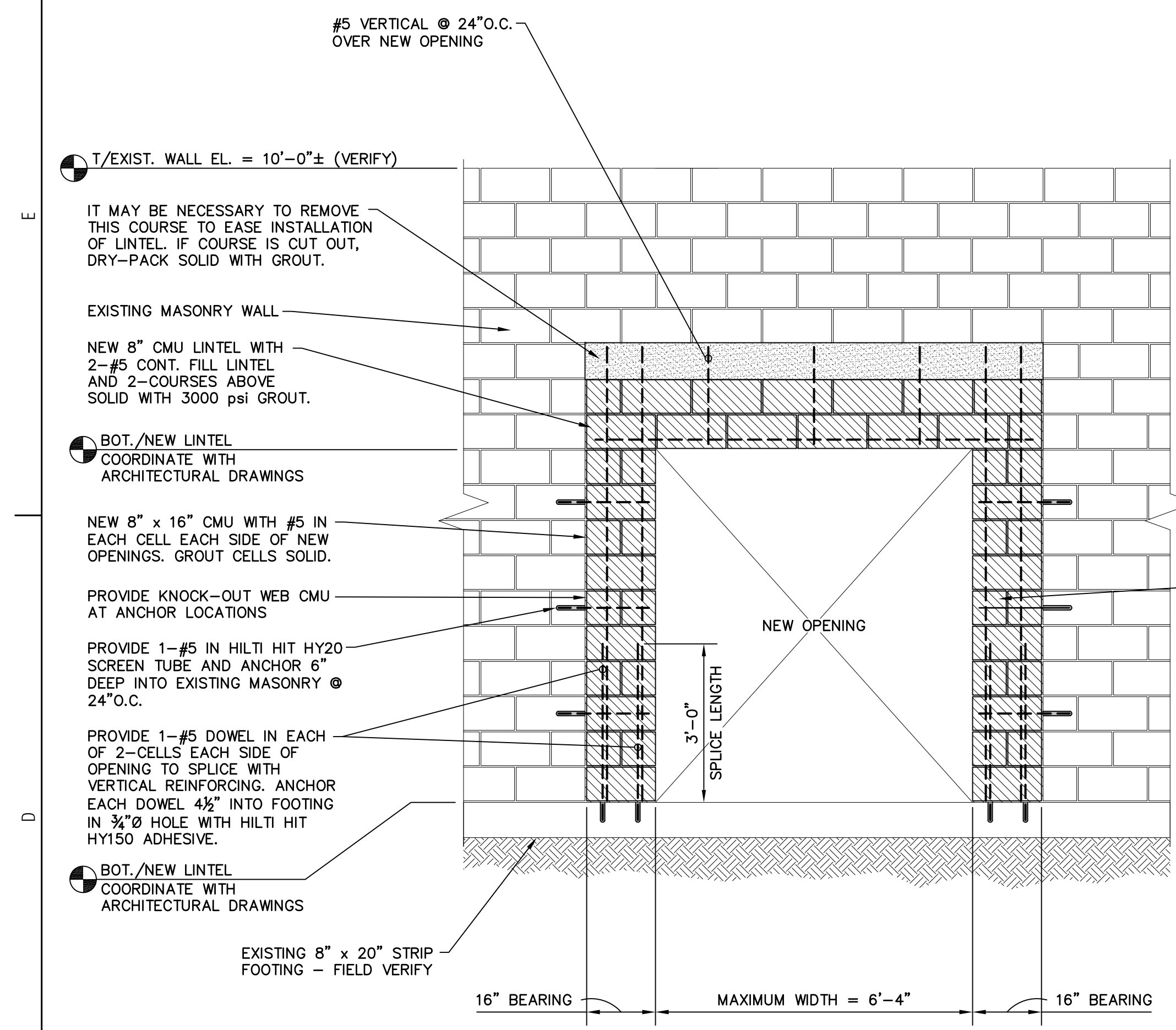




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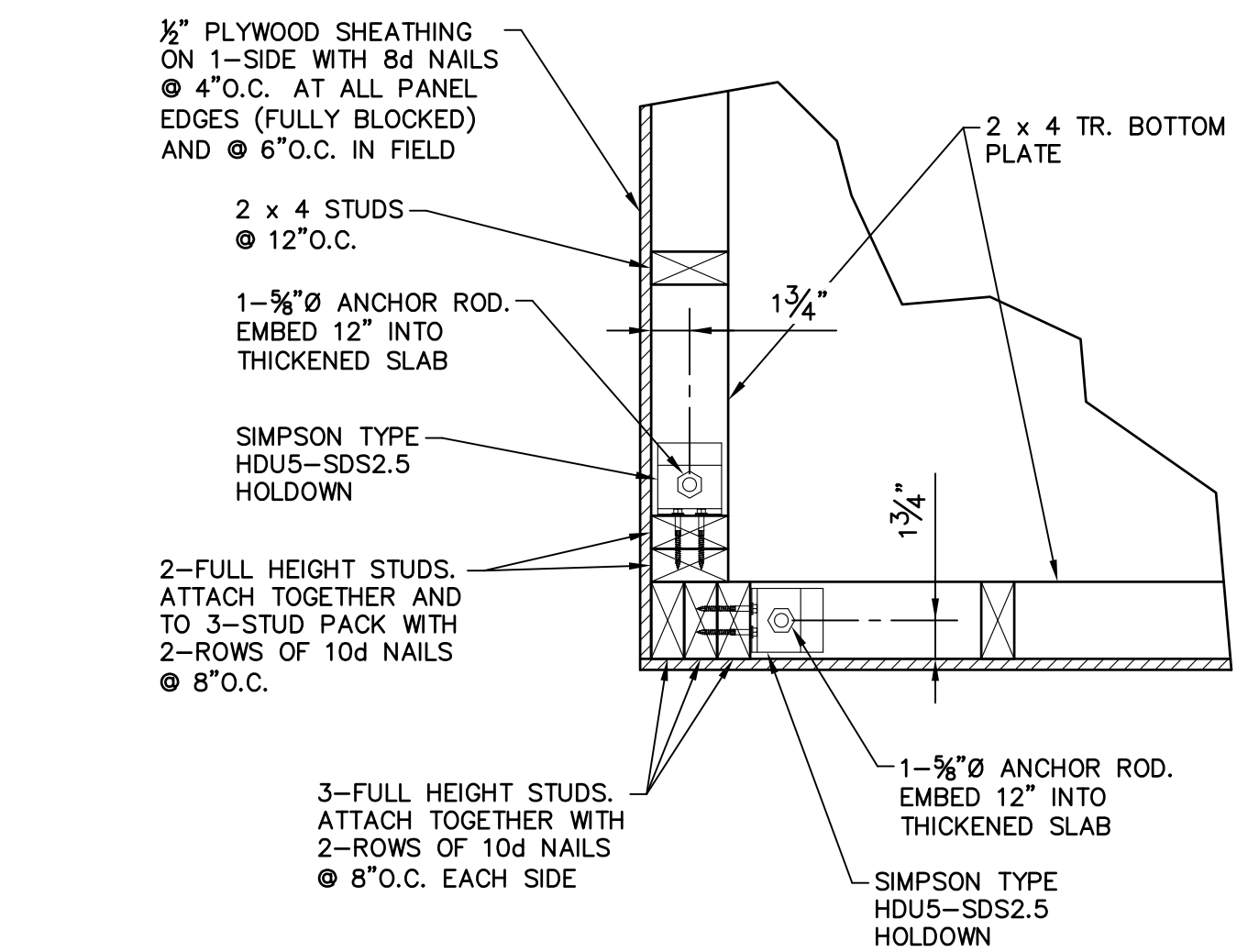
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FOUNDATION
DETAILS

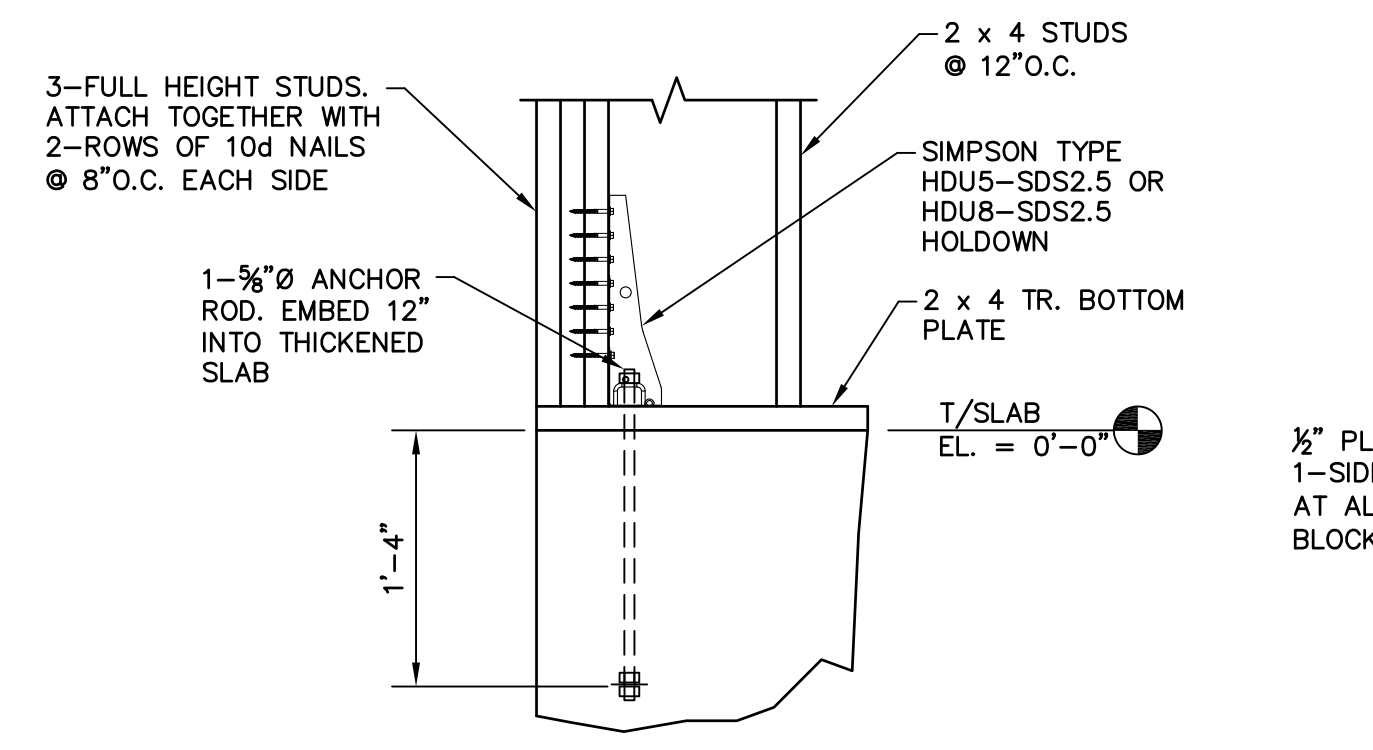


NEW OPENING IN EXISTING CMU WALL
1/2"=1'-0"

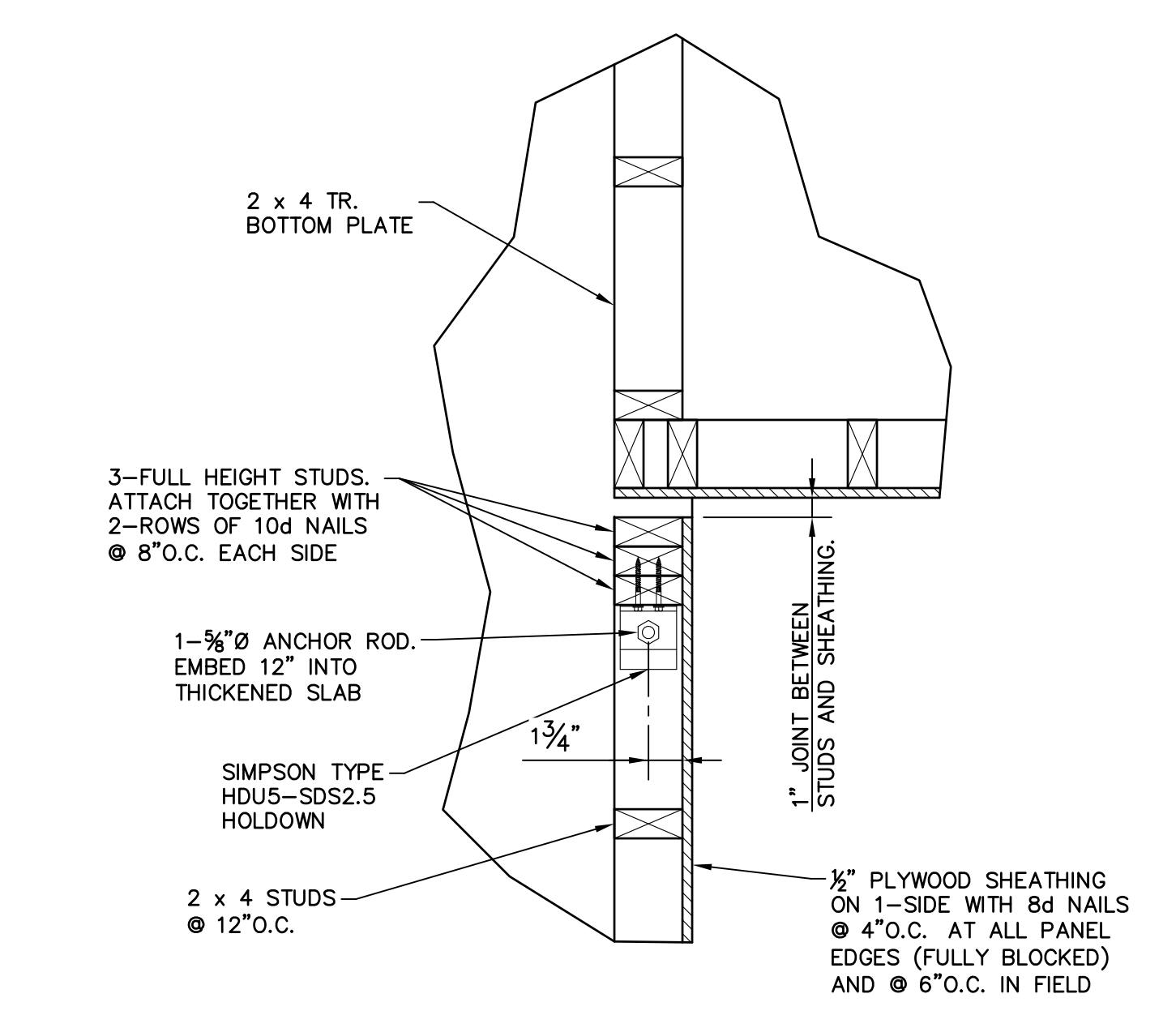
- NOTES:
- EXISTING SLAB ON GRADE NOT SHOWN FOR CLARITY.
 - EXISTING ROOF JOISTS OR TRUSSES NOT SHOWN. WALL AND ROOF STRUCTURE TO BE SHORED DURING CONSTRUCTION OF NEW OPENING.
 - L4 x 3 1/2 x 3/8 LOOSE LINTEL SHALL BE USED FOR BRICK VENEER AND SHALL BEAR MINIMUM OF 8" ON EXISTING BRICK EACH SIDE.
 - FOR IN-FILL IN EXISTING MASONRY WALLS: EXISTING OPENINGS SHALL BE FILLED IN WITH LIGHT WEIGHT 8" CMU AND REINFORCED WITH #5 @ 24" O.C. NEW CMU SHALL BE CONNECTED TO EXISTING CMU WITH 1-#5 IN HILTI HIT HY20 SCREEN TUBE AND ANCHORED 6" DEEP INTO EXISTING MASONRY @ 24" O.C. VERTICALLY.
 - COORDINATE ALL DIMENSIONS WITH ARCHITECTURAL DRAWINGS.



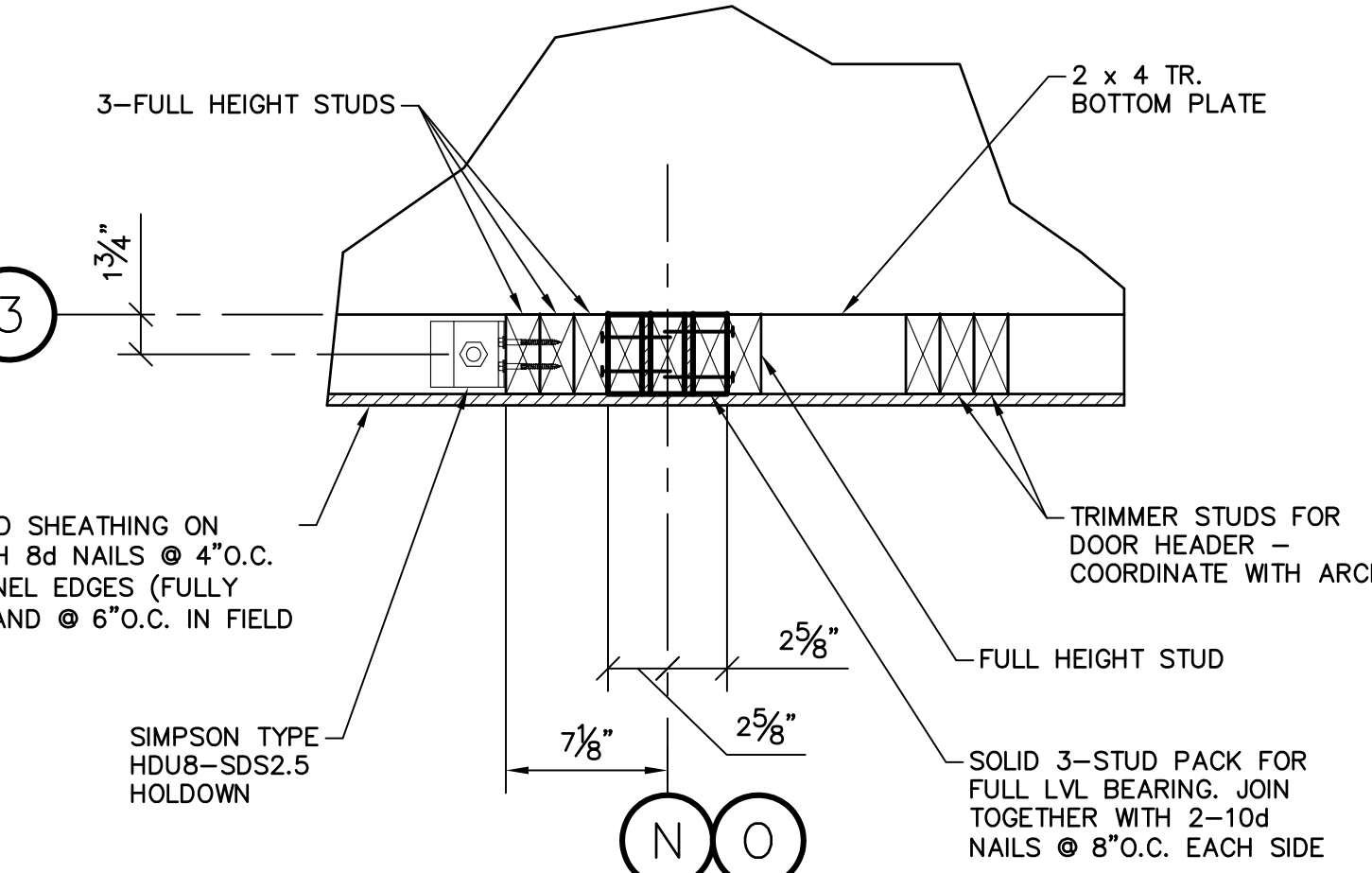
DETAIL A
1/2"=1'-0" S2 | S7 | S3



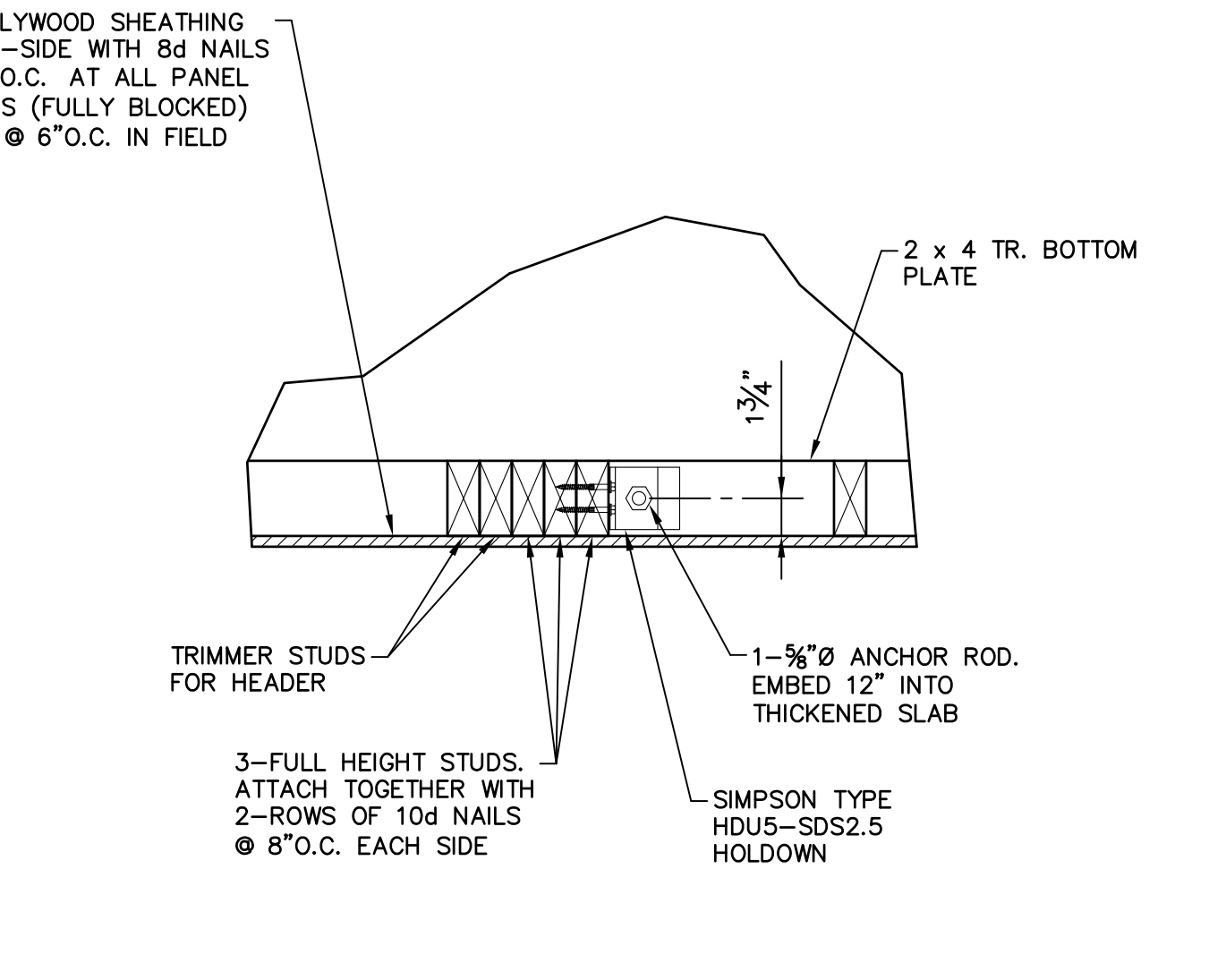
TYPICAL HOLDOWN DETAIL
1"=1'-0"



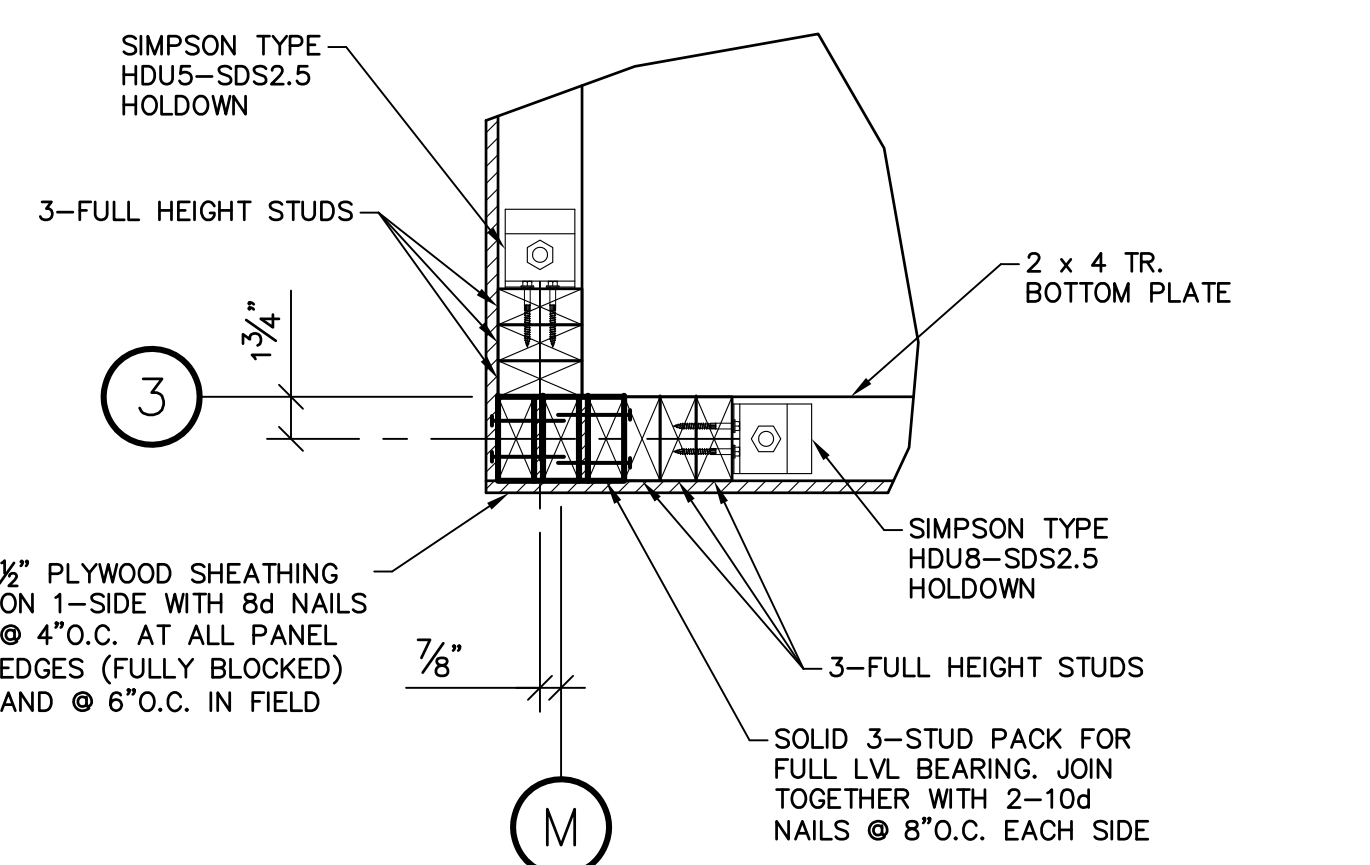
DETAIL C
1/2"=1'-0" S2 | S7 | S3



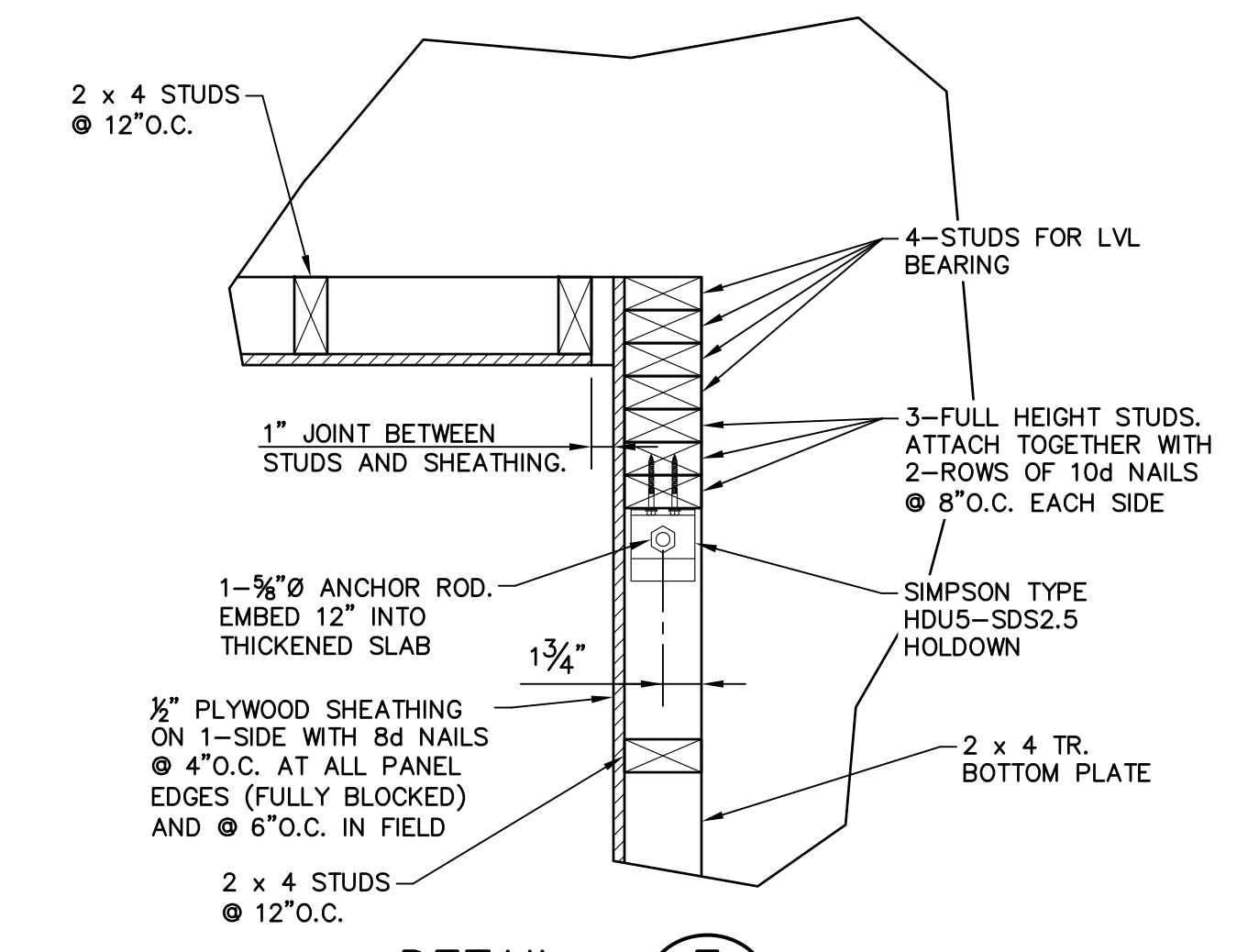
DETAIL D
1/2"=1'-0" S3 | S7



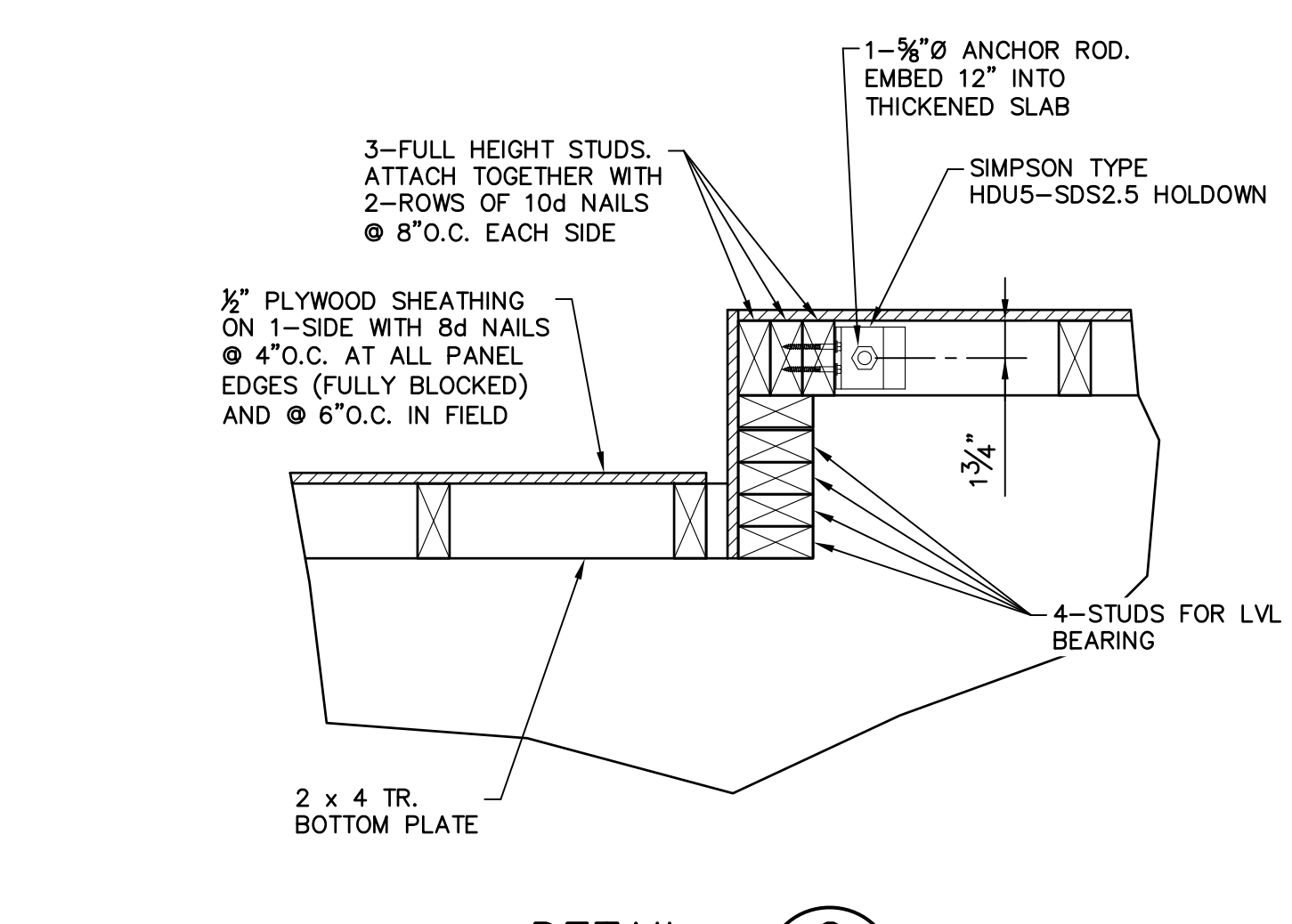
DETAIL E
1/2"=1'-0" S3 | S7



DETAIL F
1/2"=1'-0" S3 | S7



DETAIL G
1/2"=1'-0" S2 | S7 | S3



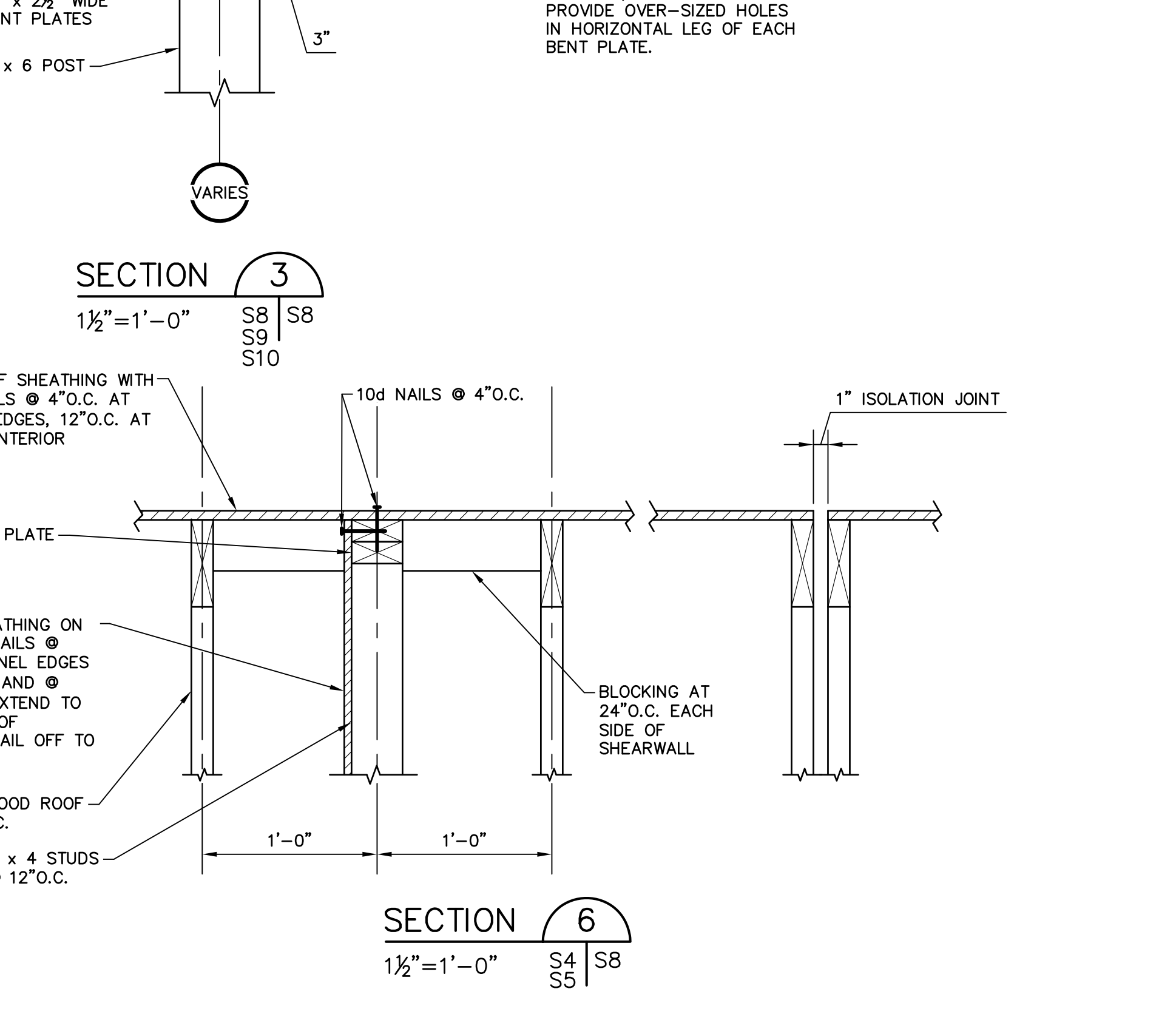
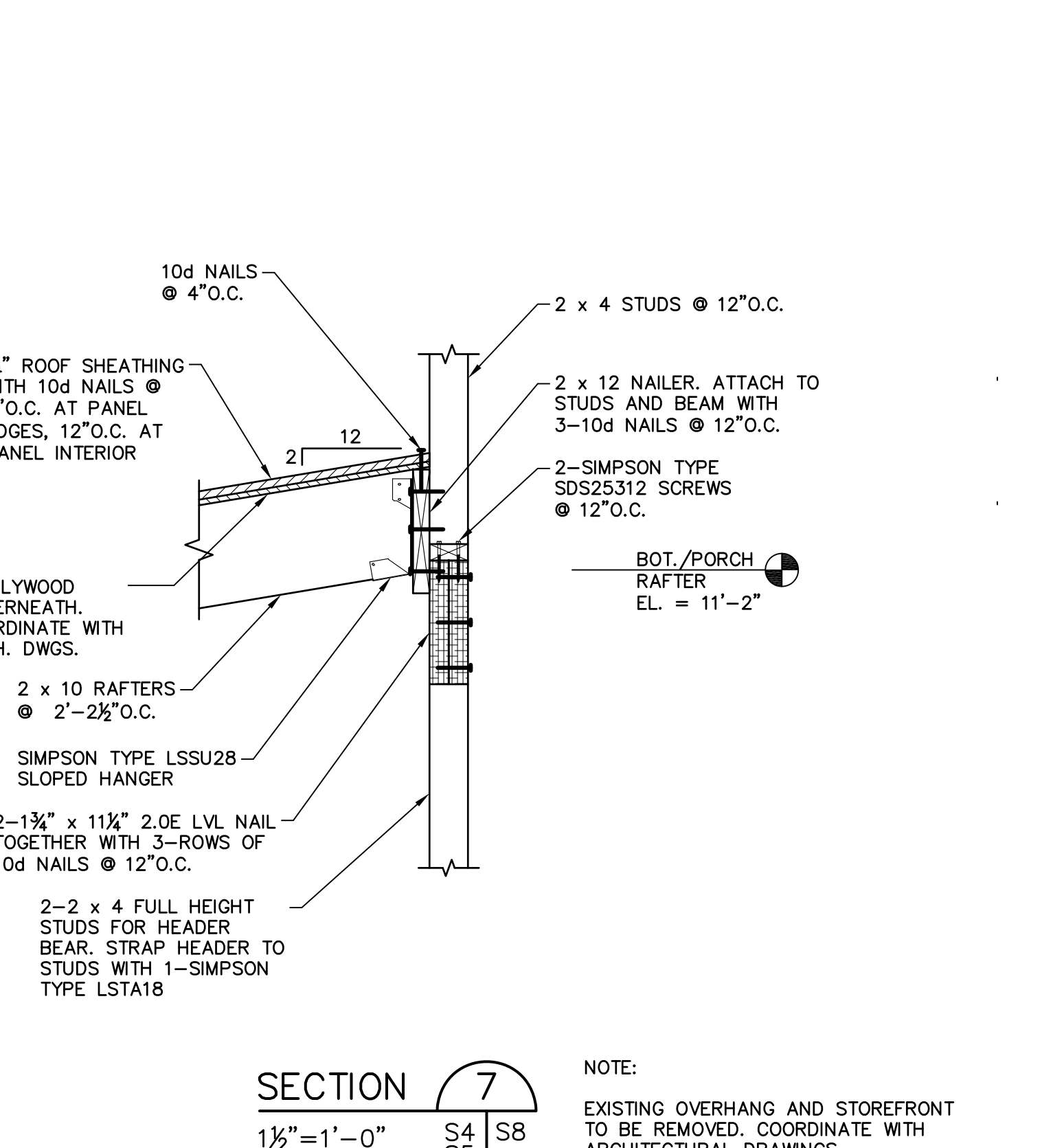
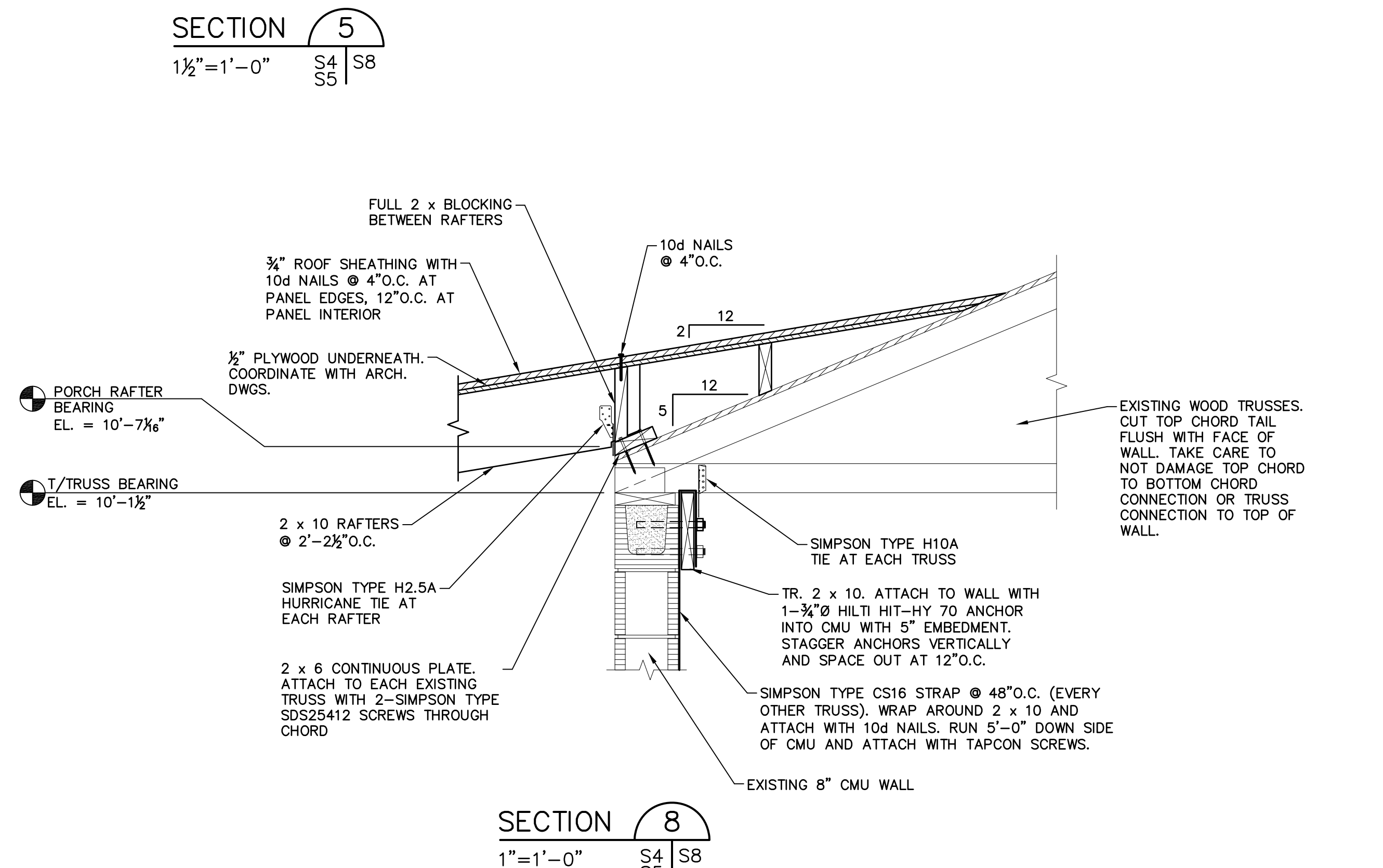
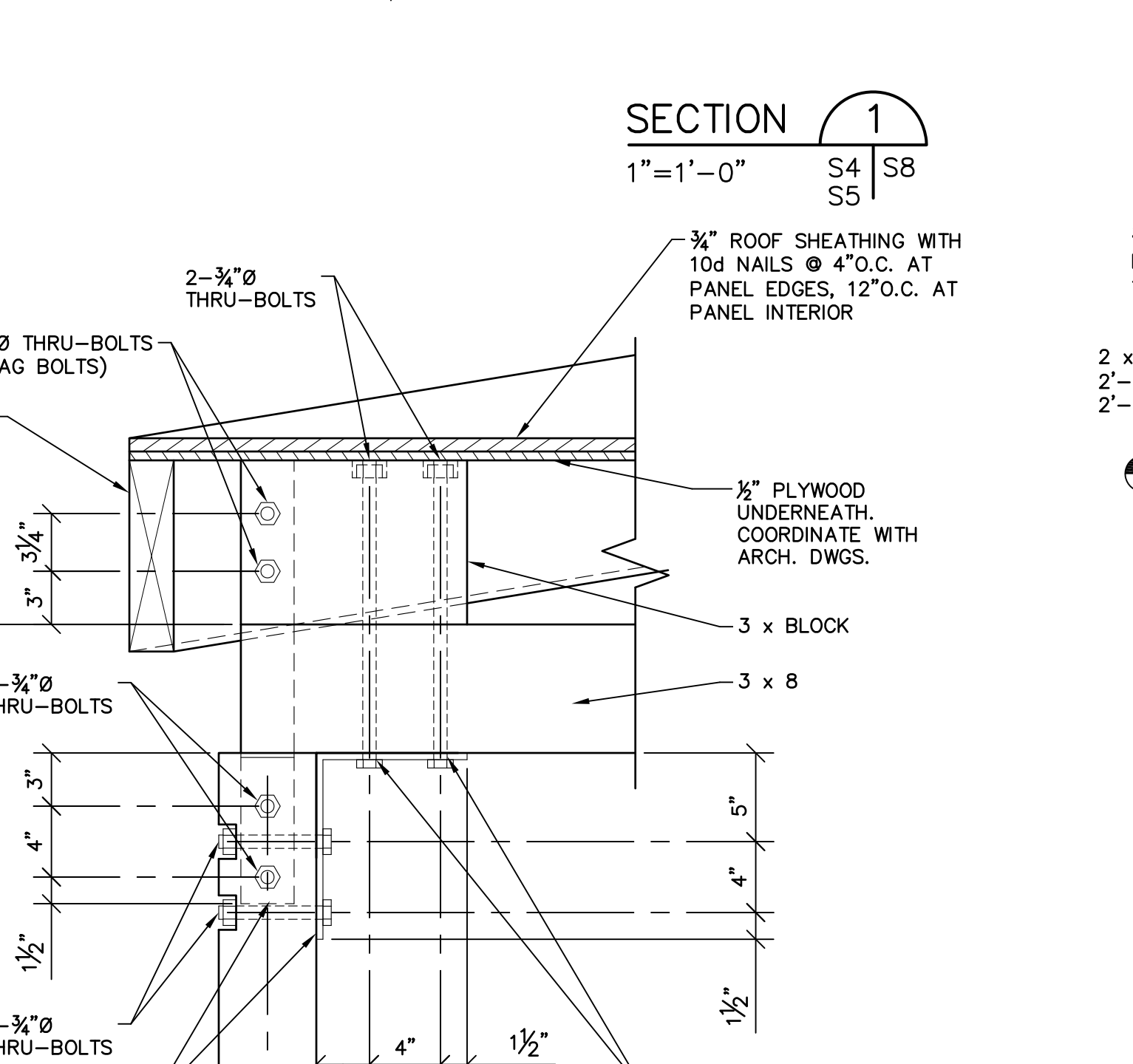
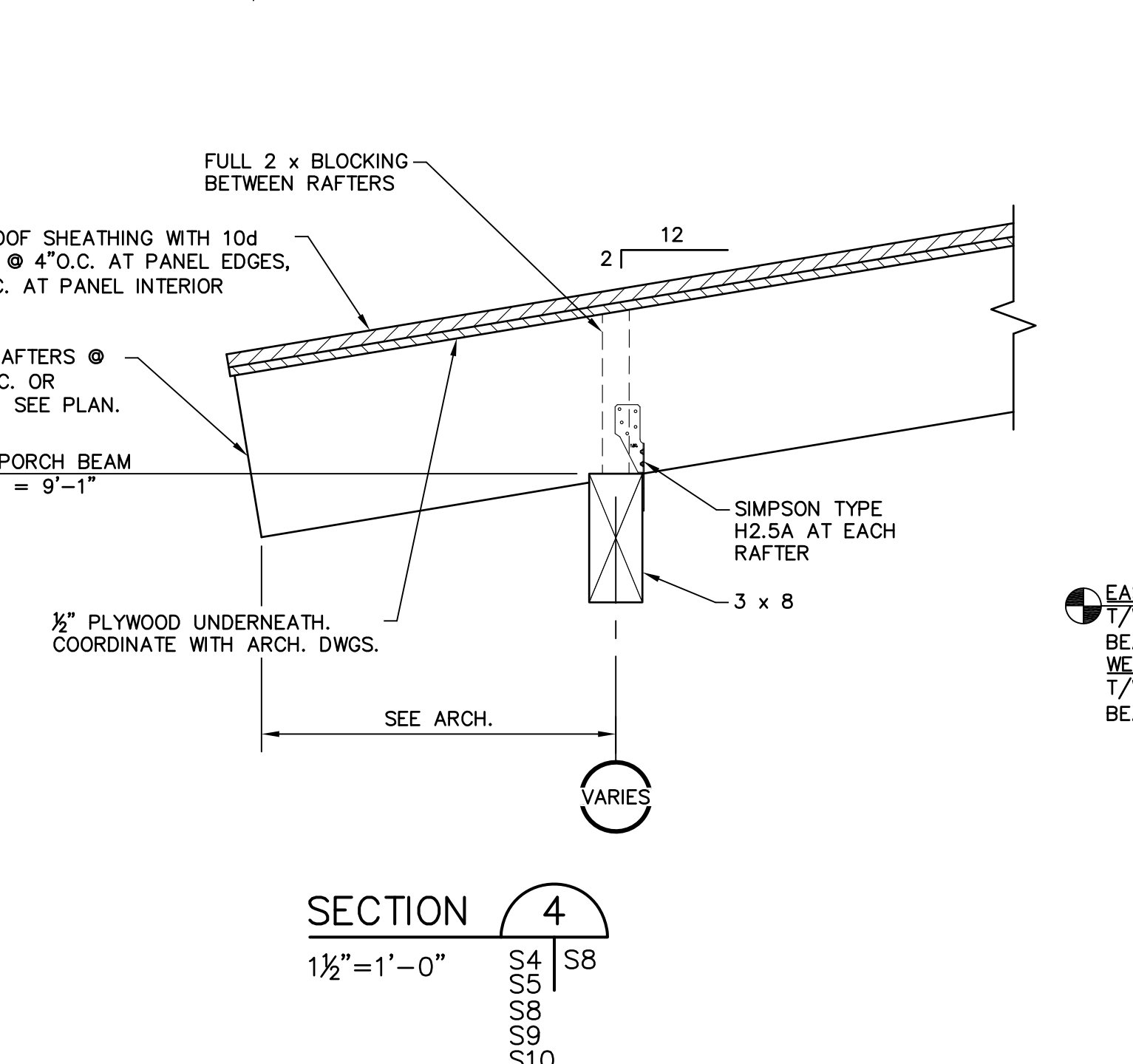
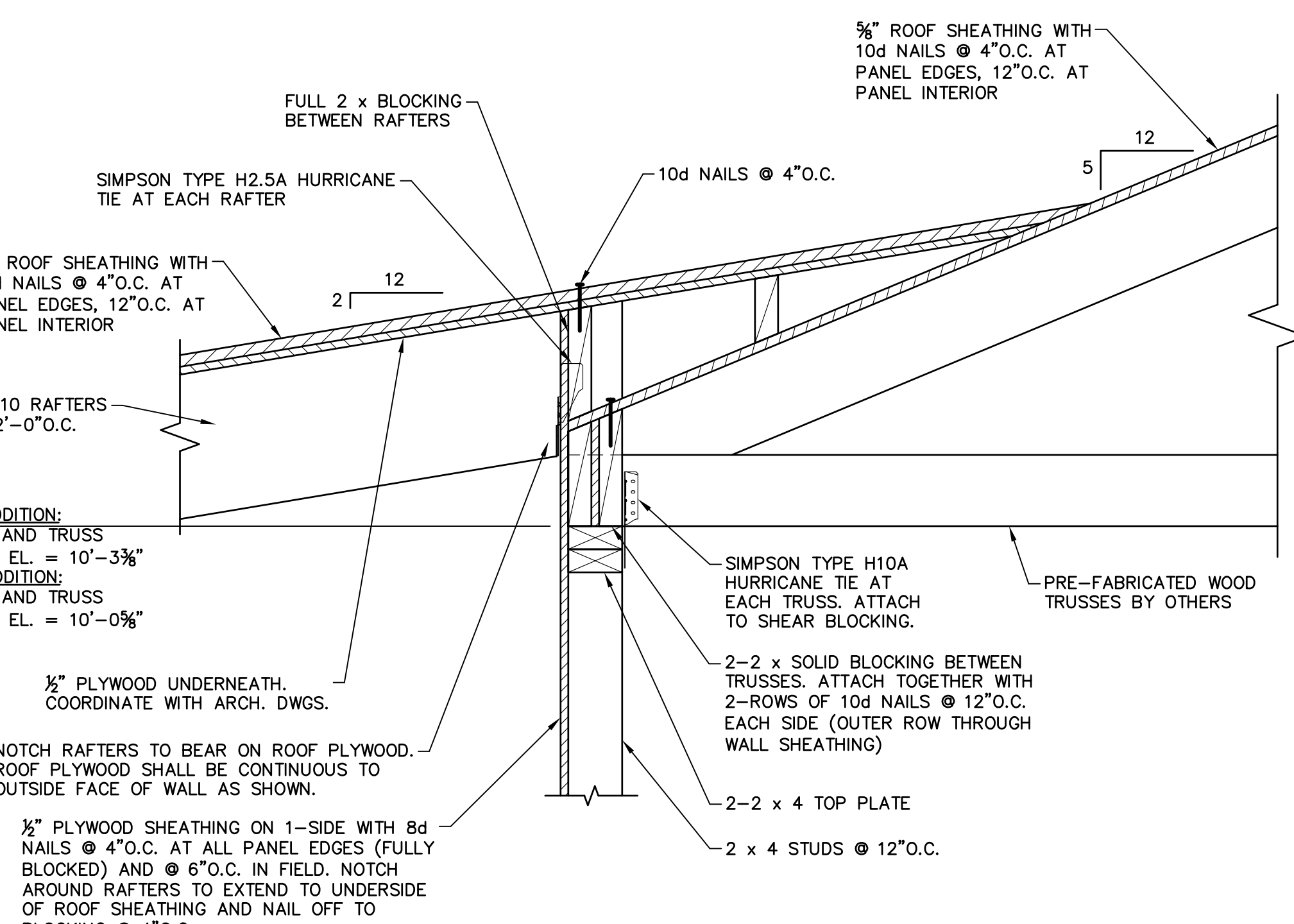
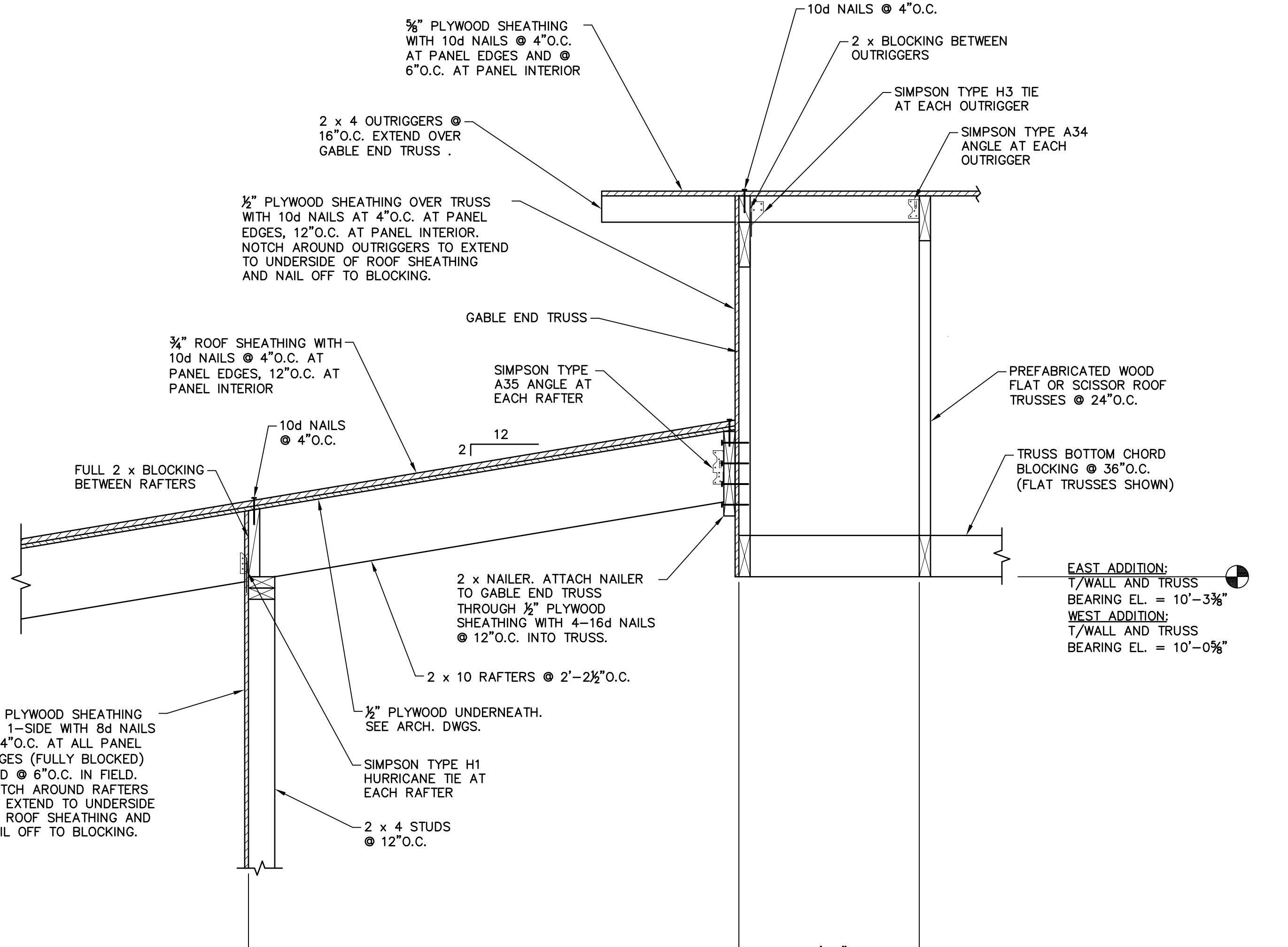
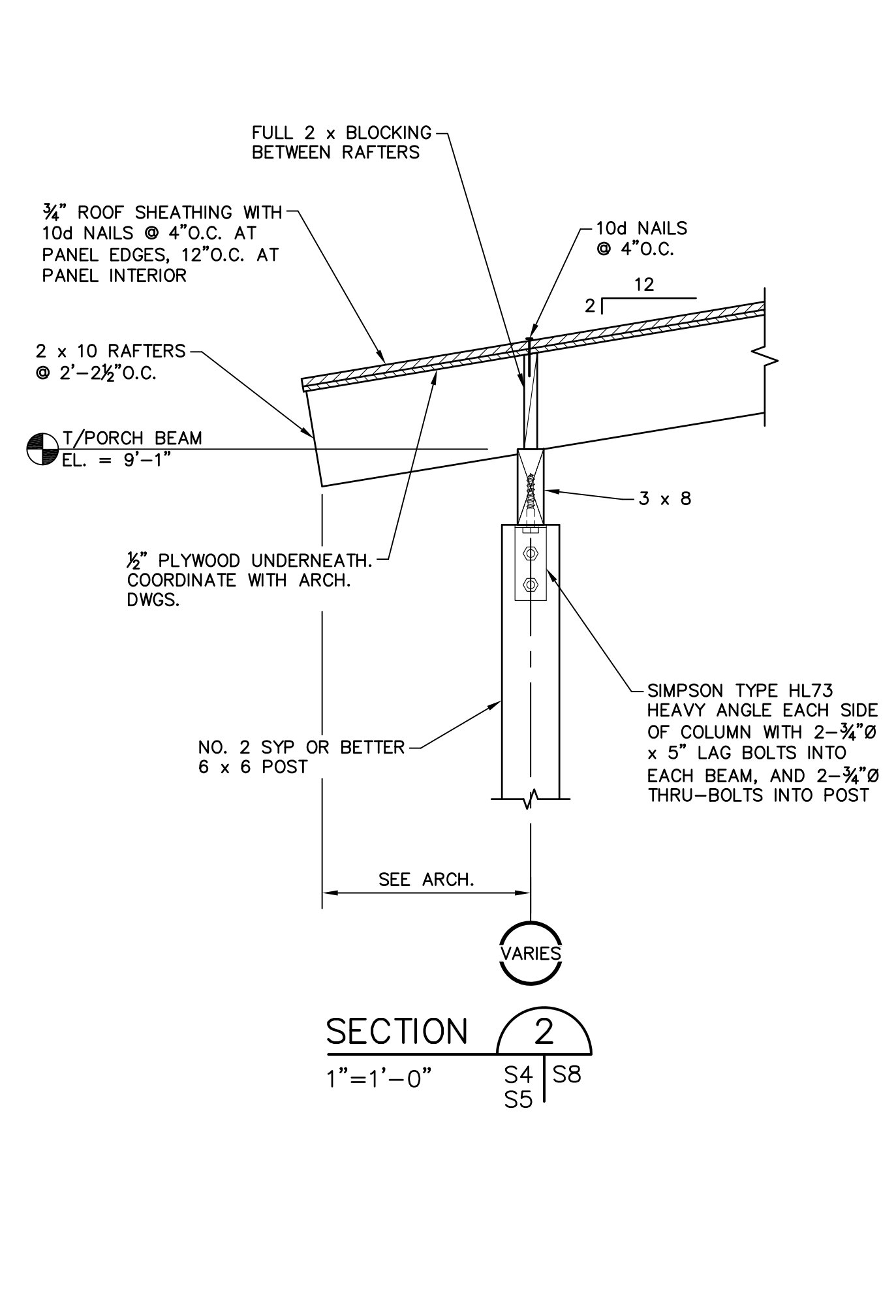
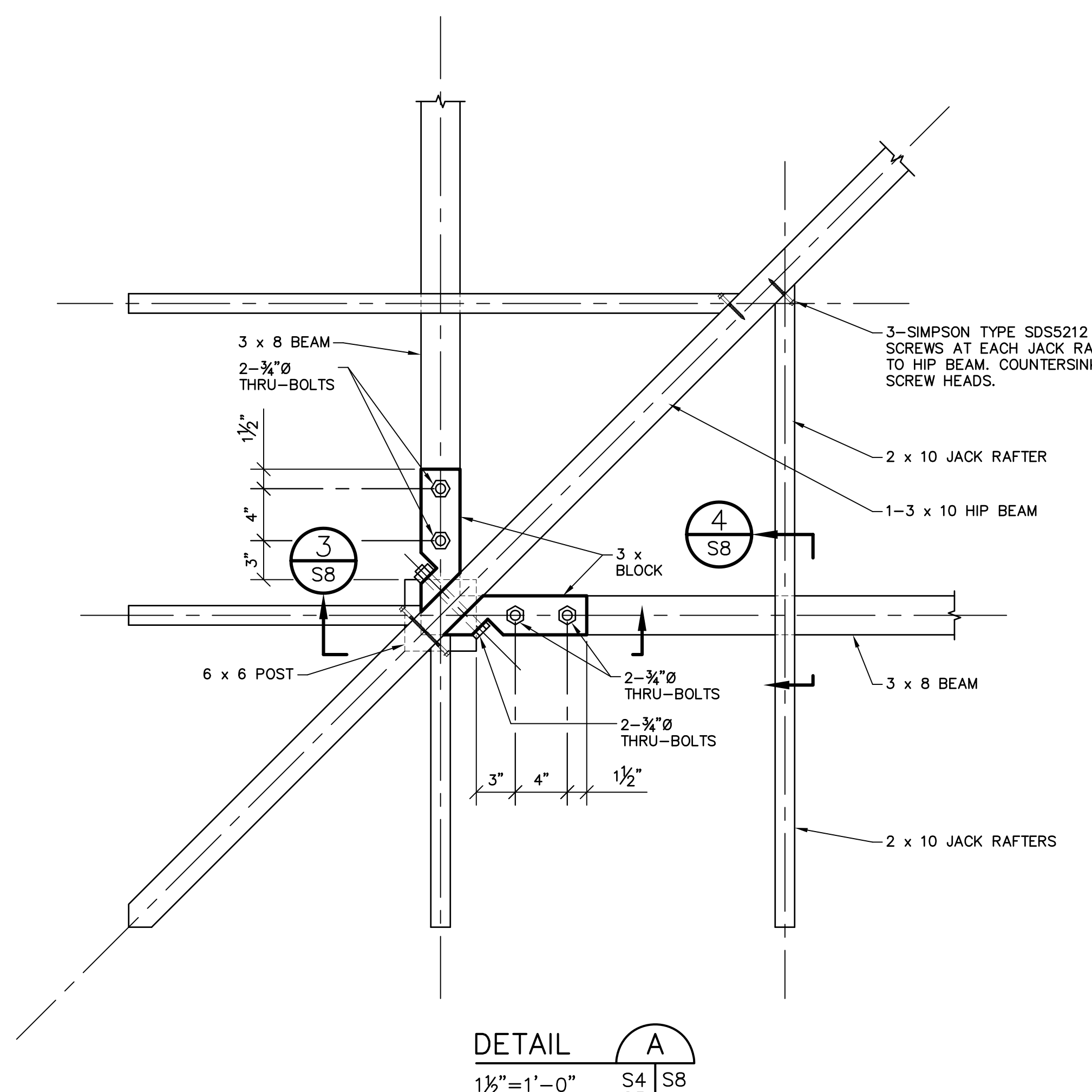
DETAIL H
1/2"=1'-0" S2 | S7 | S3



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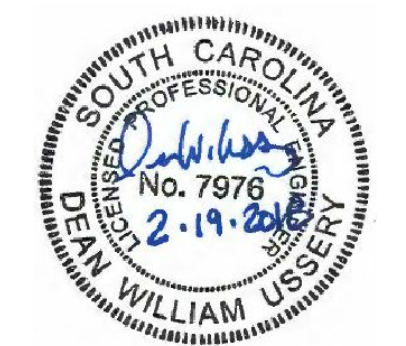
#	DATE	REVISION

ROOF FRAMING
DETAILS



NOTE:
EXISTING OVERHANG AND STOREFRONT
TO BE REMOVED. COORDINATE WITH
ARCHITECTURAL DRAWINGS.

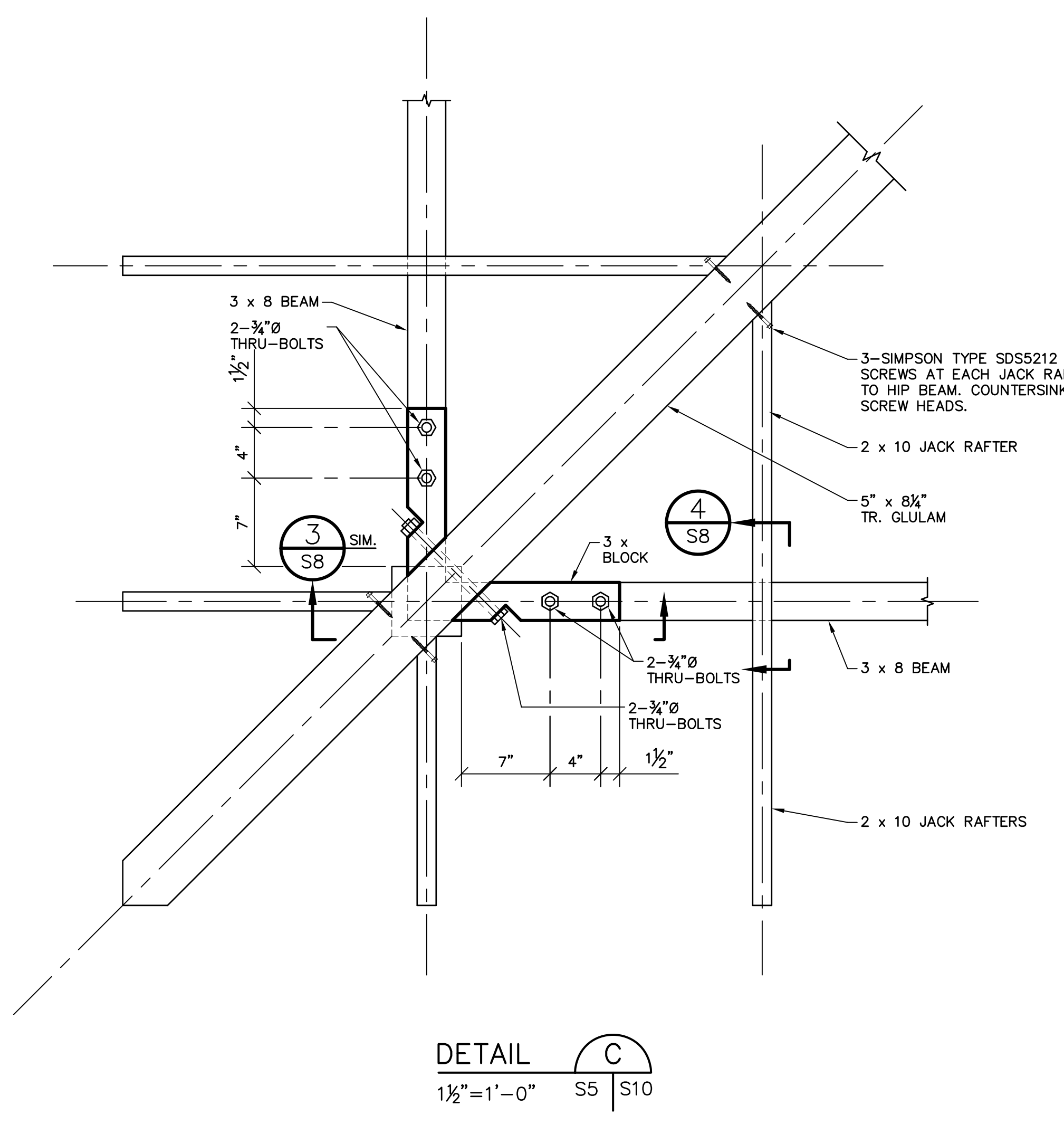
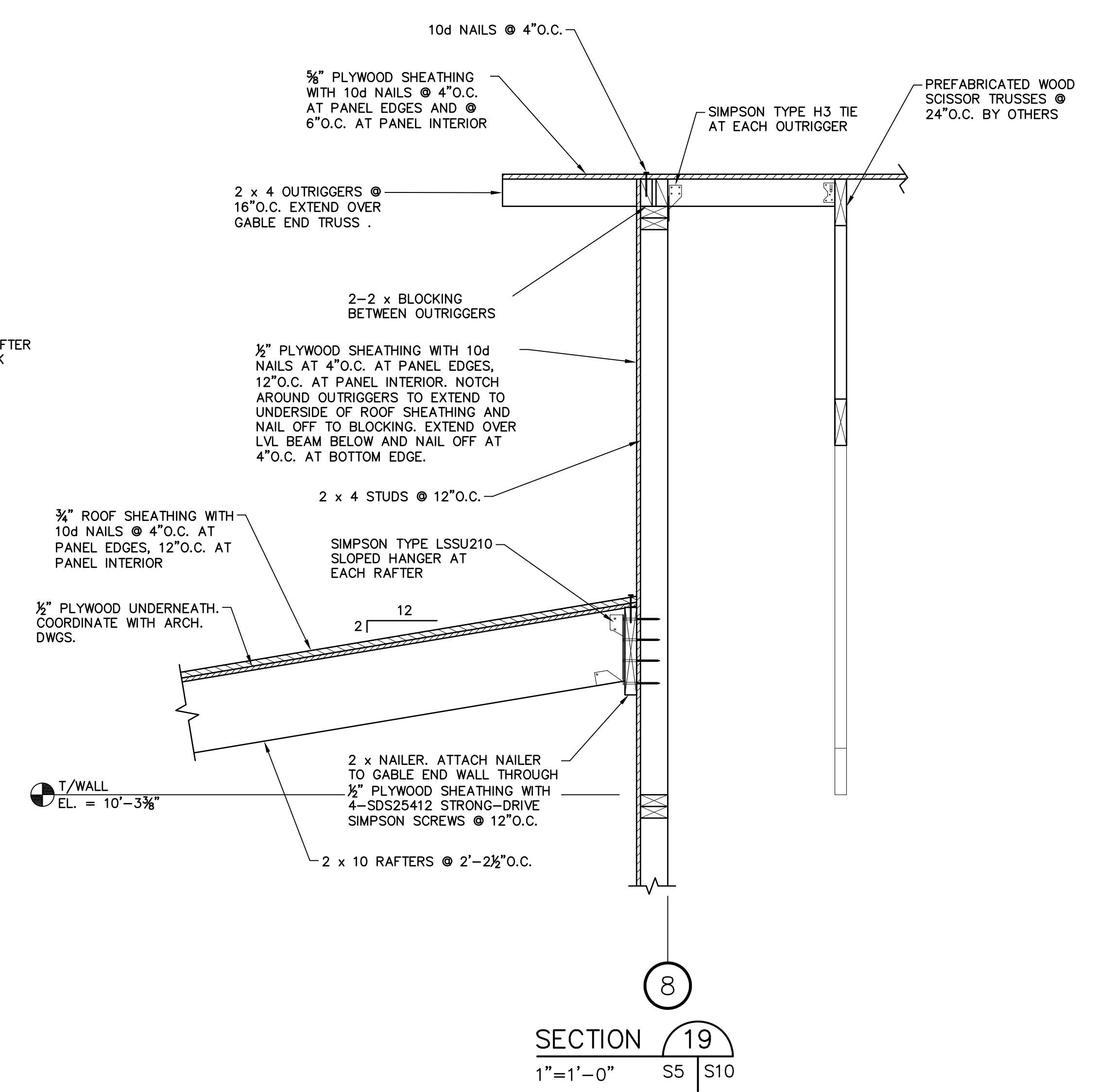
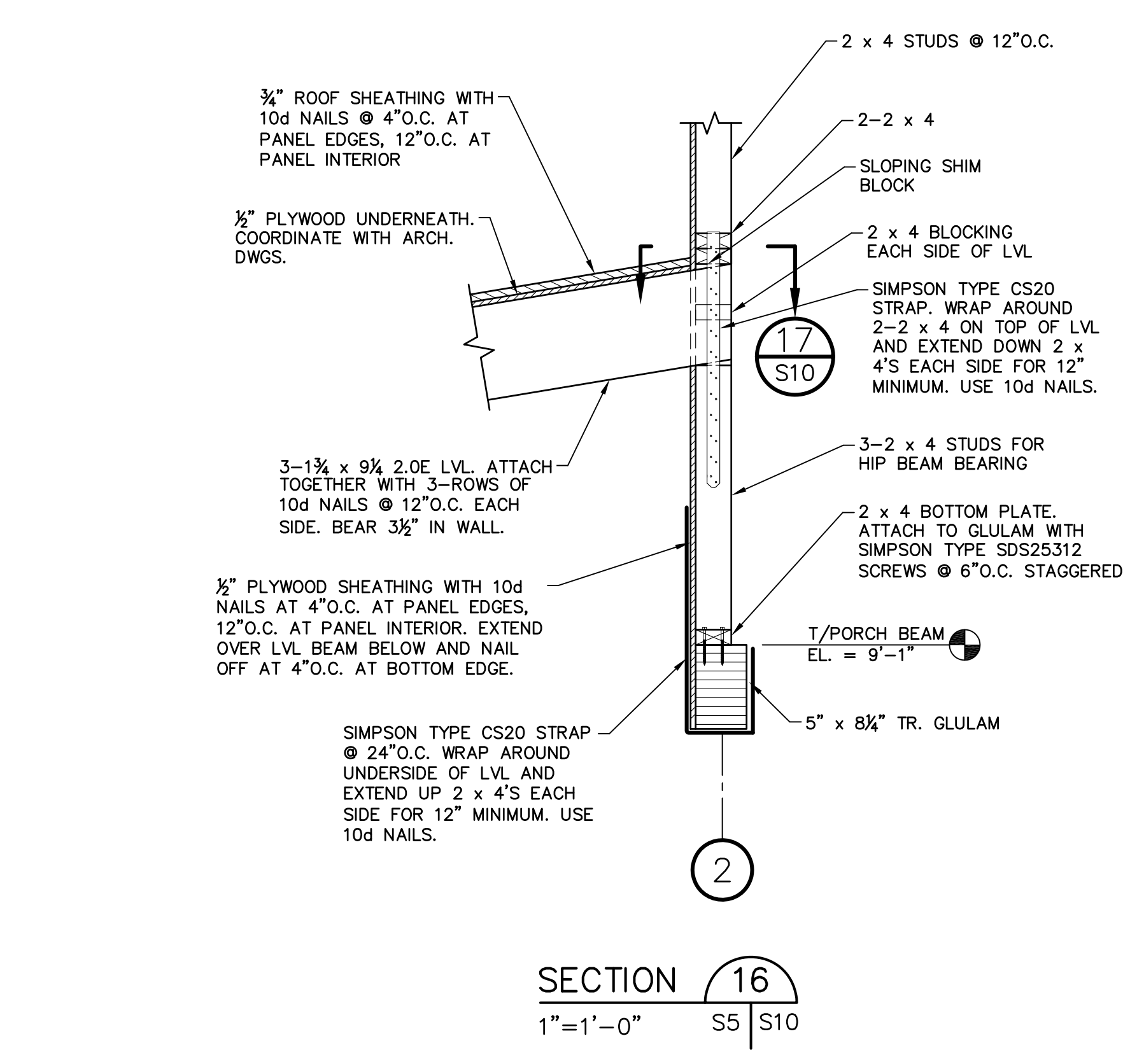
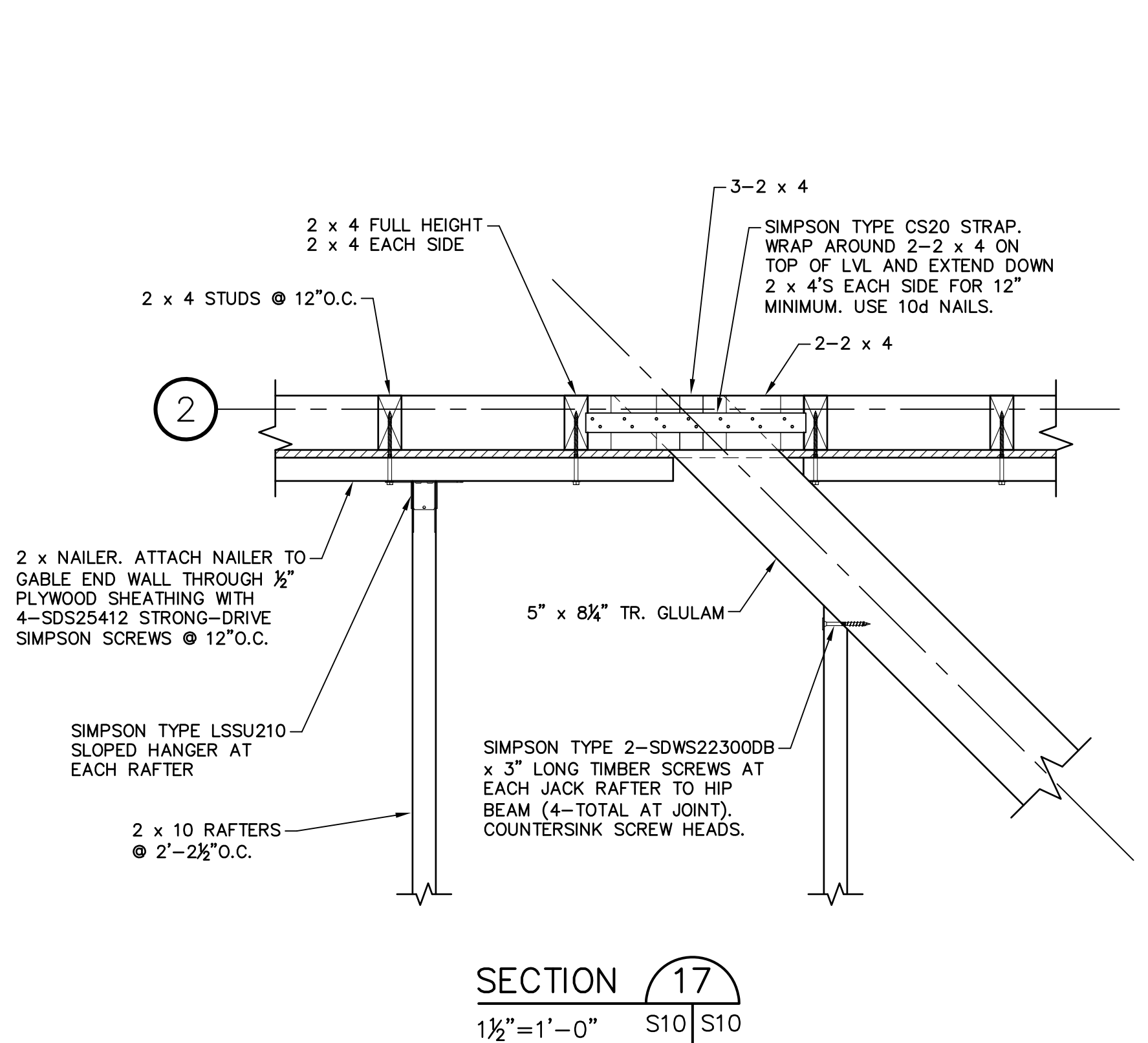
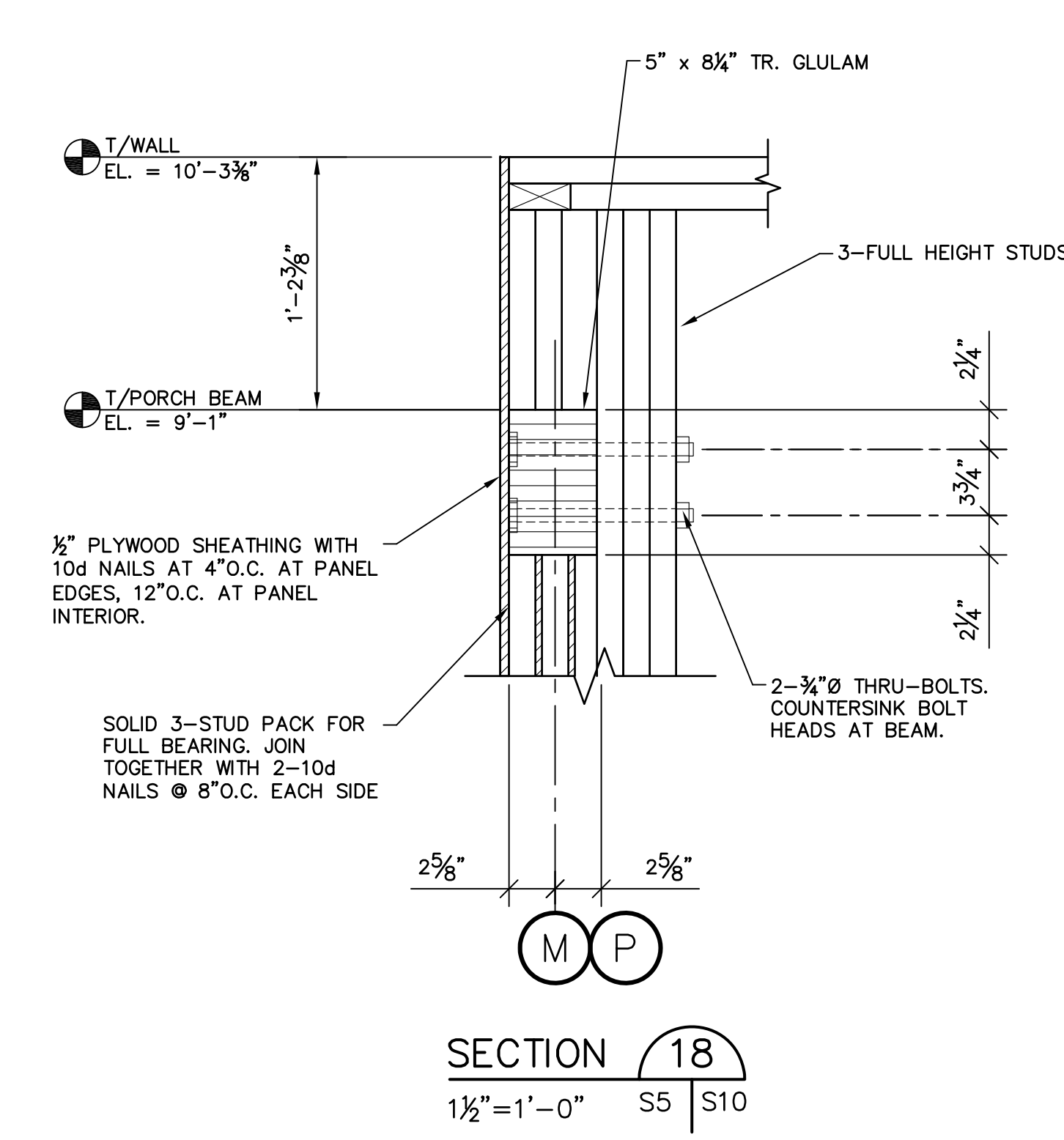
1
2
3
4
5
6



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ROOF FRAMING
DETAILS

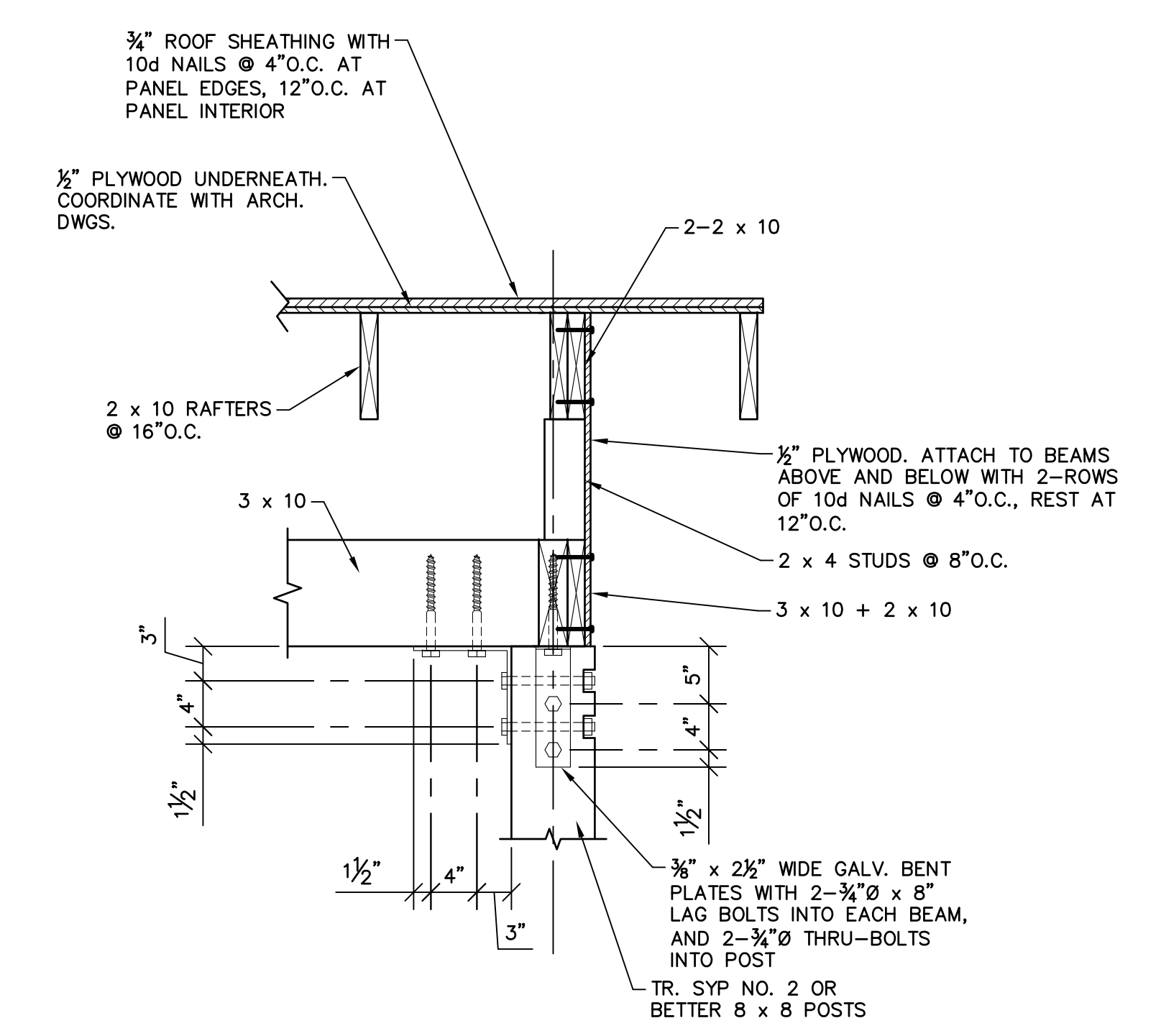




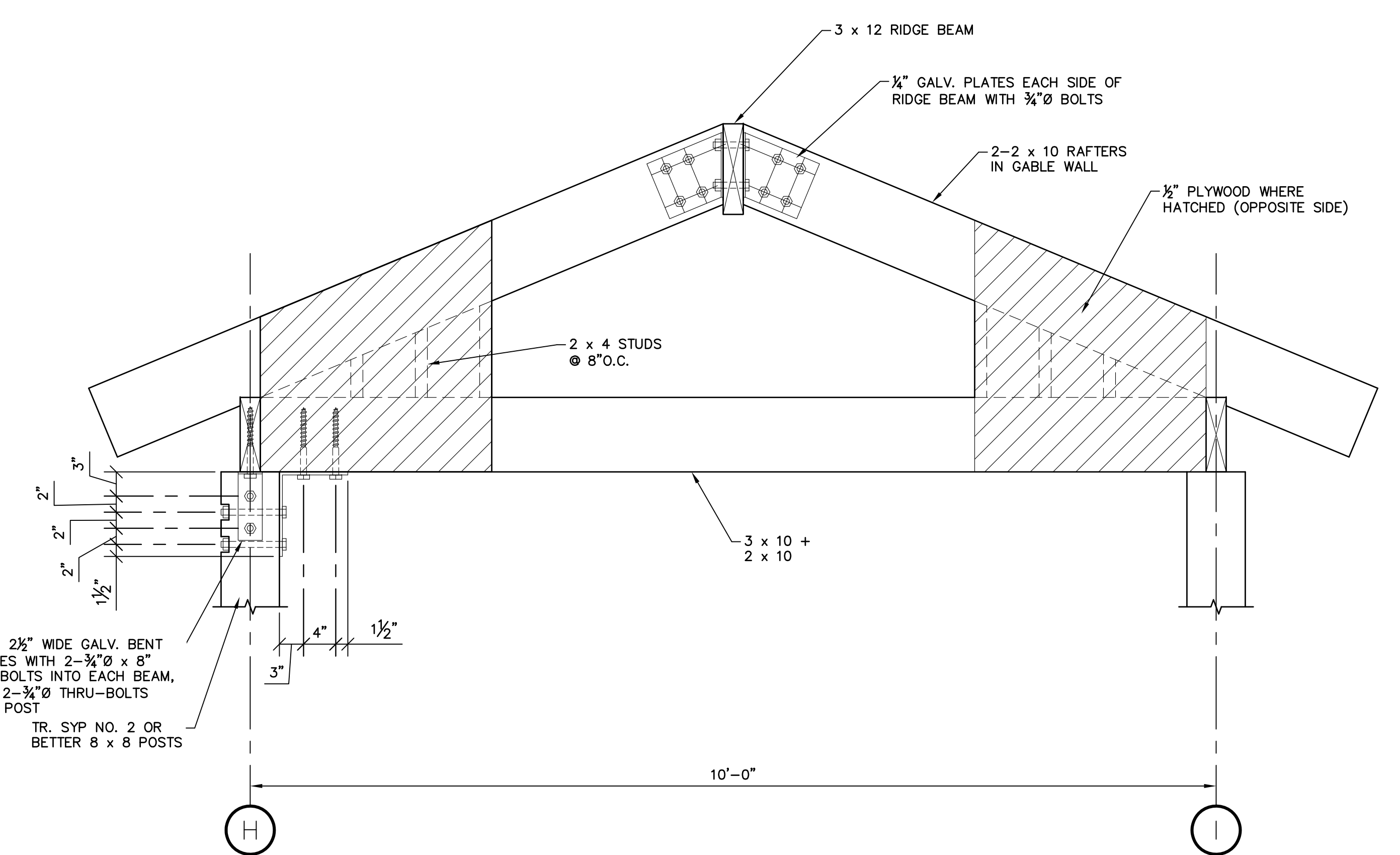
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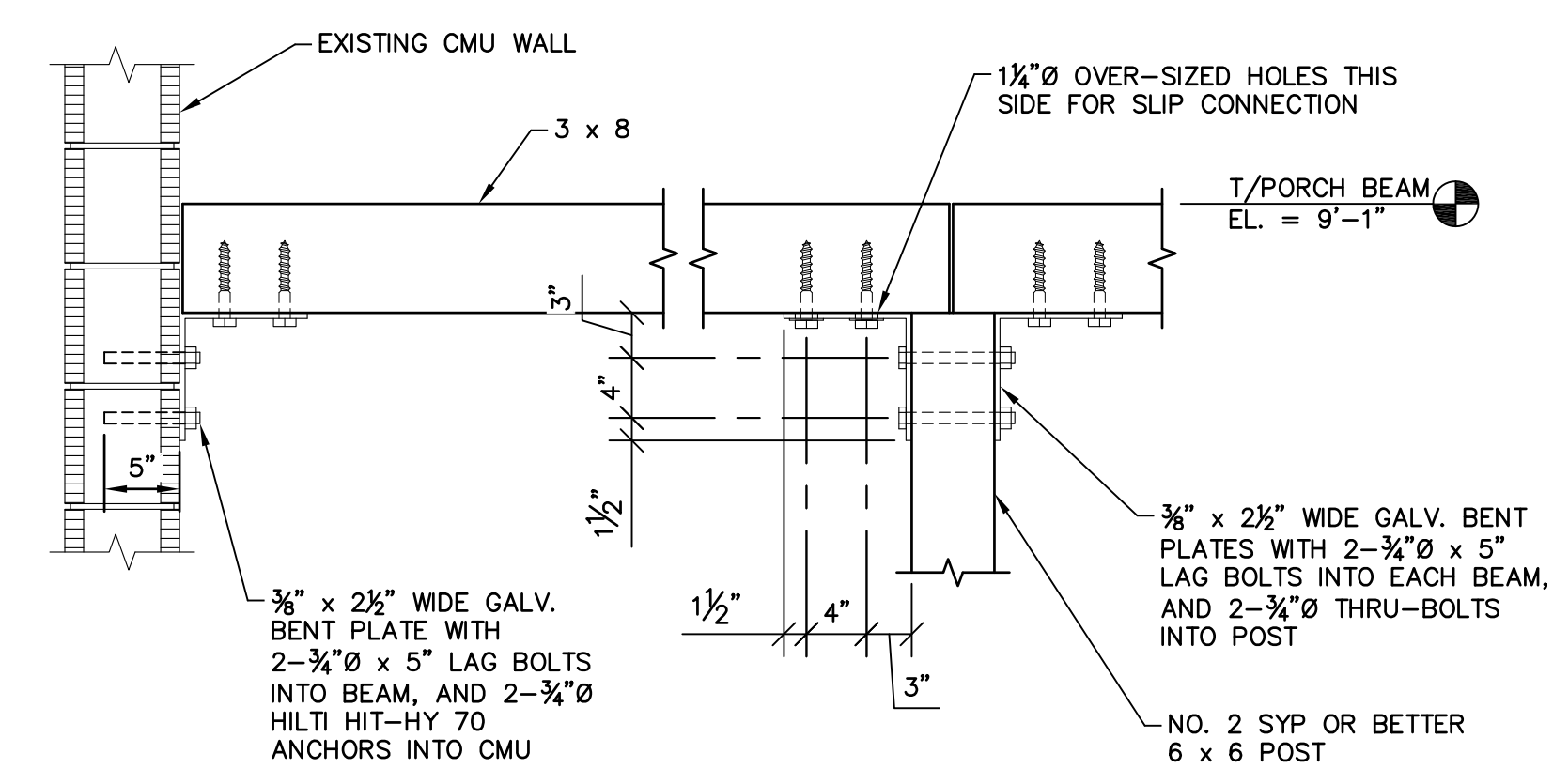
ROOF FRAMING
DETAILS



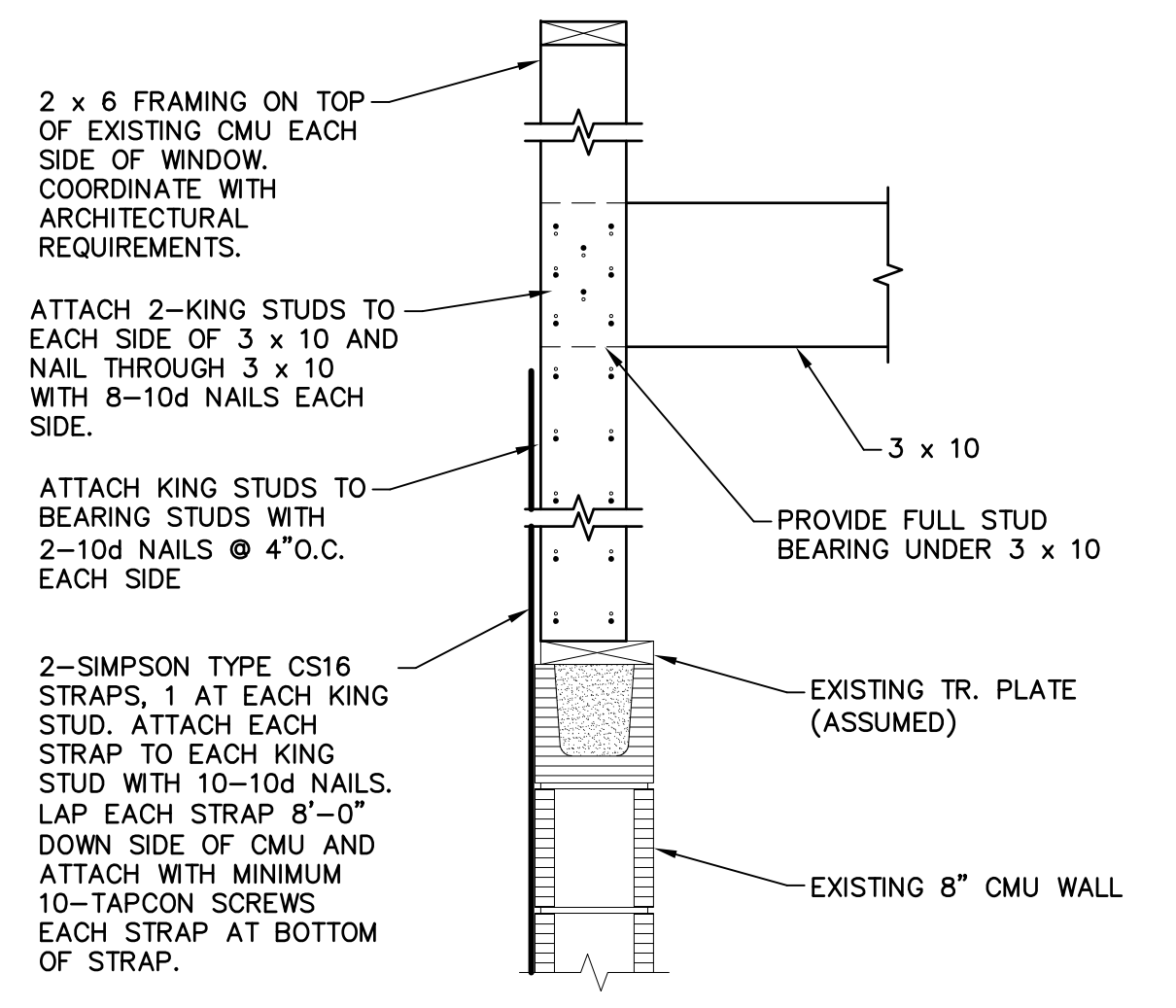
SECTION 3A
1"=1'-0" S10A | S10A



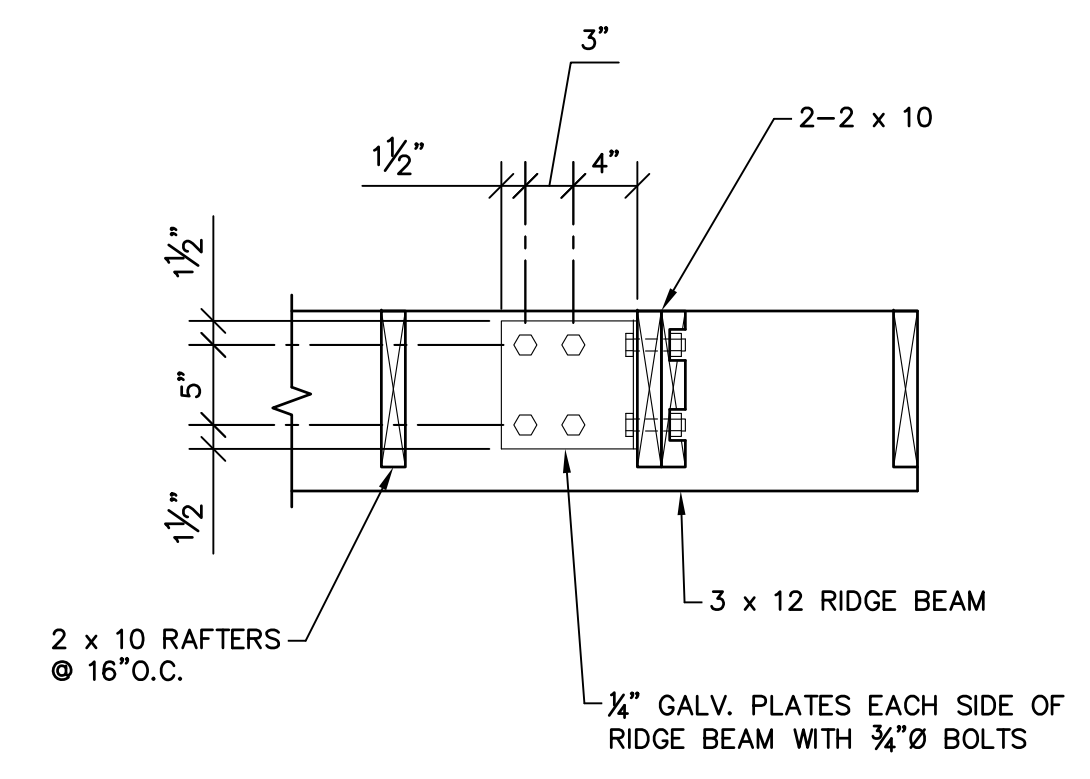
SECTION 2A
1"=1'-0" S4 | S10A
S5 |



SECTION 5A
1"=1'-0" S4 | S10A
S5 |



SECTION 1A
1"=1'-0" S4 | S10A
S5 |



SECTION 4A
1"=1'-0" S10A | S10A

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A ONE LAYER OF GYPSUM WALL BOARD APPLIED TO EACH SIDE OF WOOD STUDS

CONSTRUCTION:	A4			
STUD SIZE	2x4			
GWB THICKNESS	5/8"			
PARTITION THICKNESS (T)	4 3/4"			

ACOUSTICAL: TYP S - SEE INSULATION DESCRIPTION

NO INSULATION (STC)	40			
INSULATION (STC)	49			

TYP. PARTITION DETAIL - A SCALE: 3"=1'-0"

D ONE LAYER OF GYPSUM WALL BOARD APPLIED TO ONE SIDE OF WOOD STUDS

CONSTRUCTION:	D1	D2	D4	
STUD SIZE	1x	2x4 (SIDE)	2x4	
GWB THICKNESS	5/8"	5/8"	5/8"	
PARTITION THICKNESS (T)	1 3/8"	2 1/8"	4 1/8"	

ACOUSTICAL: TYP S - SEE INSULATION DESCRIPTION

NO INSULATION (STC)		40		
INSULATION (STC)		49		

TYP. PARTITION DETAIL - D SCALE: 3"=1'-0"

TYP. PLAN DETAIL - FIBER CEMENT BD TRIM
A0.00 3"=1'-0"

- PARTITION NOTES:**
- WHERE FIRE TESTS ARE INDICATED IN PARTITION DESCRIPTION, CONFIGURE AND INSTALL PARTITION PER TESTING AGENCY CRITERIA OR OTHER TESTS APPROVED BY LOCAL CODE OFFICIALS. TESTING AGENCY CRITERIA MAY INCLUDE ADDITIONAL COMPONENTS NOT SPECIFICALLY INDICATED ON THIS SCHEDULE OR REFERENCED DETAILS.
 - DO NOT SCALE DRAWINGS. WRITTEN DIMENSIONS SHALL ESTABLISH LOCATION OF ALL PARTITIONS. LARGER SCALE DRAWINGS HAVE PRIORITY OVER SMALLER SCALE DRAWINGS. CONTRACTOR SHALL NOTIFY THE ARCHITECT OF ANY DISCREPANCIES IN THE DRAWINGS BEFORE PROCEEDING WITH CONSTRUCTION.
 - GYP BD (GWB) IS 5/8" TYPE X FIRE RATED GYP BD, TYPICAL.
 - GYP BD PARTITION CONTROL JOINTS ARE REQUIRED AT APPROXIMATELY 30'-0" O.C. FOR STRAIGHT & CONTINUOUS WALLS. AT OPENING LOCATIONS, OR AS NOTED OTHERWISE ON DRAWINGS, WHERE NOT SPECIFICALLY INDICATED ON THE DRAWINGS, SUBMIT CONTRACTOR'S PROPOSED CONTROL JOINT LOCATIONS TO ARCHITECT FOR APPROVAL.
 - DO NOT PLACE MECHANICAL AND/OR ELECTRICAL DEVICES BACK TO BACK IN SOUND BARRIER PARTITIONS. ALL DEVICES TO BE PLACED IN SEPARATE STUD SPACES WITH 8" O.C. MIN. SEPARATION.
 - DUCT PENETRATIONS THROUGH SOUND BARRIER PARTITIONS TO RECEIVE PERIMETER SOUND SEAL BETWEEN DUCT AND WALL FRAMING ON BOTH SIDES OF GYPSUM WALLBOARD LAYER MEETING DUCT SURFACES.
 - OUTER LAYER OF ALL INTERIOR GYP. BD. PARTITIONS ADJACENT OR EXPOSED TO HUMID CONDITIONS SHALL BE CONSTRUCTED WITH WATER RESISTANT GYP. BD. OR EQUAL, AS THE SUBSTRATE. PREPARE SUBSTRATE TO RECEIVE SCHEDULED CERAMIC OR STONE TILE, WATER RESISTANT WALL PANELS OR HIGH PERFORMANCE PAINT FINISHES. HUMID SPACES INCLUDE BUT ARE NOT LIMITED TO TOILET ROOM WALLS, KITCHEN WALLS AND WALLS ADJACENT TO WATER FEATURES. USE GLASS-MAT TILE BACKING PANELS AT ALL WALLS IN DIRECT CONTACT WITH WATER, FOR EXAMPLE, SHOWERS, STEAM ROOMS, ETC. U.N.O.
 - FINISH ALL EXPOSED GYP BD CONSTRUCTION. ALL GYP BD CONSTRUCTION SHALL BE TAPED AND FLOATED. ALL EXPOSED CONSTRUCTION WILL BE SANDED SMOOTH TO REMOVE ALL INDICATION OF THE JOINT WITH A VISUAL INSPECTION AND PREPARED TO RECEIVE THE APPROPRIATE SCHEDULED WALL FINISH. FINISH SHALL BE IN ACCORDANCE WITH THE ROOM FINISH SCHEDULE AND/OR FINISH LEVELS NOTED IN THE GYPSUM BOARD SPECIFICATION SECTION 092900.
 - PARTITIONS ARE DIMENSIONED TO FACE OF GYP. BD, FACE OF MASONRY AND TO FACE OF EXISTING CONSTRUCTION. ANY INTERIOR PARTITIONS DIMENSIONED TO FACE OF STUD ARE NOTED - FOS.
 - PERIMETER DIMENSIONS ARE TO FACE OF WALL BELOW SILL, U.O.N.
 - PROVIDE BLOCKING AS SHOWN OR AS REQUIRED FOR ATTACHMENT OF WALL MOUNTED HARDWARE, TOILET ACCESSORIES, CASEWORK, MILLWORK, FINISH CARPENTRY ETC. AS MAY BE REQUIRED FOR THE SECURE ATTACHMENT OF ADJOINING WORK.
 - PROVIDE A 1/4" WIDE SOFT JOINT AT ALL INTERSECTIONS OF INTERIOR PARTITIONS WITH EXTERIOR WALLS. SEE TYPICAL DETAIL.

- INSULATION:**
- PROVIDE SOUND ATTENUATION BLANKET AS INDICATED. FILL VOIDS AT STRUCTURE W/ SOUND ATTENUATION BLANKET & SEAL PERIMETER. REFER TO SPECIFICATIONS FOR ADDITIONAL INFORMATION & REQUIREMENTS.
- HEIGHT CONDITIONS:**
- PARTITIONS TO EXTEND TO UNDERSIDE OF STRUCTURE ABOVE (TYP.) U.O.N.

- PARTITION TYPE LEGEND:**
- CATEGORY**
 - A-E STUD WALLS
 - M MASONRY
 - TYPE**
 - SEE SCHEDULE THIS SHEET
 - INSULATION**
 - SEE DESCRIPTION THIS SHEET

- ASSEMBLY TYPE LEGEND:**
- EW-01**
 - TYPE**
 - SEE DESCRIPTION THIS SHEET
 - CATEGORY**
 - EW EXTERIOR WALLS
 - SF STOREFRONT
 - RF ROOFS

RF-02 ASPHALT SHINGLES OVER ROOF SHEATHING (TYPICAL AT PORCHES)

TYP. ASSEMBLY DETAIL - RF-02 SCALE: 3"=1'-0"

RF-01 ASPHALT SHINGLES OVER ROOF SHEATHING (TYPICAL AT ATTIC AREAS)

TYP. ASSEMBLY DETAIL - RF-01 SCALE: 3"=1'-0"

TRIM PROFILES:

FIBER CEMENT BD TRIM
BASIS-OF-DESIGN: JAMES HARDIE

TYP. ASSEMBLY DETAIL - TRIM SCALE: 3"=1'-0"

EW-04 3/4" PLYWOOD w/ FIBER CEMENT BD VERTICAL SIDING PANELS (APPLIED TO EX WALL CONSTRUCTION ABOVE BRICK)

TYP. ASSEMBLY DETAIL - EW-04 SCALE: 3"=1'-0"

EW-03 BRICK ON CMU INFILL AT EX EXTERIOR WALL CONSTRUCTION

TYP. ASSEMBLY DETAIL - EW-03 SCALE: 3"=1'-0"

EW-02 WD FURRING w/ FIBER CEMENT BD LAP SIDING (APPLIED TO EX EXTERIOR WALL CONSTRUCTION)

TYP. ASSEMBLY DETAIL - EW-02 SCALE: 3"=1'-0"

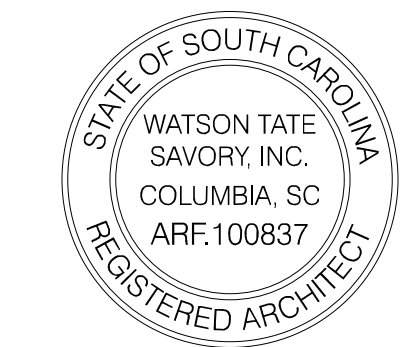
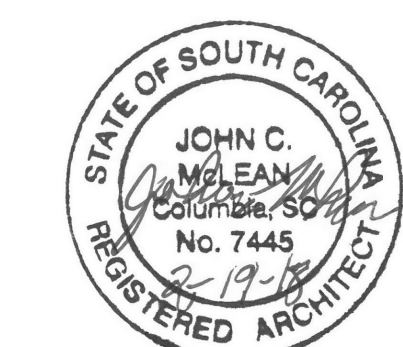
EW-01 2x4 WD STUDS w/ FIBER CEMENT BD LAP SIDING

EW-01A 2x4 WD STUDS w/ FIBER CEMENT BD LAP SIDING (EXCLUDE 5/8" GWB & INSULATION)

TYP. ASSEMBLY DETAIL - EW-01 SCALE: 3"=1'-0"

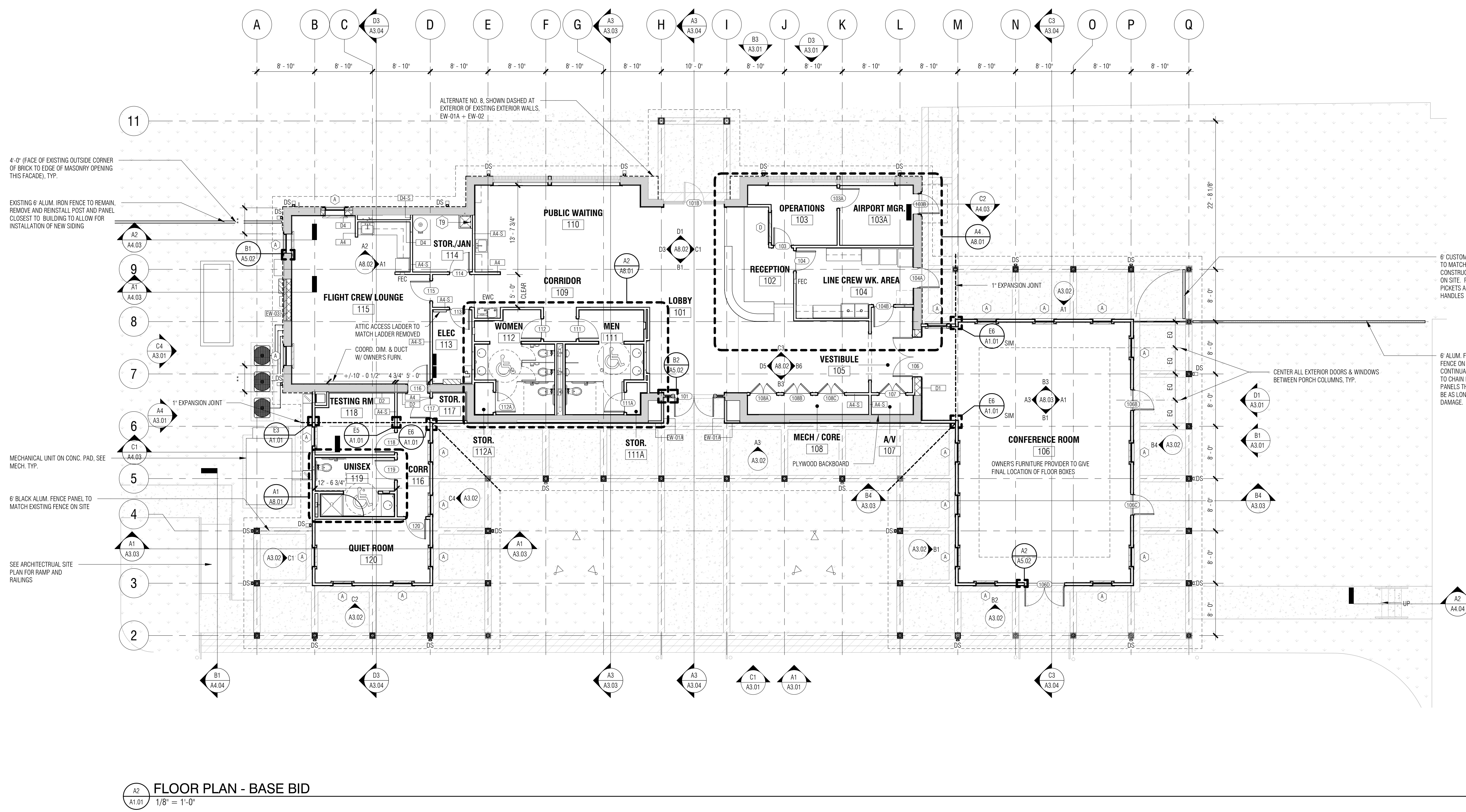
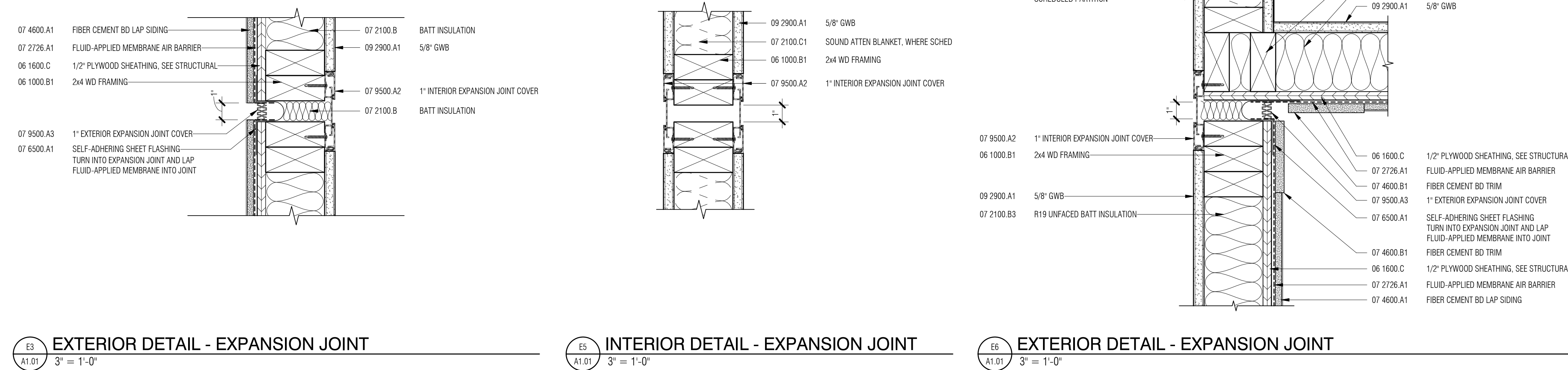
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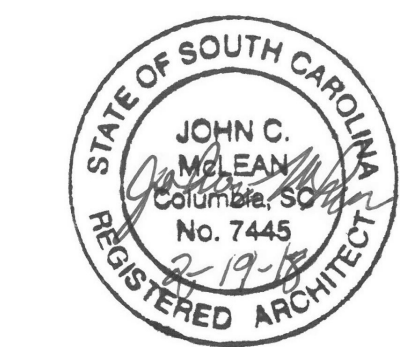
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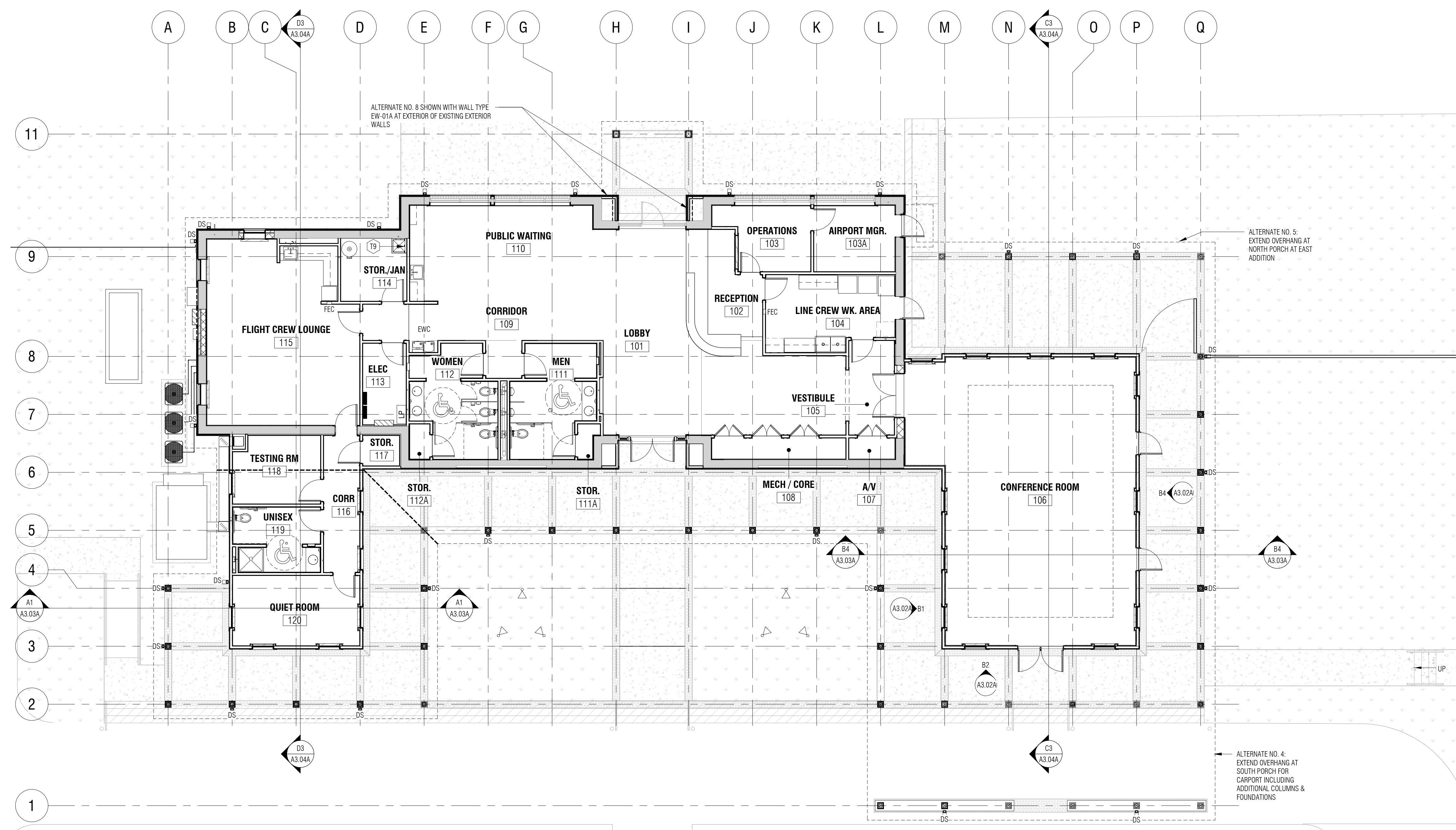
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#	DATE	REVISION

FLOOR PLAN -
ALTERNATES

STATE PROJECT NO. 1509
FIRM PROJECT NO. SHEET

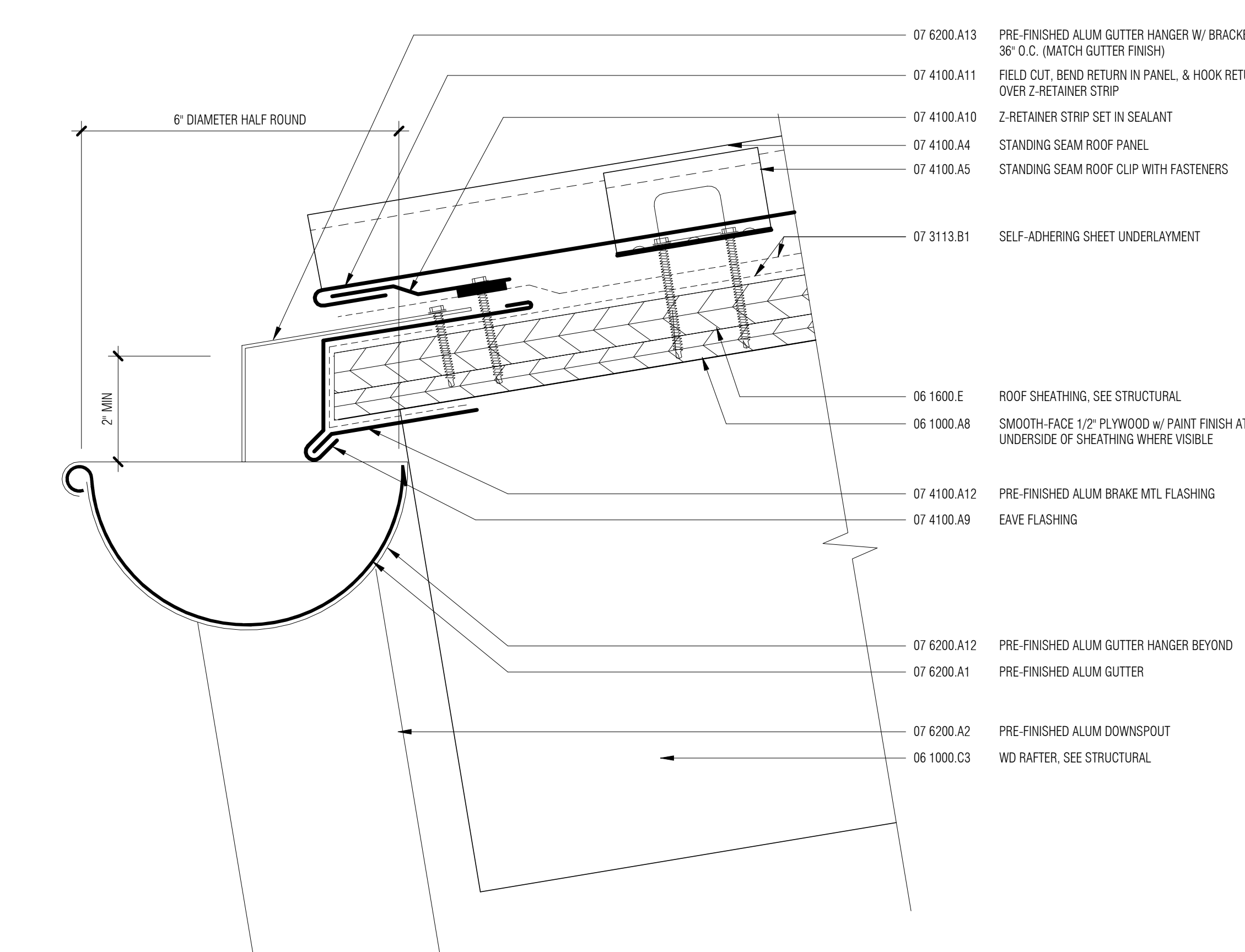
A1.01A



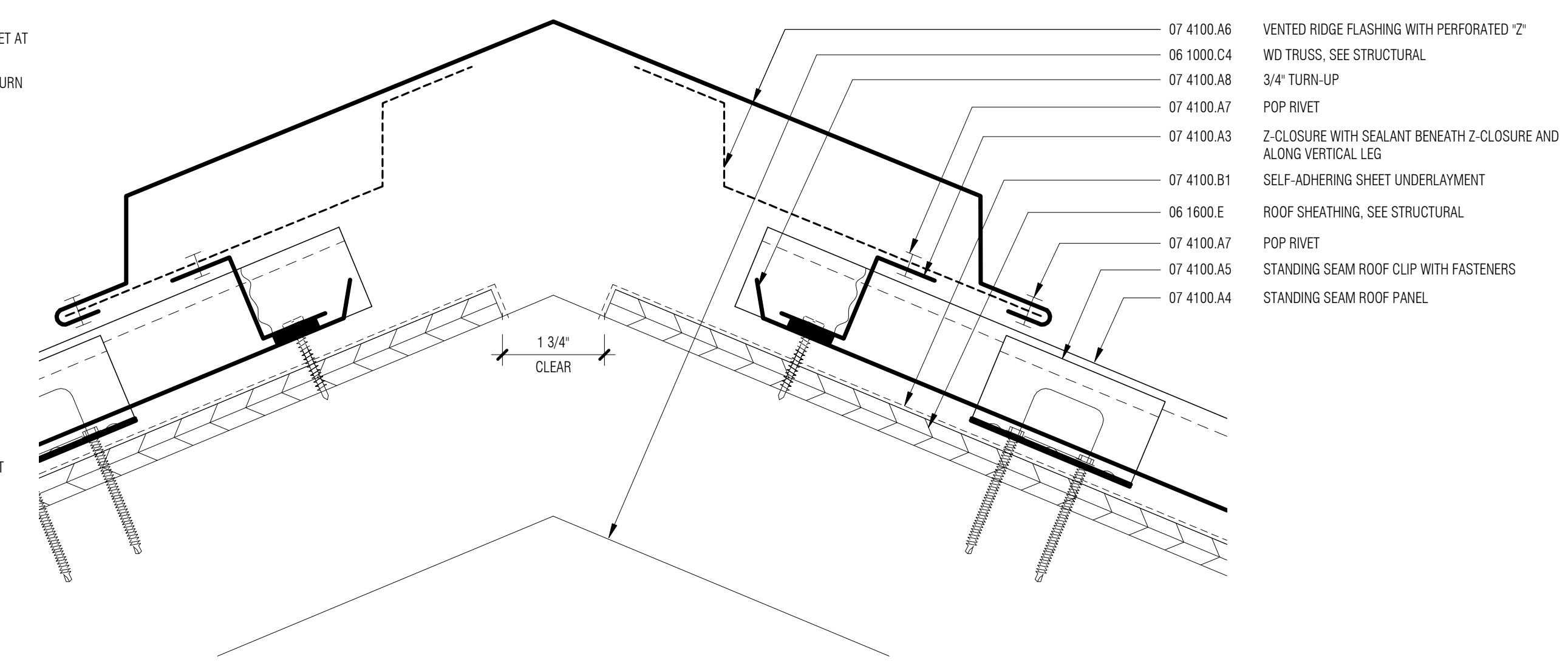
FLOOR PLAN - ALTERNATES
A2
A1.01A
1/8" = 1'-0"

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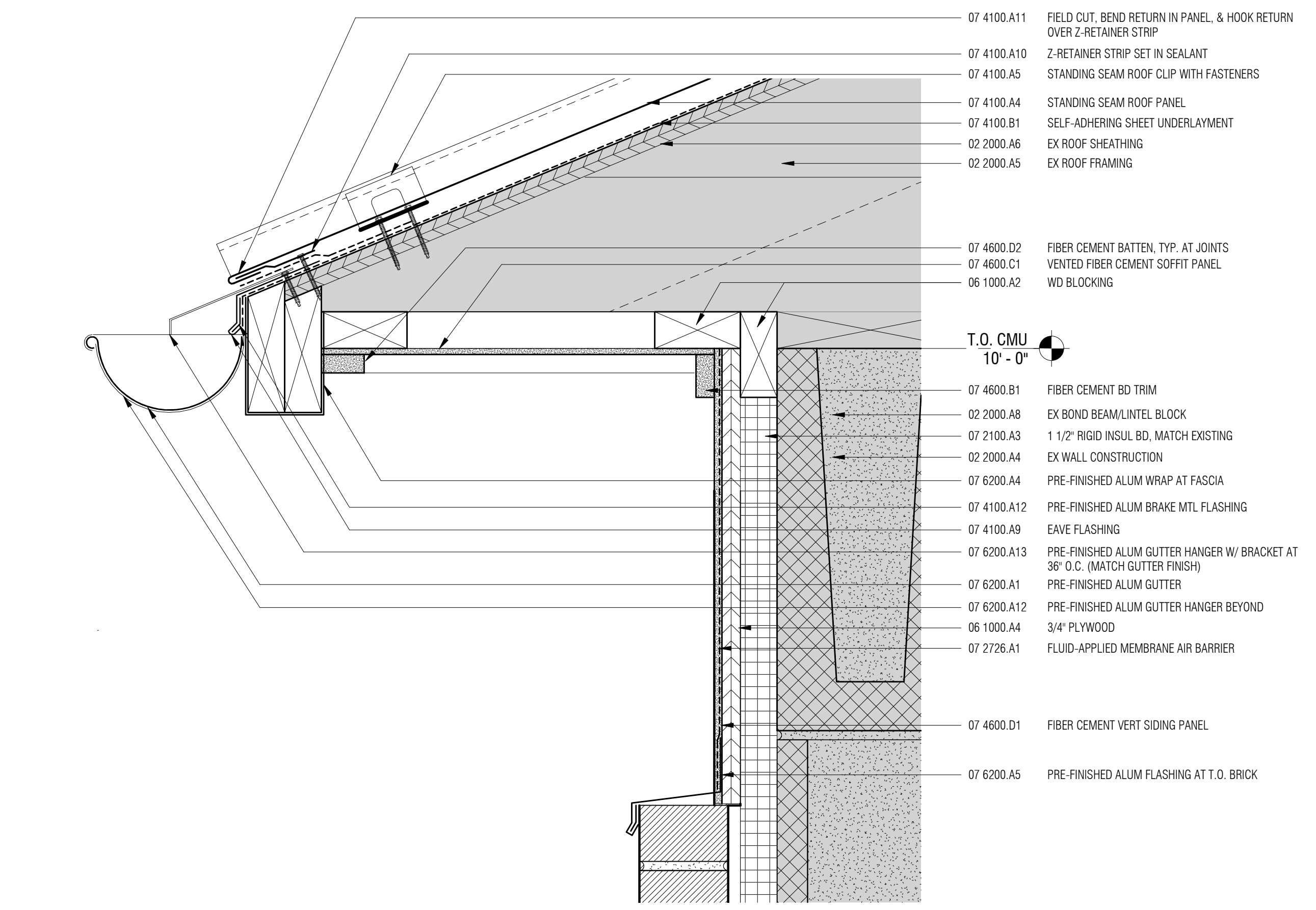
#	DATE	REVISION



D2 ADD ALT. #9 ROOF DETAIL - PORCH
A1.02B 6" = 1'-0"

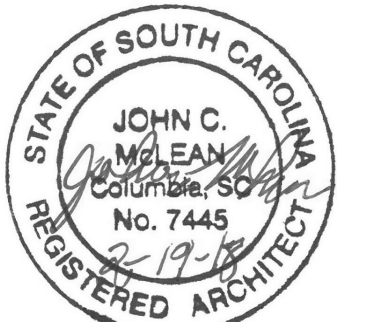


E5 ADD ALT. #9 ROOF DETAIL - RIDGE VENT
A1.02B 6" = 1'-0"



D1 ADD ALT. #9 ROOF DETAIL - EXISTING
A1.02B 3" = 1'-0"

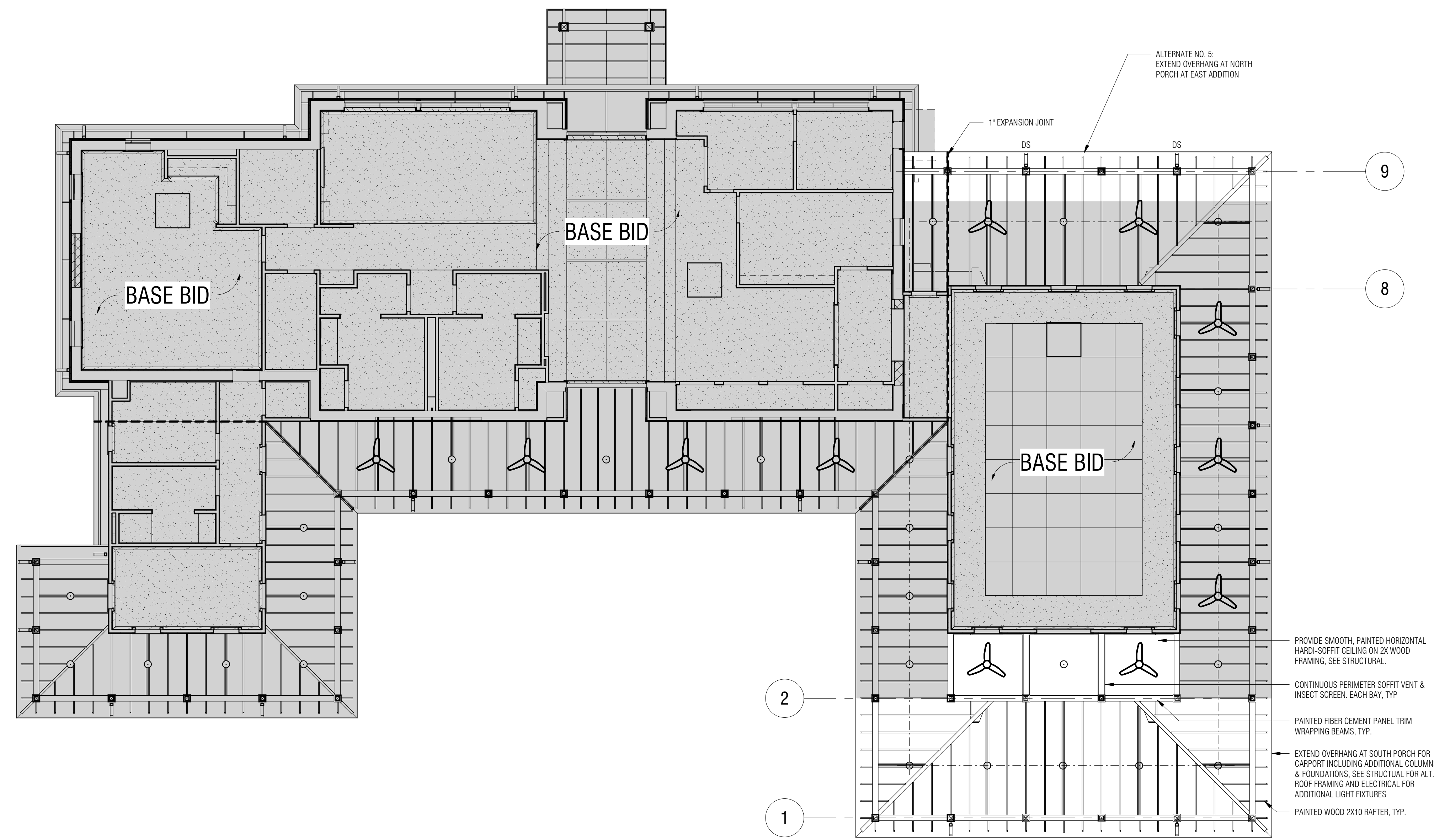
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 2/14/2018 11:49 PM
 A B C D E



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REFLECTED
CEILING PLAN -
ALTERNATES

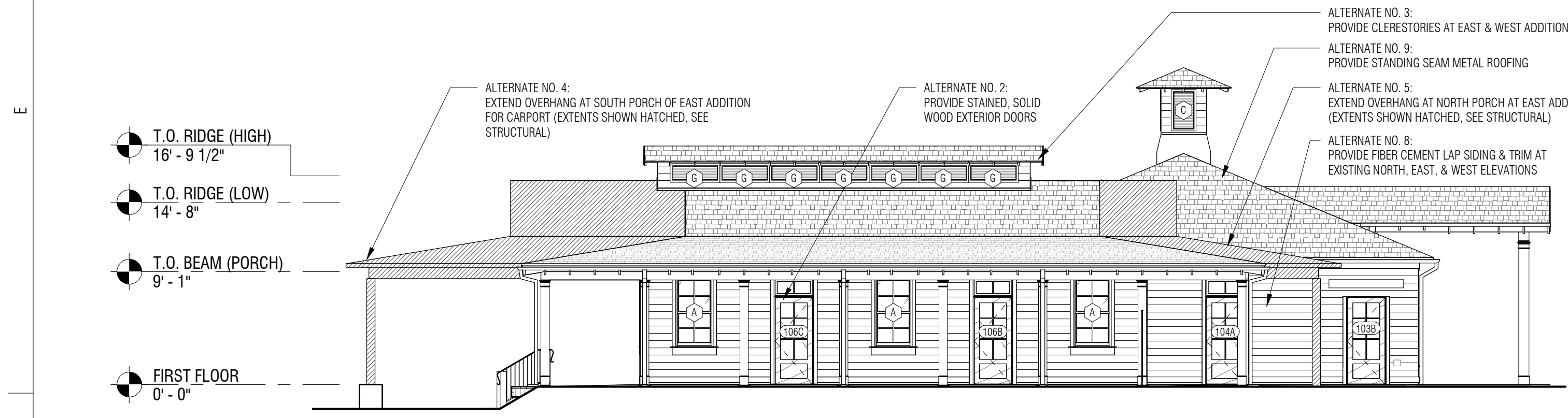


A2.01A REFLECTED CEILING PLAN - ALTERNATES
1/8" = 1'-0"

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 2/14/2018 3:01:57 PM

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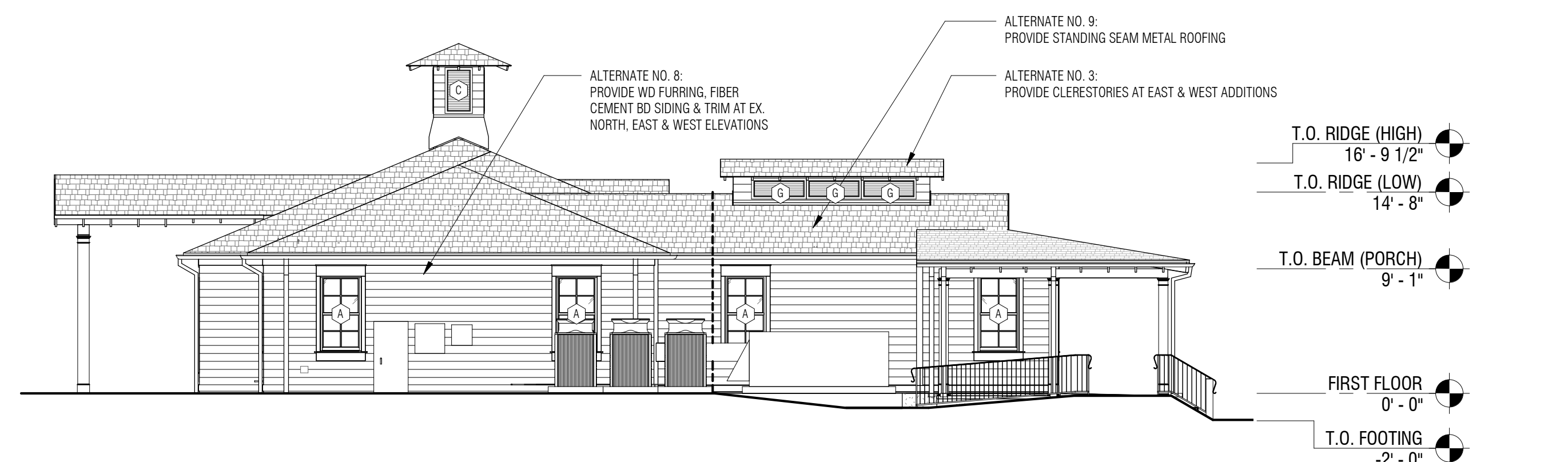
D1 EAST ELEVATION - ALTERNATES
A3.01 1/8" = 1'-0"



D3 NORTH ELEVATION - ALTERNATES
A3.01 1/8" = 1'-0"

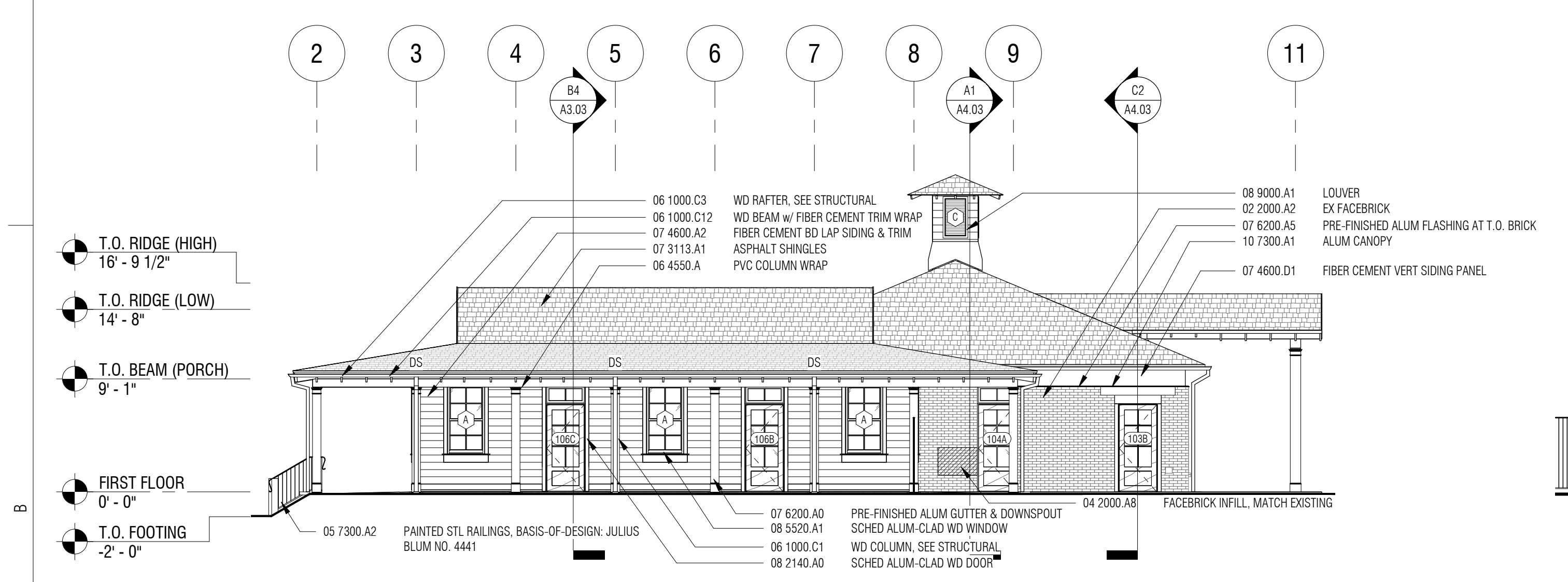


C1 SOUTH ELEVATION - ALTERNATES
A3.01 1/8" = 1'-0"

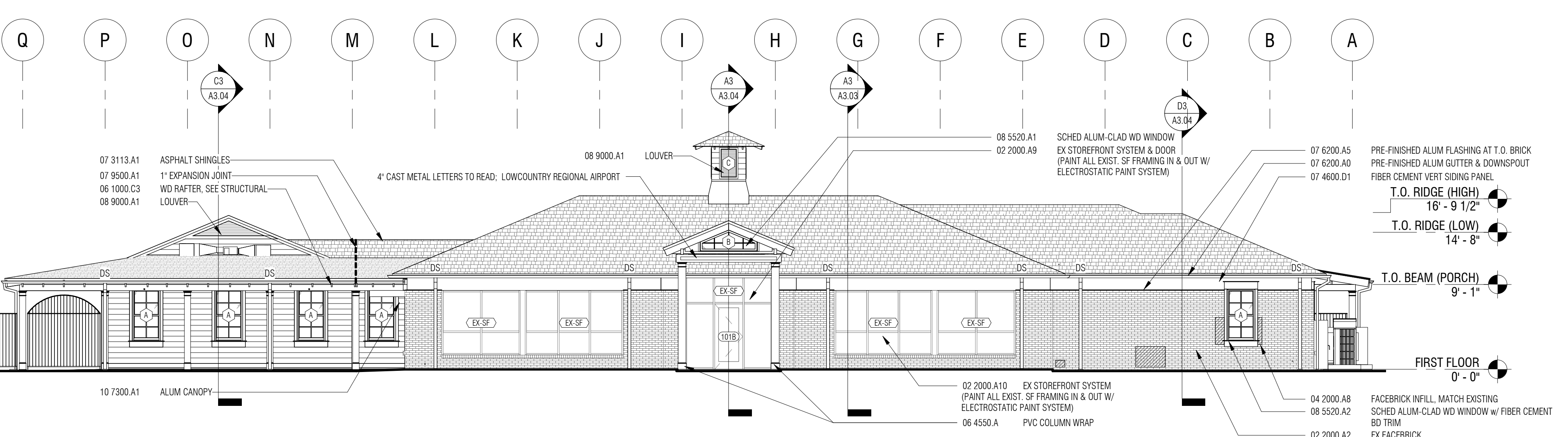


C4 WEST ELEVATION - ALTERNATES
A3.01 1/8" = 1'-0"

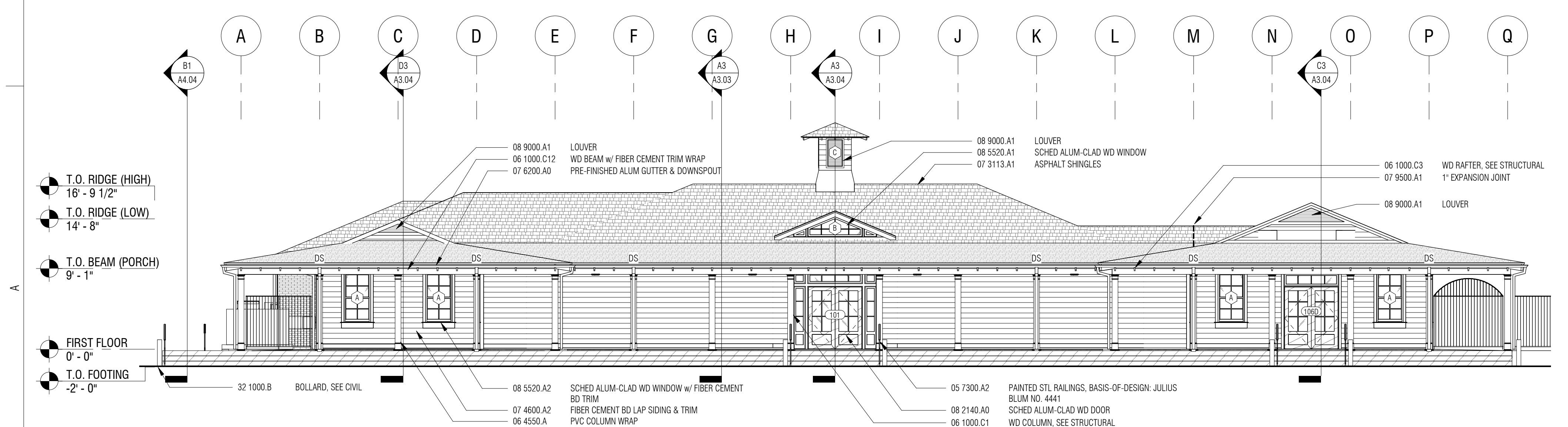
SEE BASE BID ELEVATIONS FOR TYPICAL NOTES THAT SHALL BE APPLIED TO BOTH SETS OF ELEVATIONS
SEE ALTERNATES ELEVATIONS FOR EXTENT OF ALTERNATES



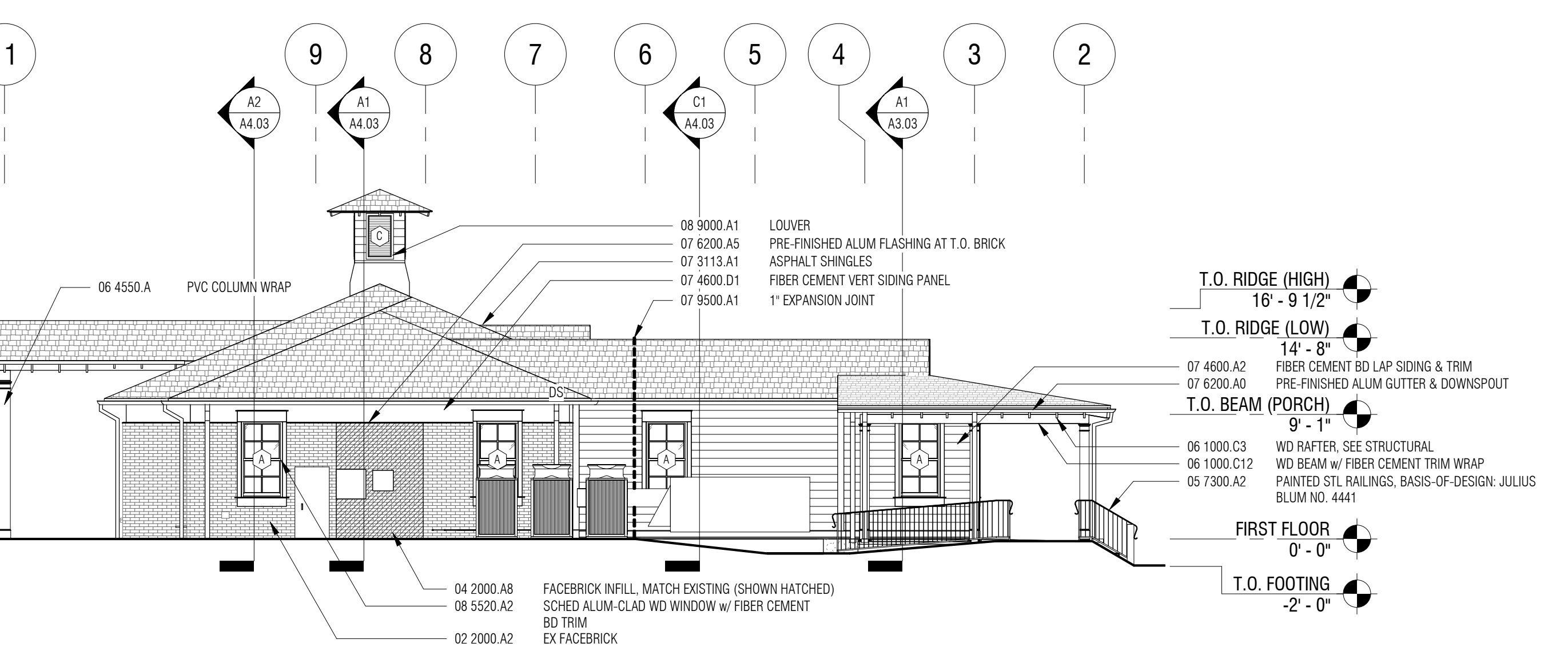
B1 EAST ELEVATION - BASE BID
A3.01 1/8" = 1'-0"



B3 NORTH ELEVATION - BASE BID
A3.01 1/8" = 1'-0"



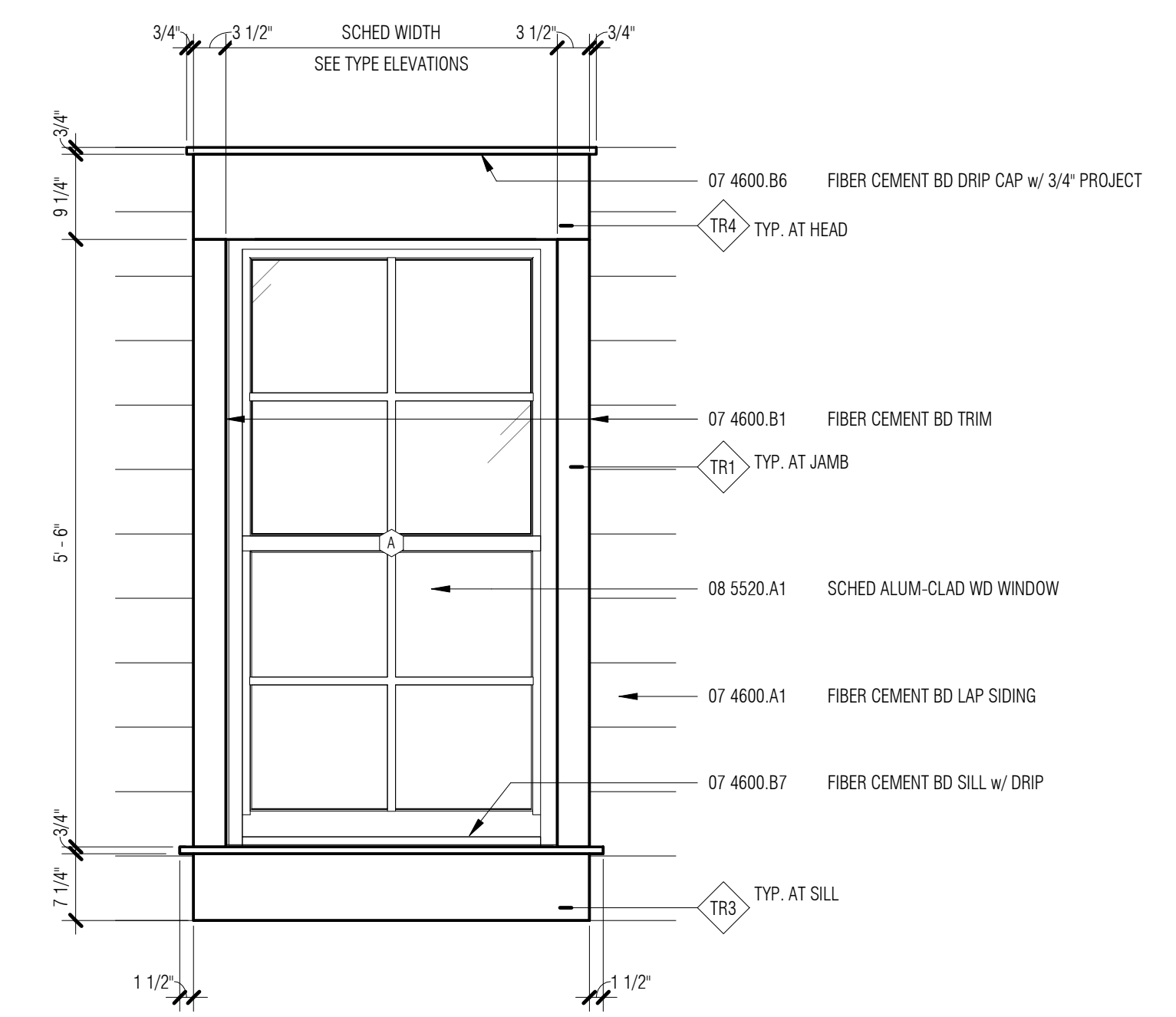
A1 SOUTH ELEVATION - BASE BID
A3.01 1/8" = 1'-0"



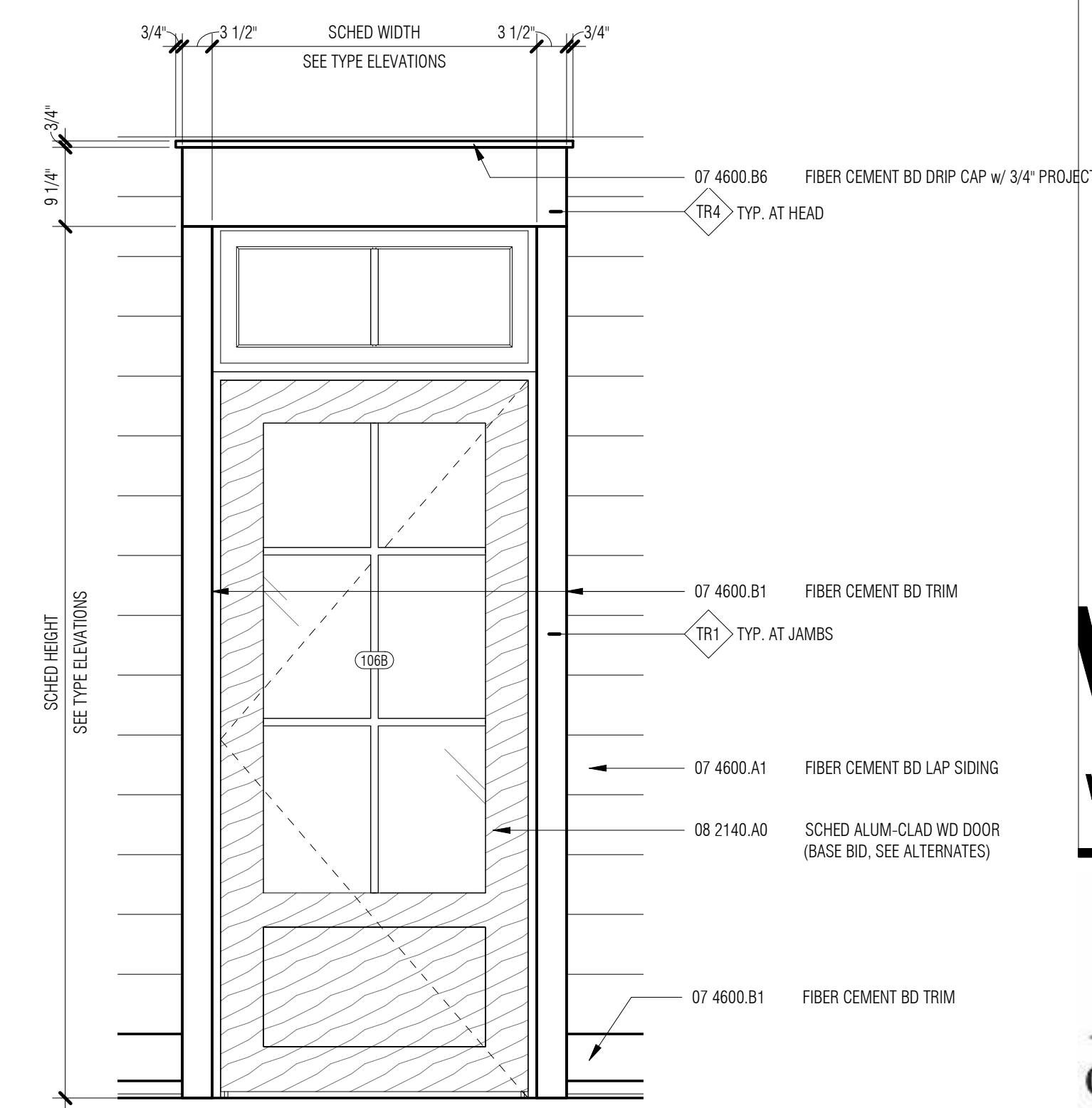
A4 WEST ELEVATION - BASE BID
A3.01 1/8" = 1'-0"

C:\Users\jcm\OneDrive\Documents\1509-Coleman Airport_A17_dgm.dwg
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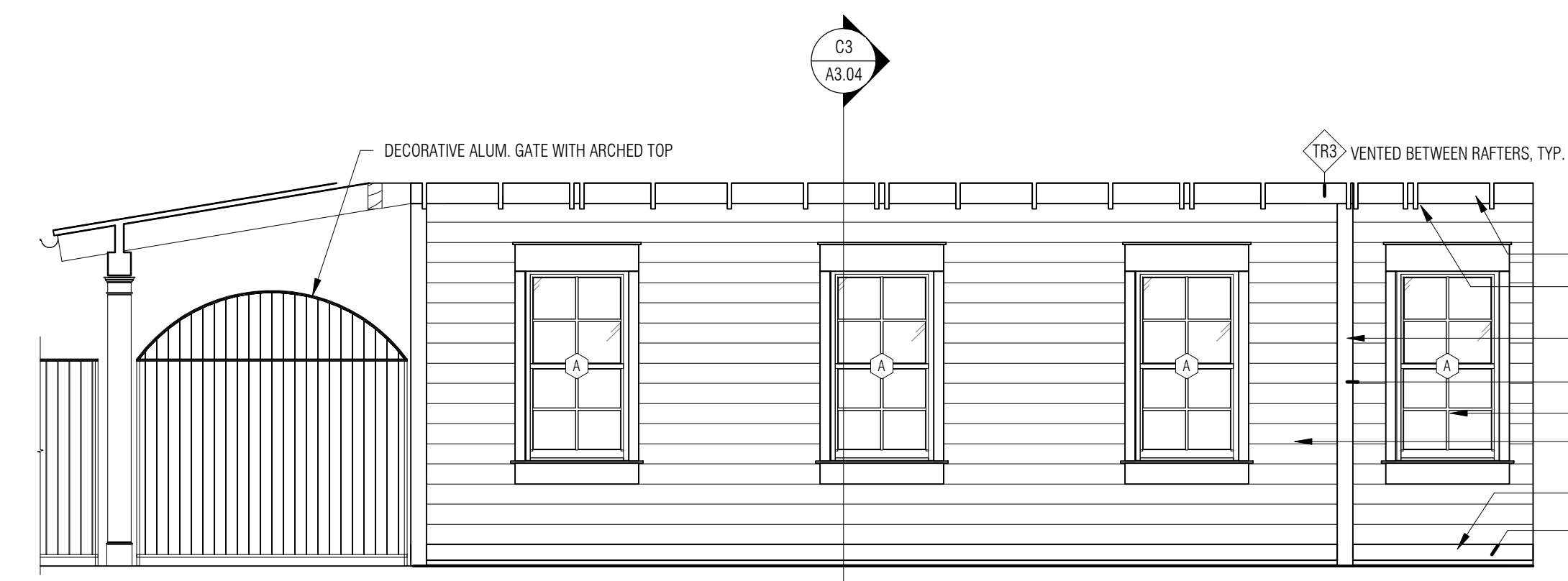
#	DATE	REVISION



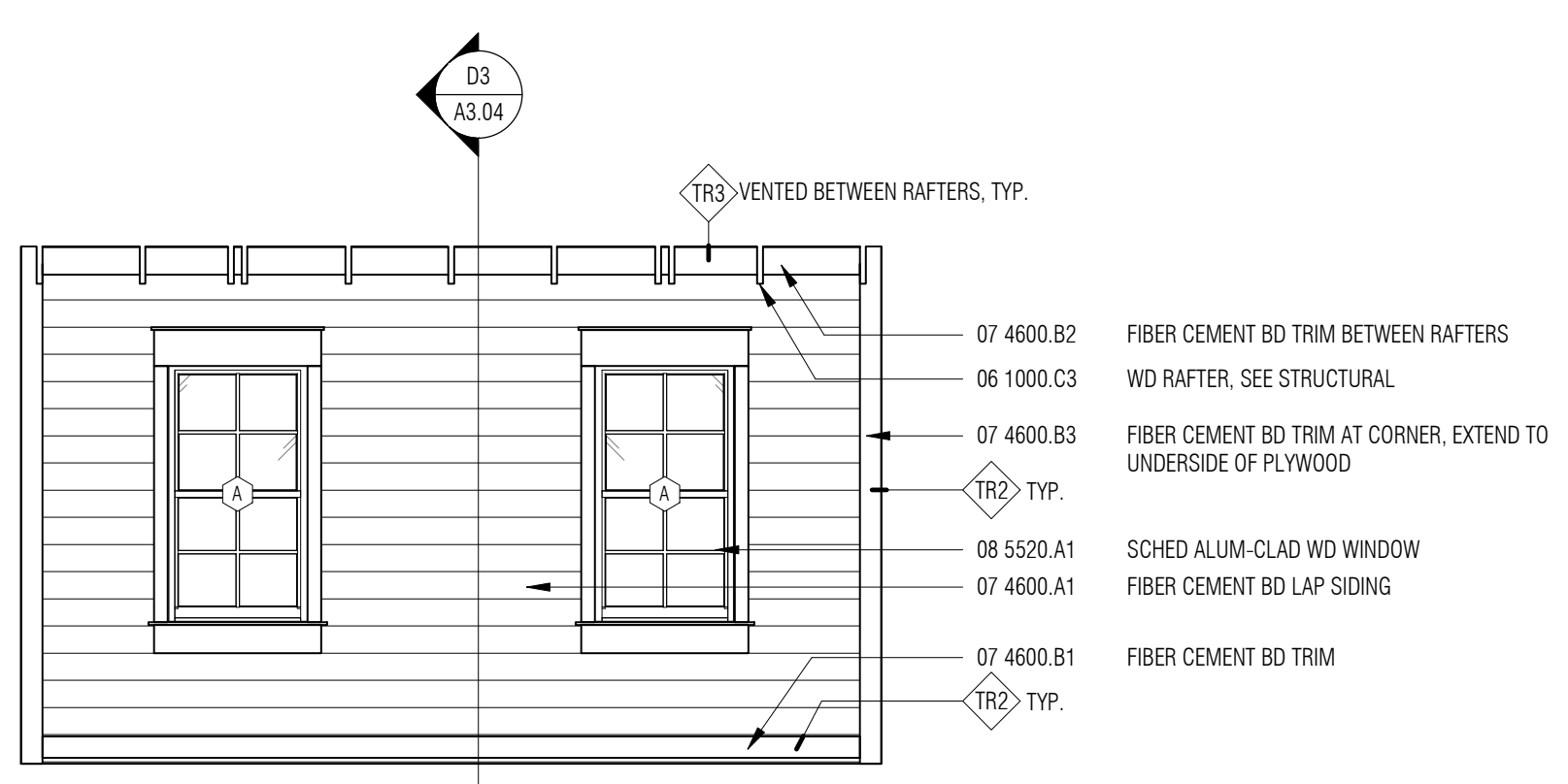
1 TYP. ELEVATION - WINDOW TRIM
A3.02 3/4" = 1'-0"



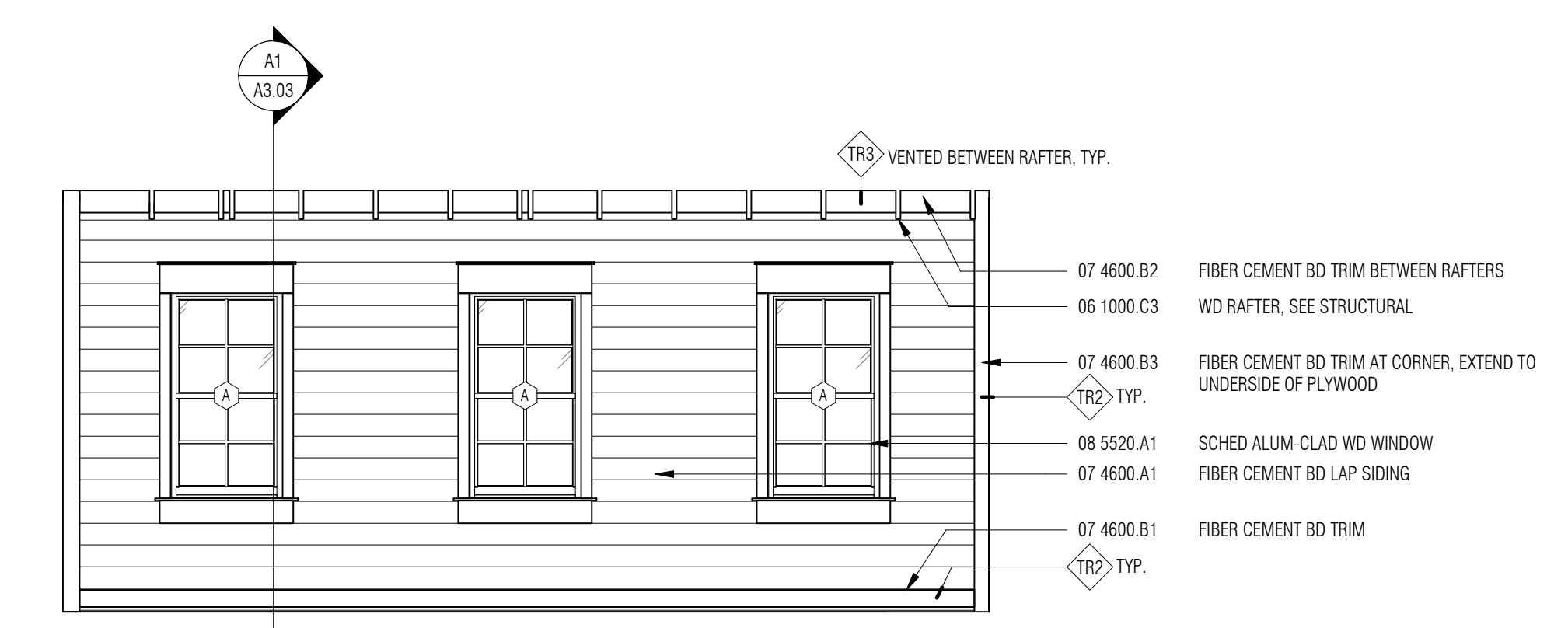
2 TYP. ELEVATION - DOOR TRIM
A3.02 3/4" = 1'-0"



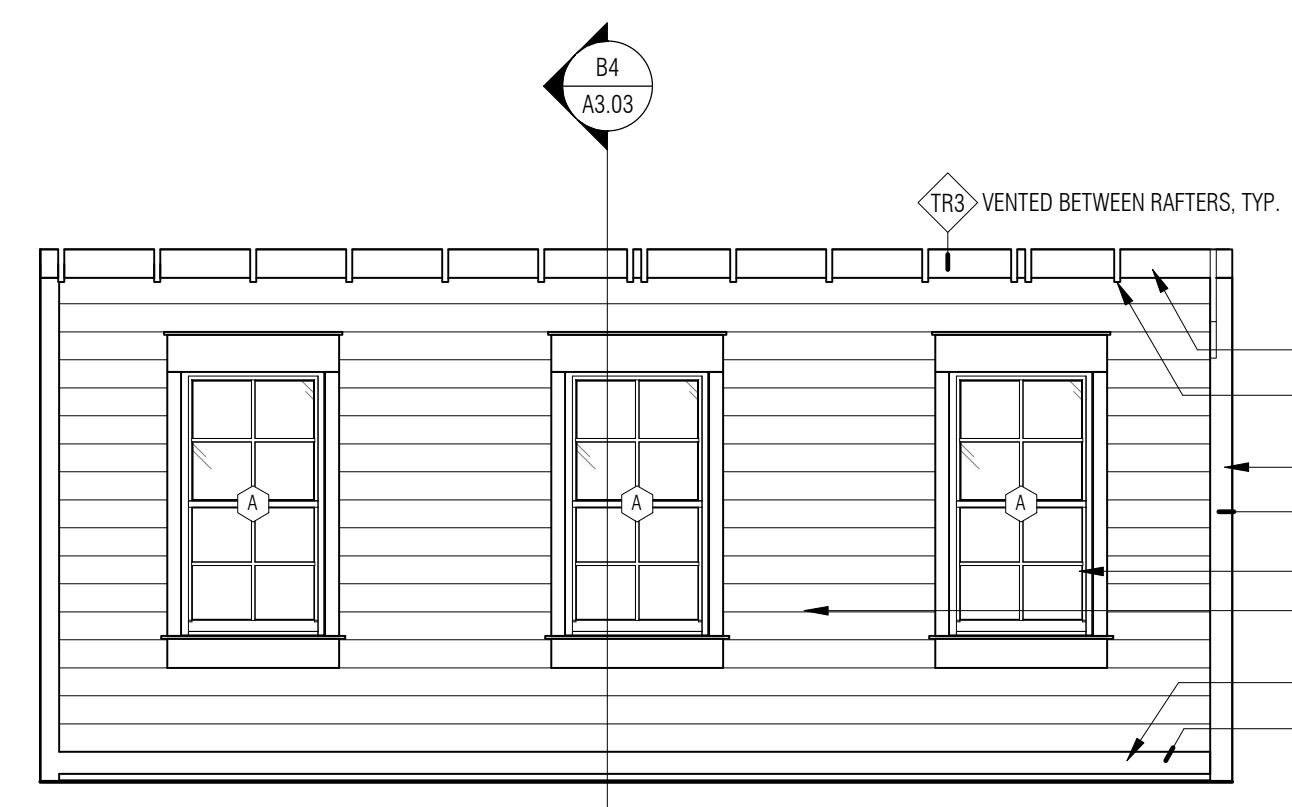
A1 NORTH PORCH ELEVATION - EAST ADDITION
A3.02 1/4" = 1'-0"



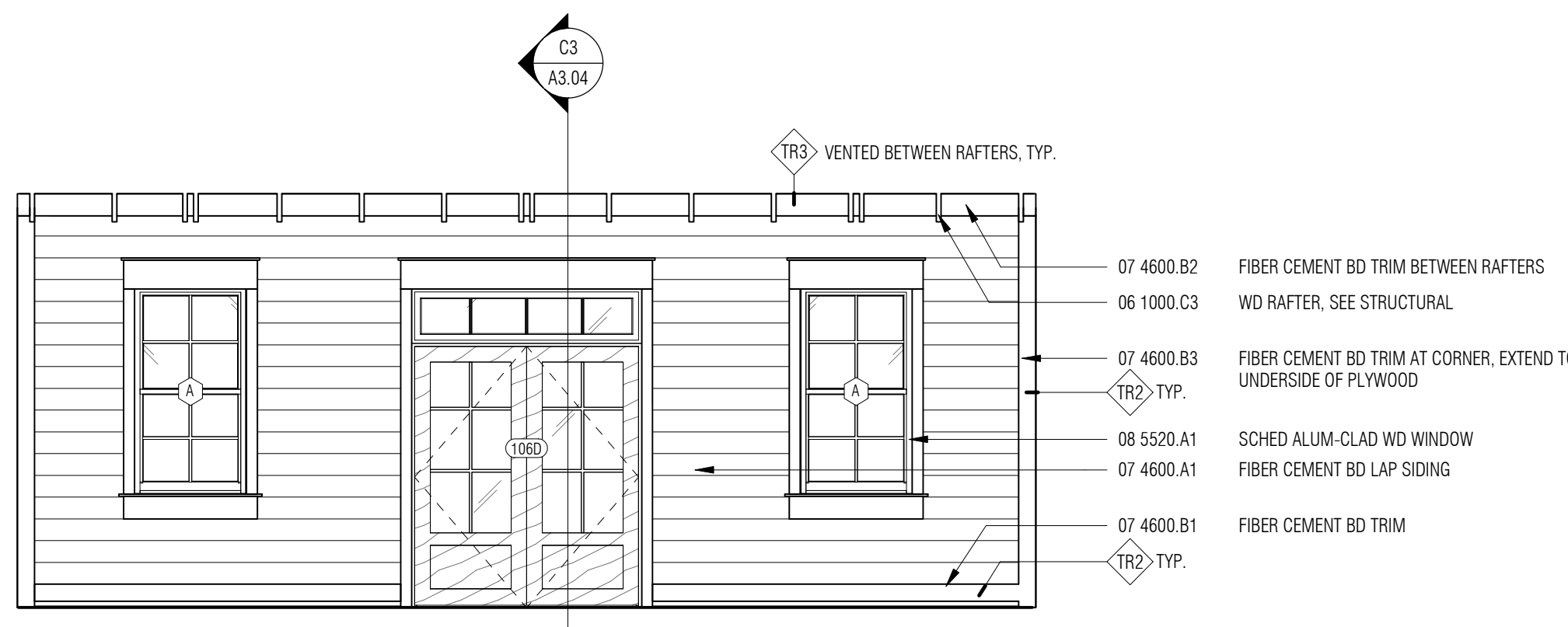
C2 SOUTH PORCH ELEVATION - WEST ADDITION
A3.02 1/4" = 1'-0"



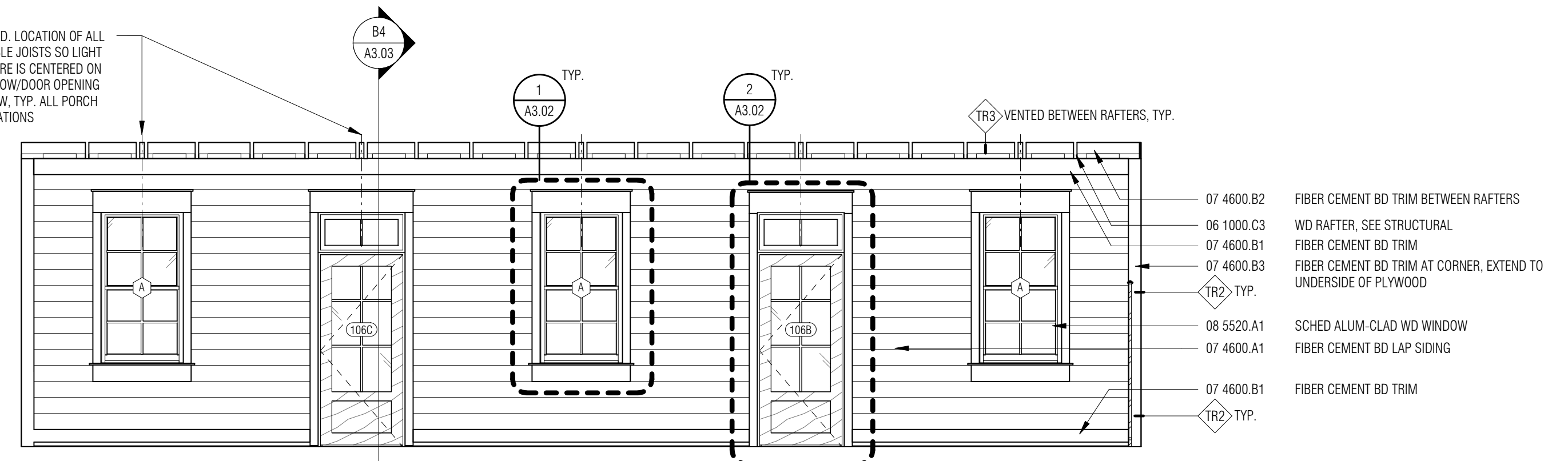
C4 EAST PORCH ELEVATION - WEST ADDITION
A3.02 1/4" = 1'-0"



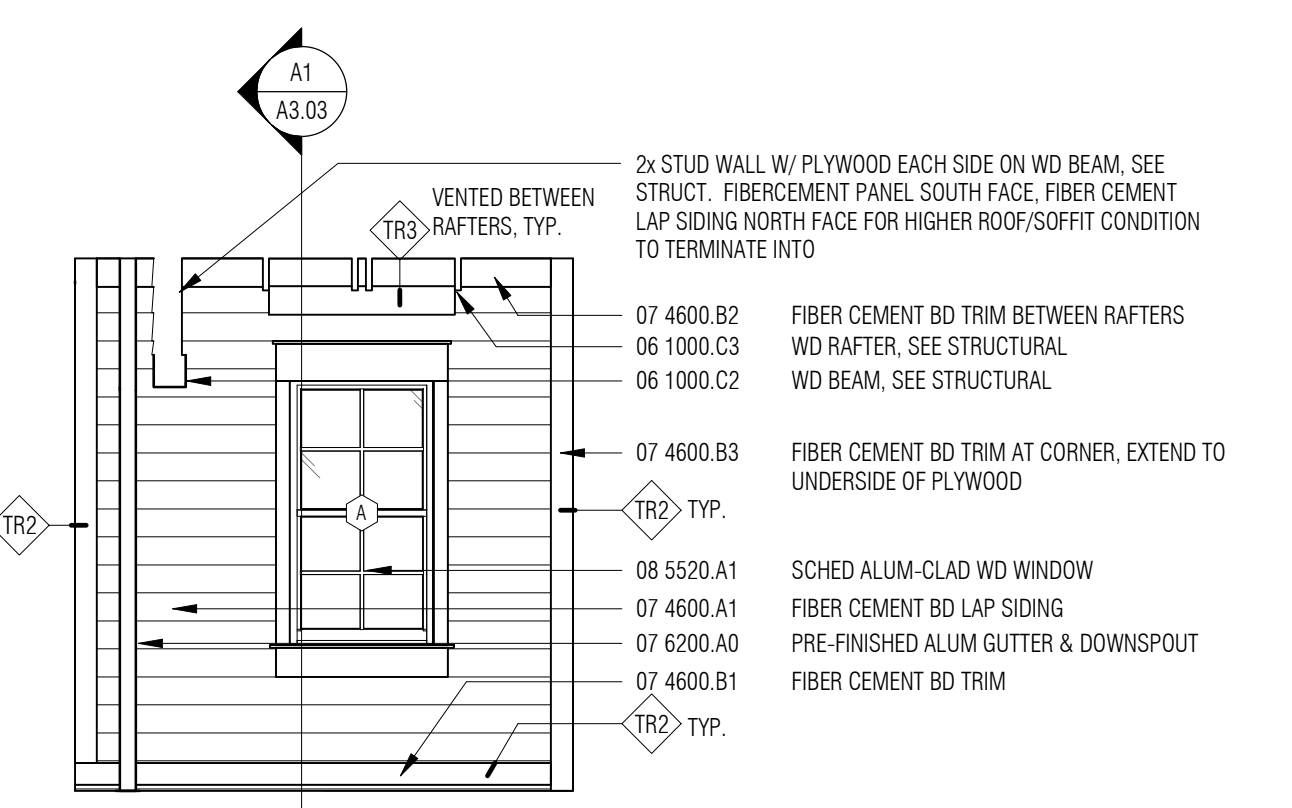
B1 WEST PORCH ELEVATION - EAST ADDITION
A3.02 1/4" = 1'-0"



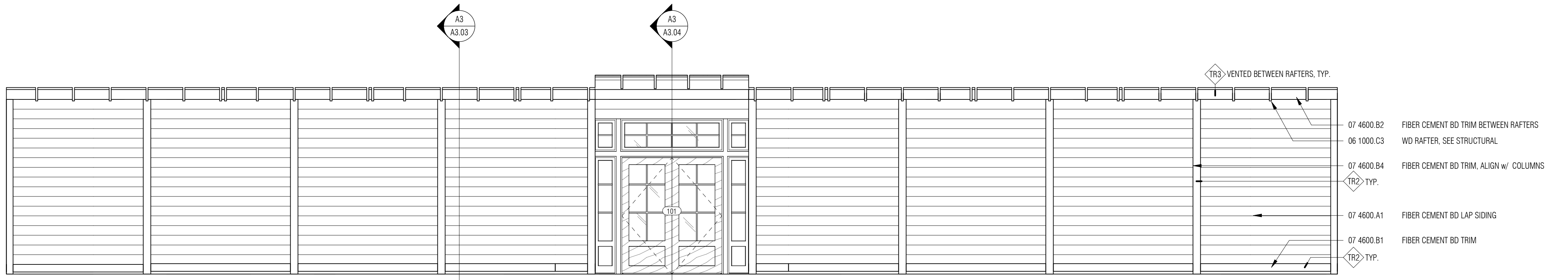
B2 SOUTH PORCH ELEVATION - EAST ADDITION
A3.02 1/4" = 1'-0"



B4 EAST PORCH ELEVATION - EAST ADDITION
A3.02 1/4" = 1'-0"

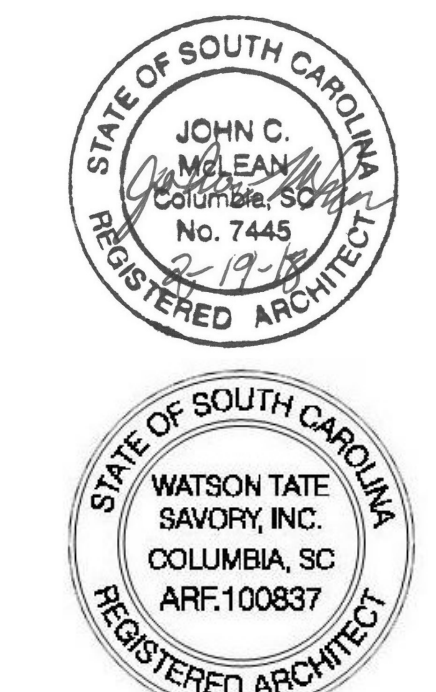


C1 WEST PORCH ELEVATION - WEST ADDITION
A3.02 1/4" = 1'-0"



A3 SOUTH PORCH ELEVATION - EXISTING ENTRANCE
A3.02 1/4" = 1'-0"

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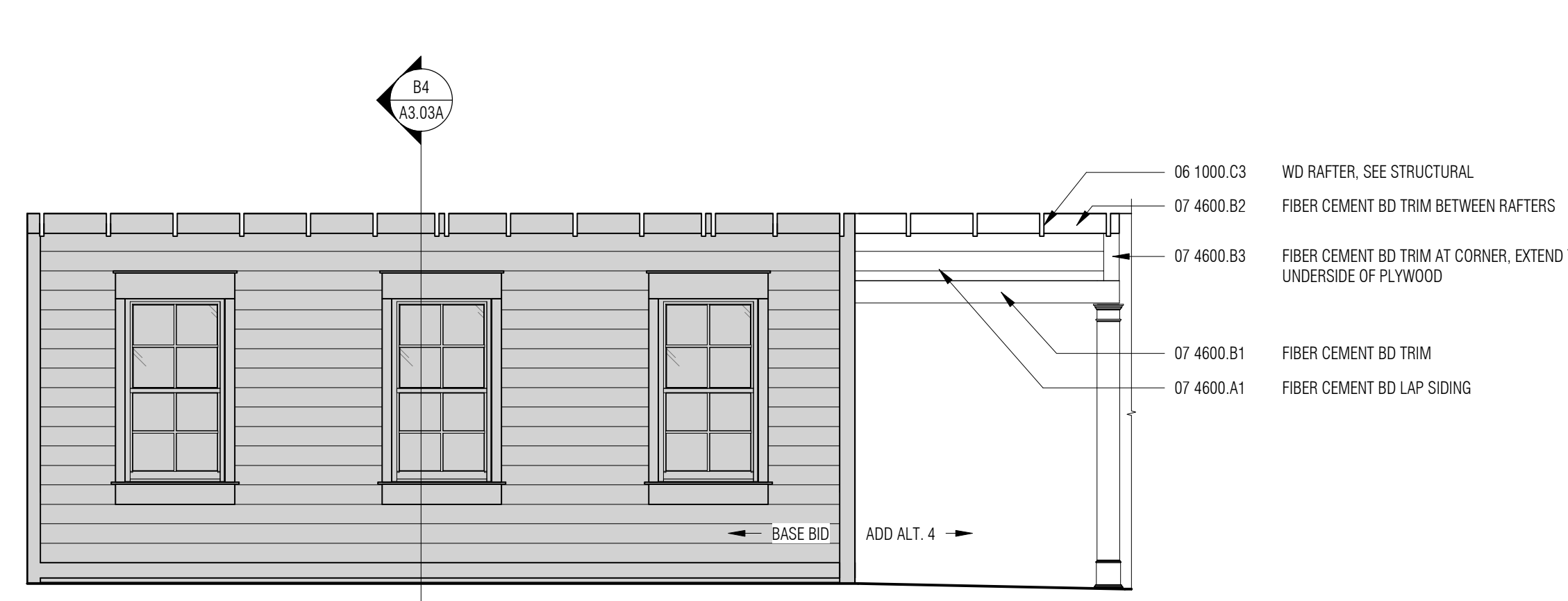
ISSUE DATE: FEBRUARY 19, 2018
PHASE: BIDDING DOCUMENTS

#	DATE	REVISION

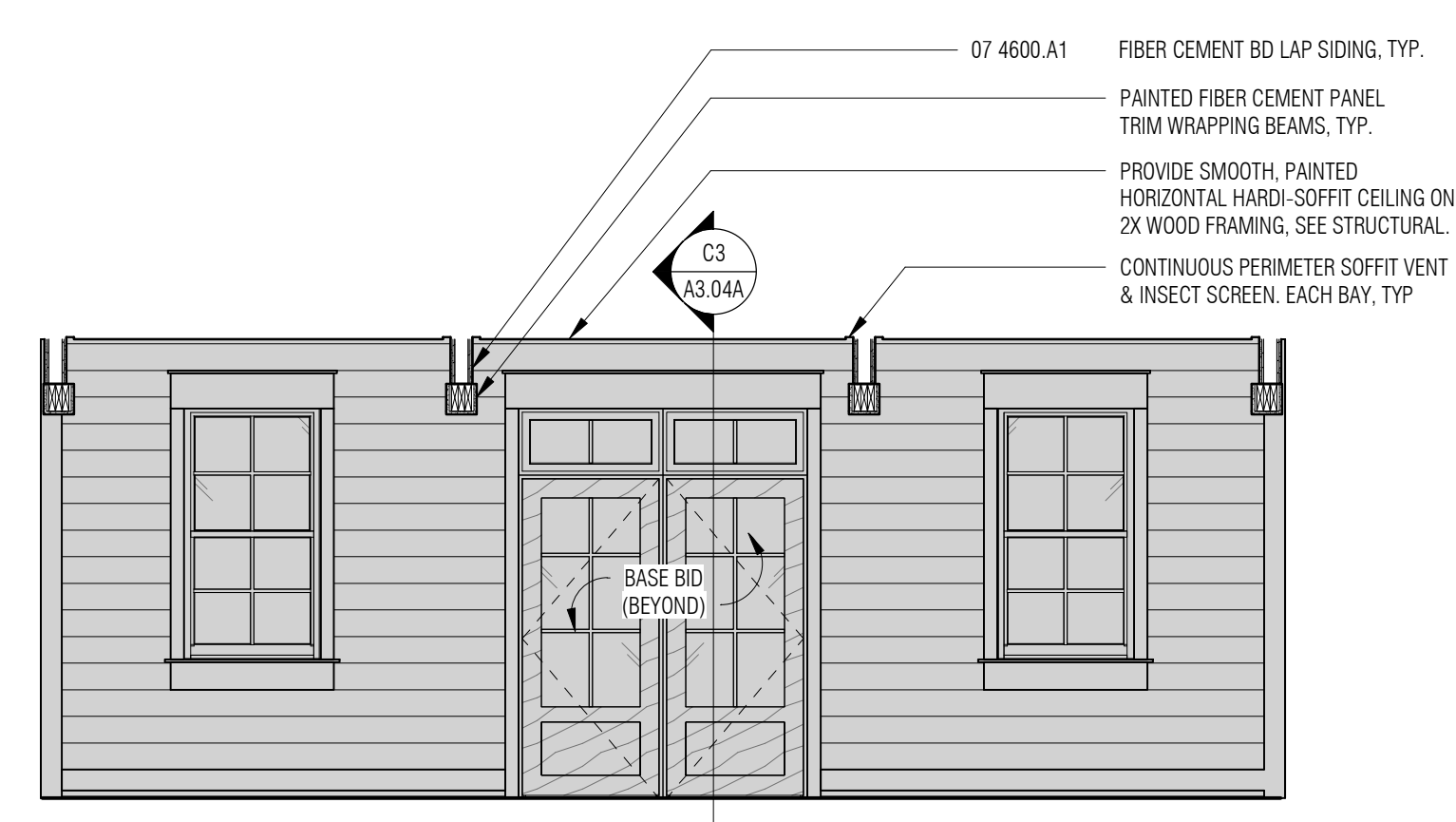
PORCH
ELEVATIONS -
ALTERNATES

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E
D
C
B
A



B1 WEST PORCH ELEVATION - EAST ADDITION - ALTERNATES
A3.02A 1/4" = 1'-0"

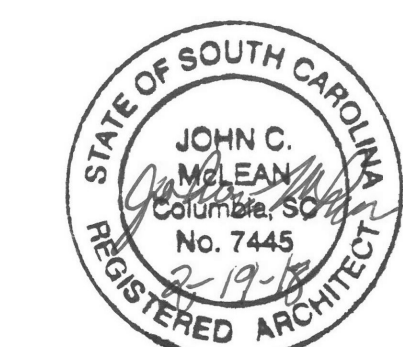


B2 SOUTH PORCH ELEVATION - EAST ADDITION - ALTERNATES
A3.02A 1/4" = 1'-0"

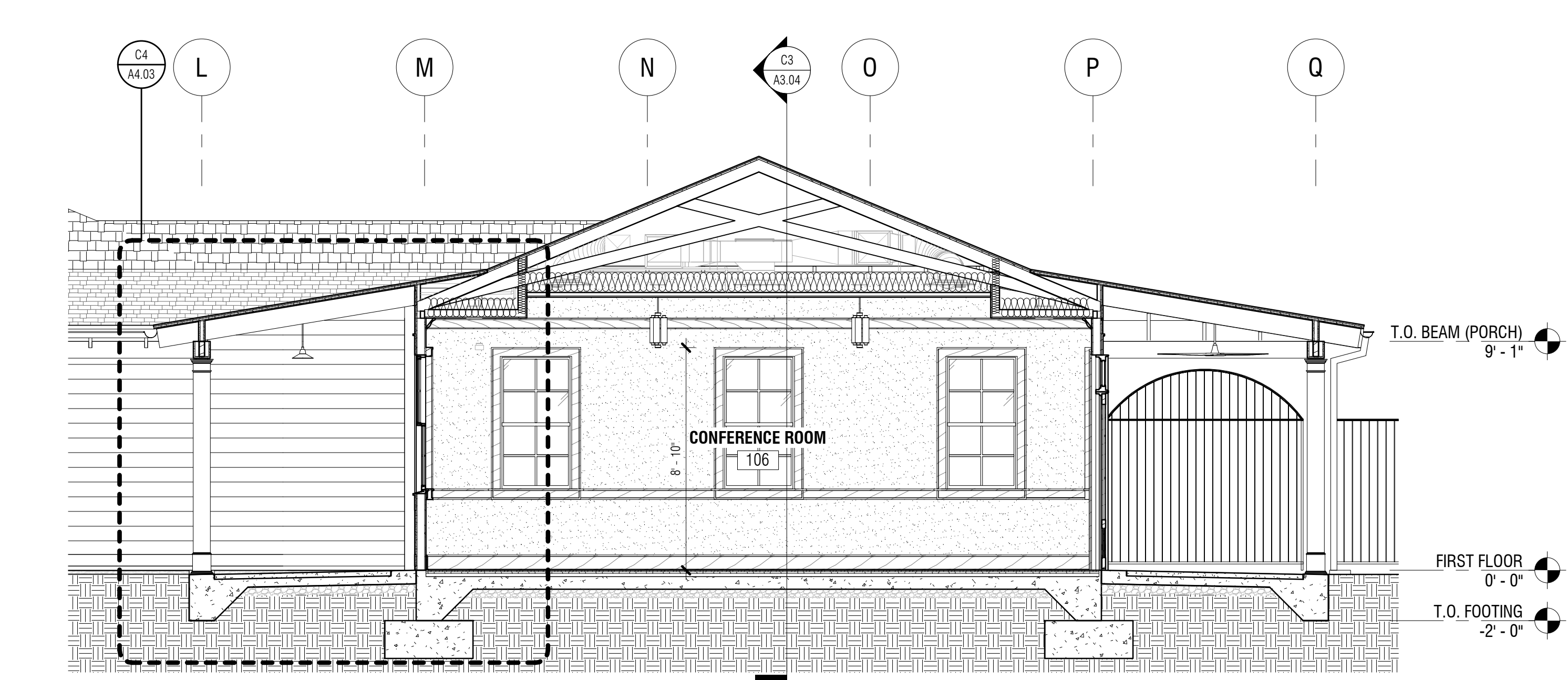


B4 EAST PORCH ELEVATION - EAST ADDITION - ALTERNATES
A3.02A 1/4" = 1'-0"

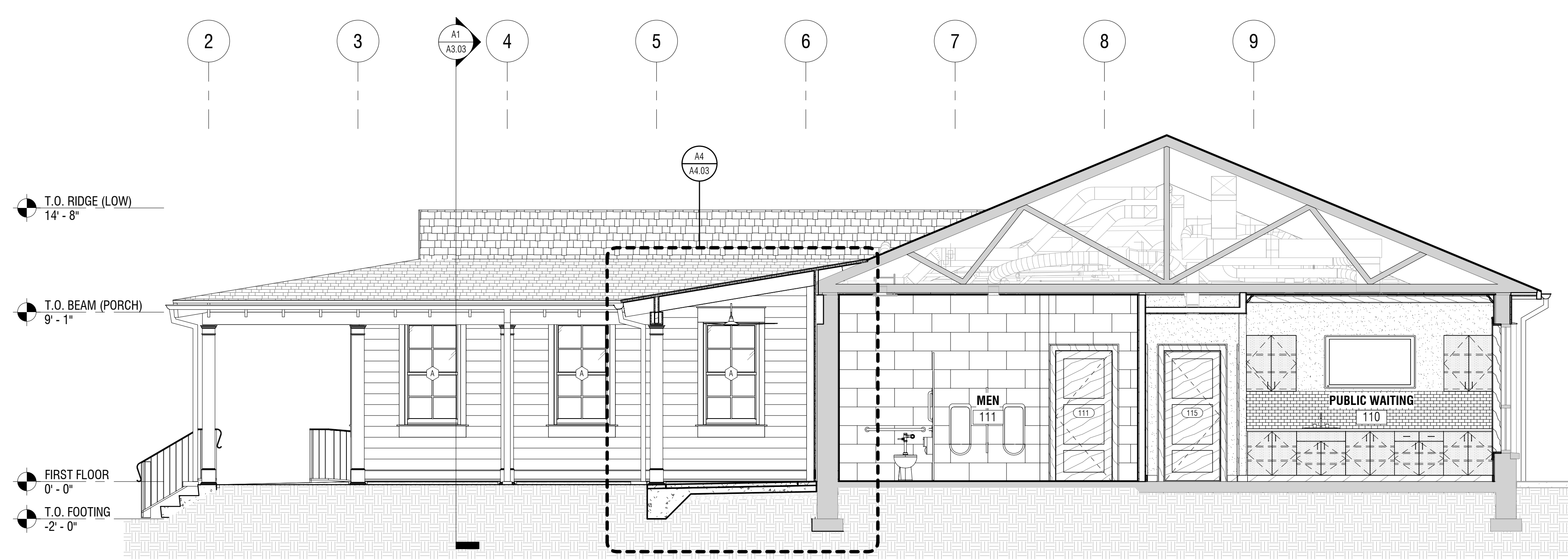
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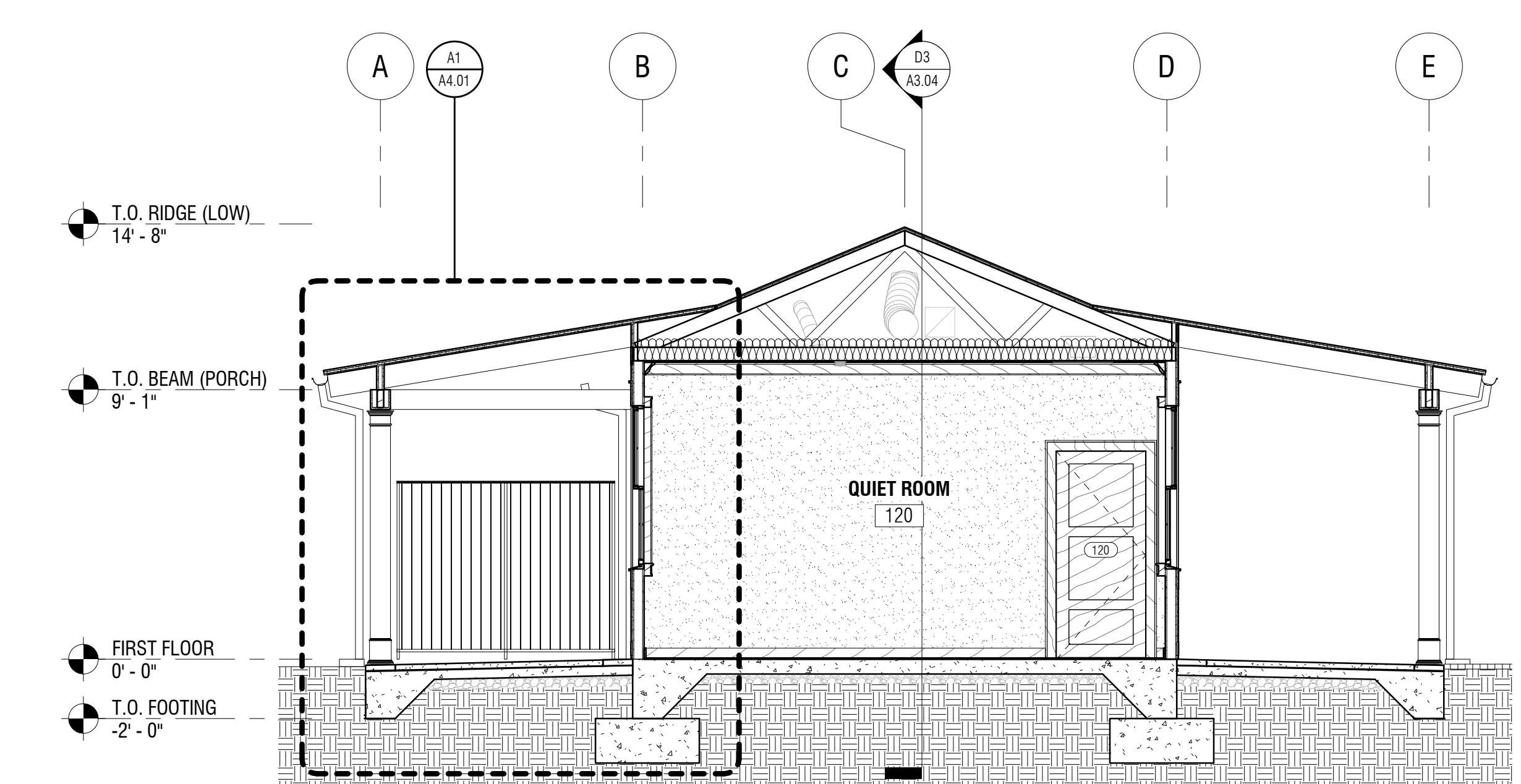
#	DATE	REVISION



A3
A3.03
BUILDING SECTION
1/4" = 1'-0"

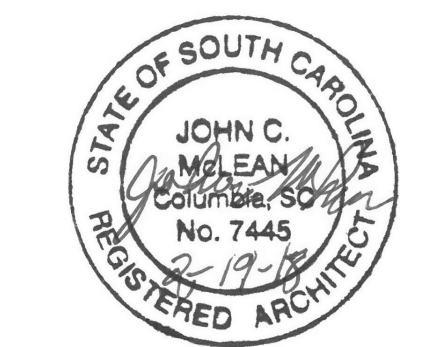


A2
A3.03
BUILDING SECTION
1/4" = 1'-0"



A1
A3.03
BUILDING SECTION
1/4" = 1'-0"

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 2/14/2018 11:15:16 PM

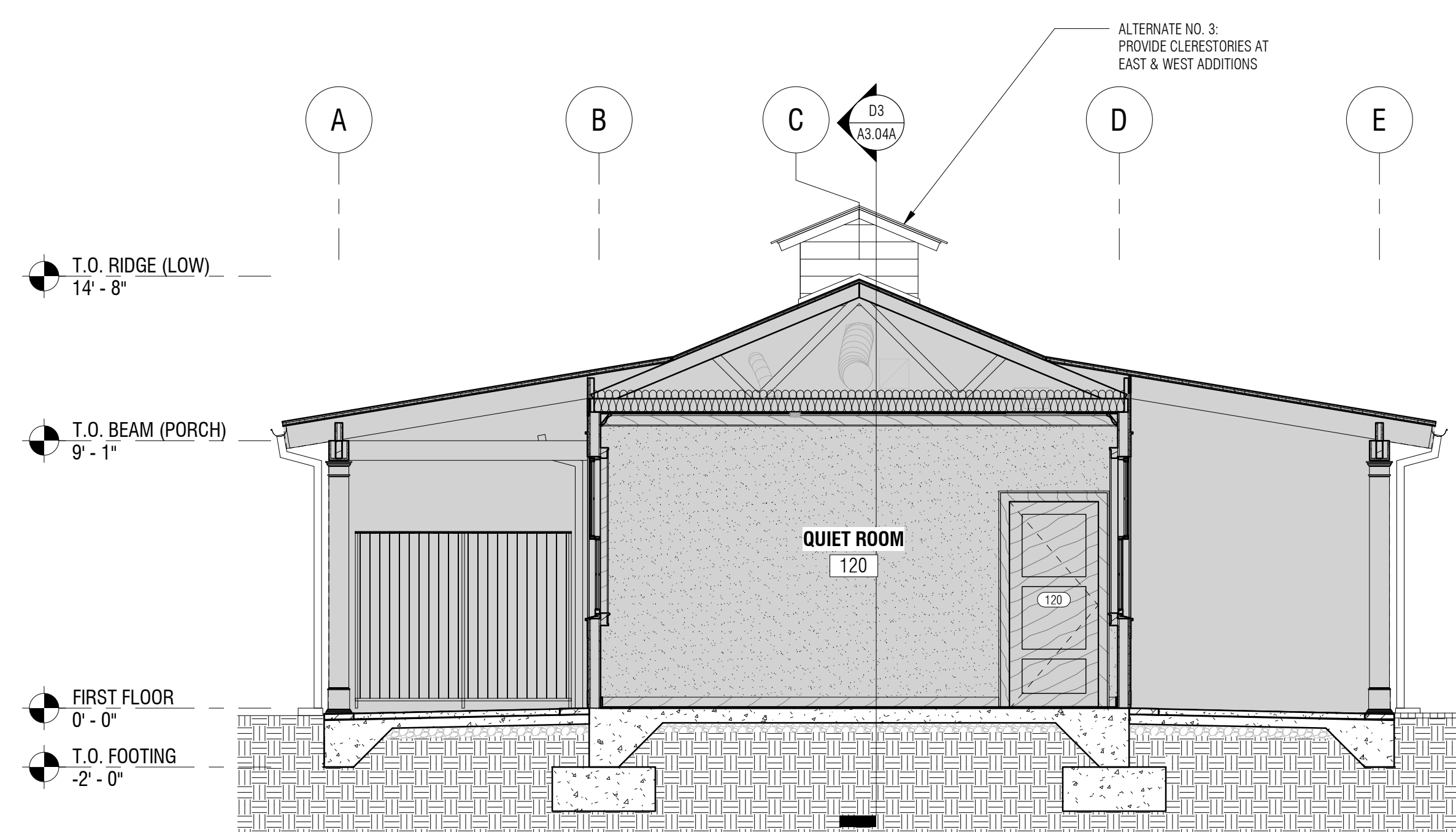


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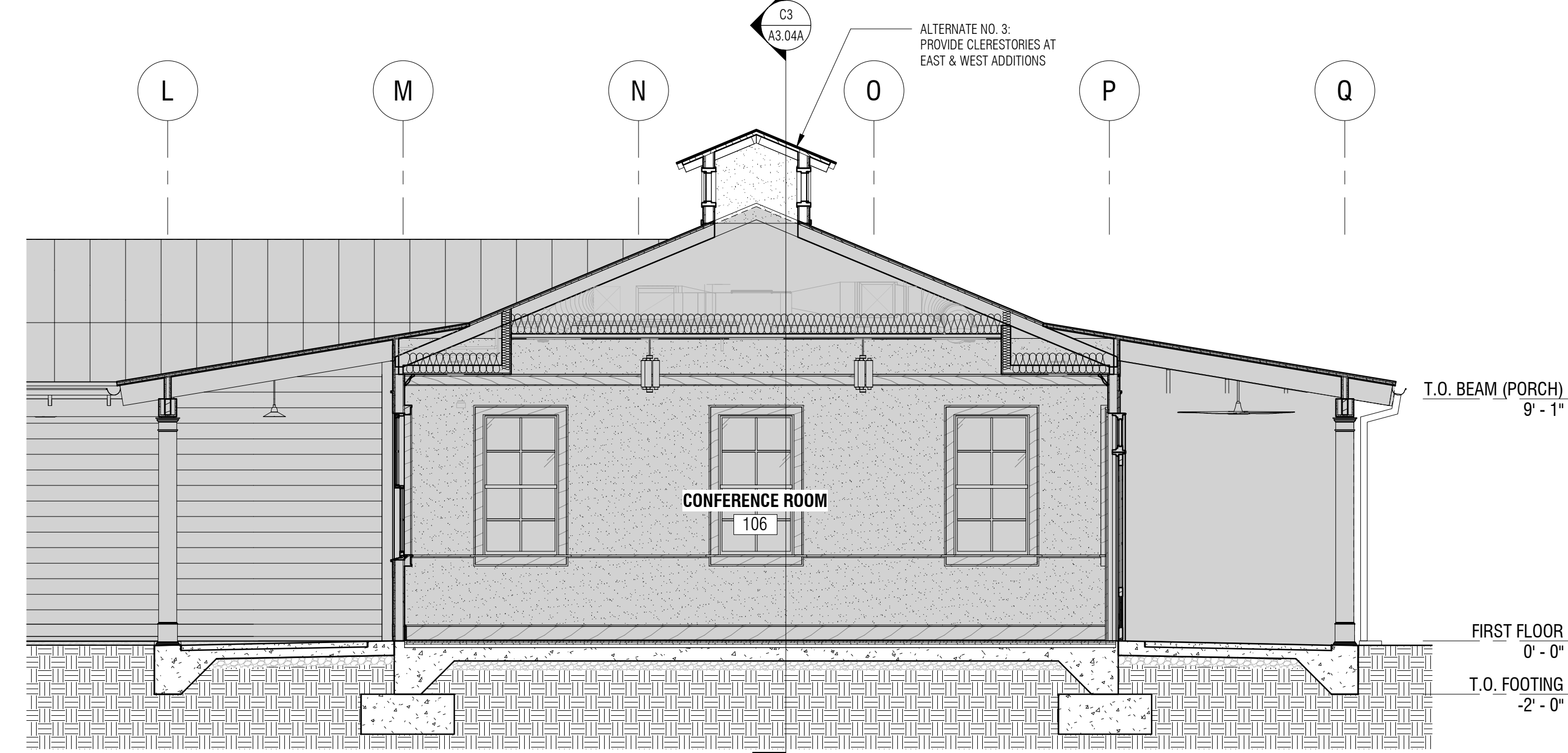
#	DATE	REVISION

BUILDING
SECTIONS -
ALTERNATES

E
D
C
B
A



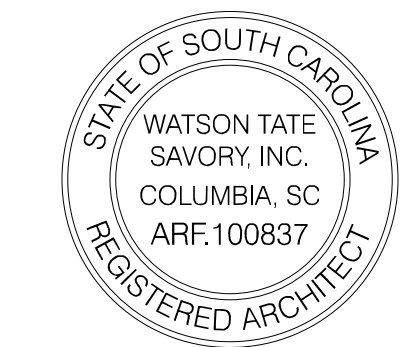
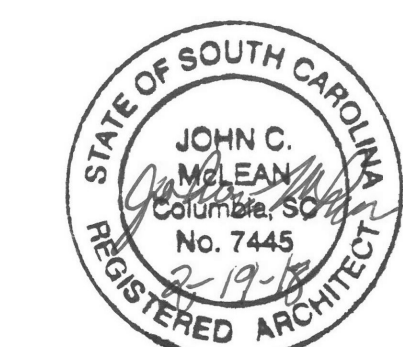
81
A3.03A
BUILDING SECTION - ALTERNATES
1/4" = 1'-0"



84
A3.03A
BUILDING SECTION - ALTERNATES
1/4" = 1'-0"

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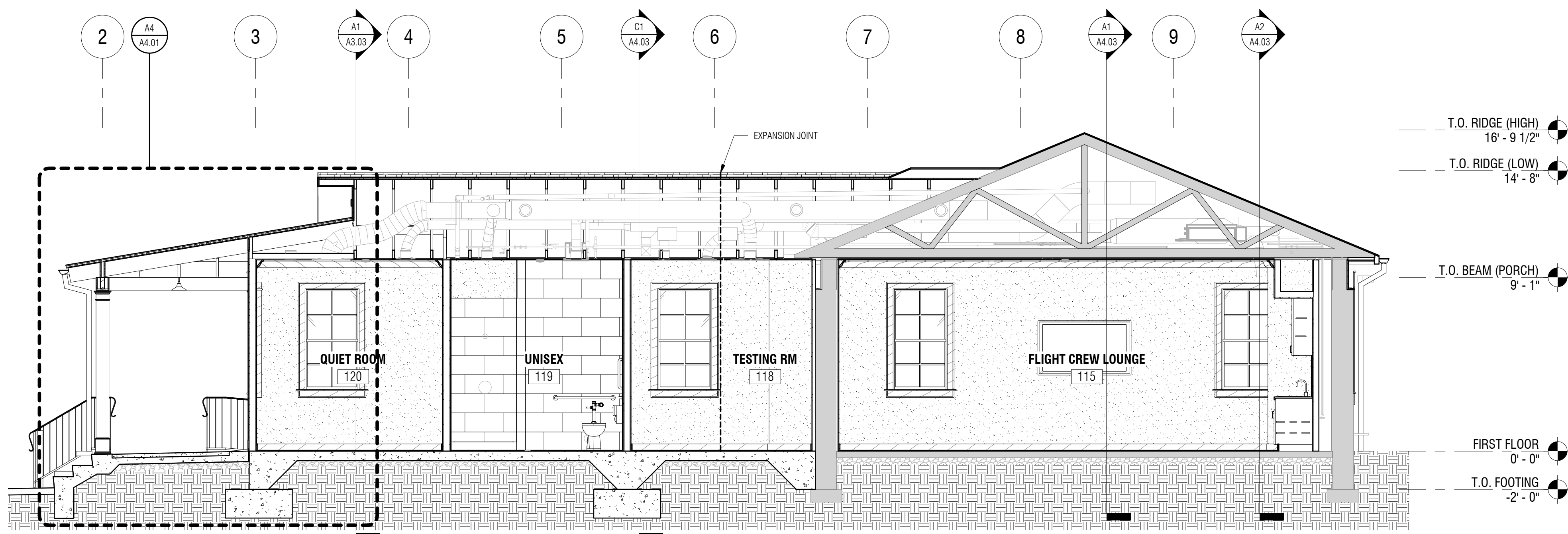
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2/14/2018 3:02:03 PM



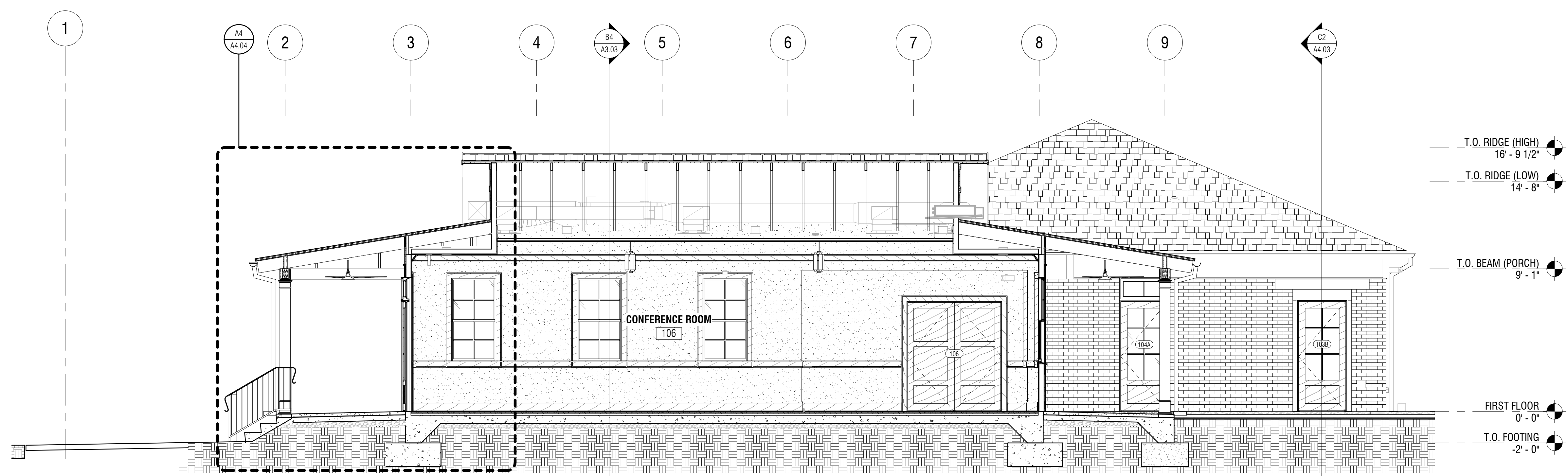
ISSUE DATE: FEBRUARY 19, 2018
PHASE: BIDDING DOCUMENTS

#	DATE	REVISION

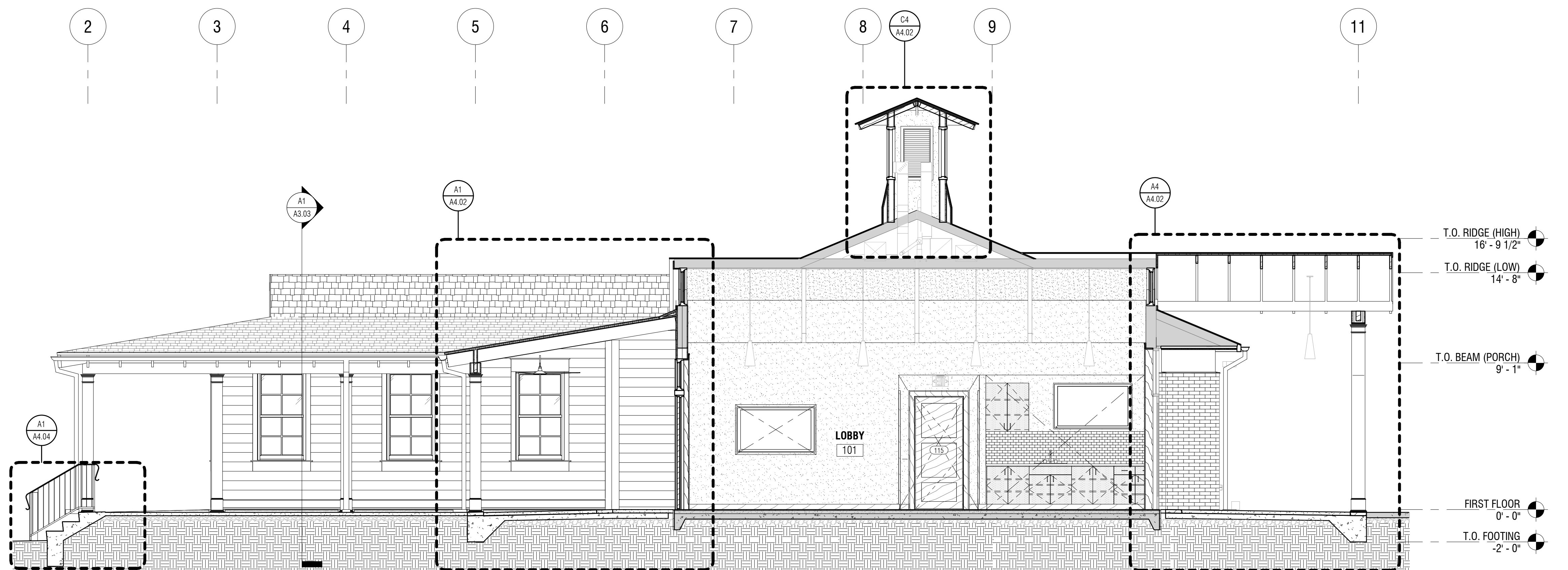
BUILDING
SECTIONS



A3.03 BUILDING SECTION
1/4" = 1'-0"



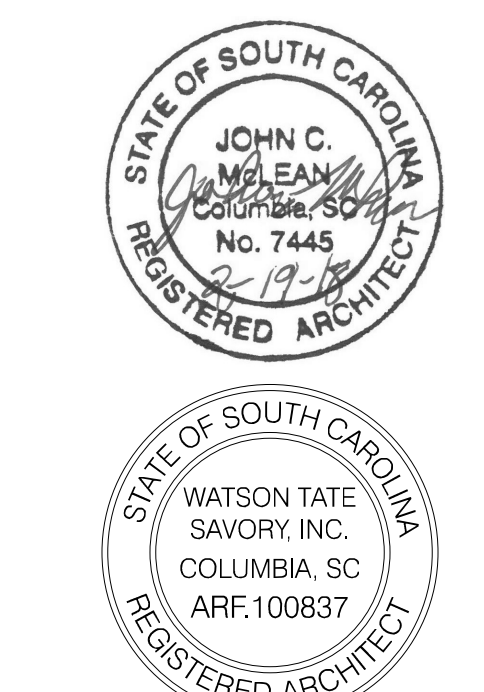
A3.04 BUILDING SECTION
1/4" = 1'-0"



A3.05 BUILDING SECTION
1/4" = 1'-0"

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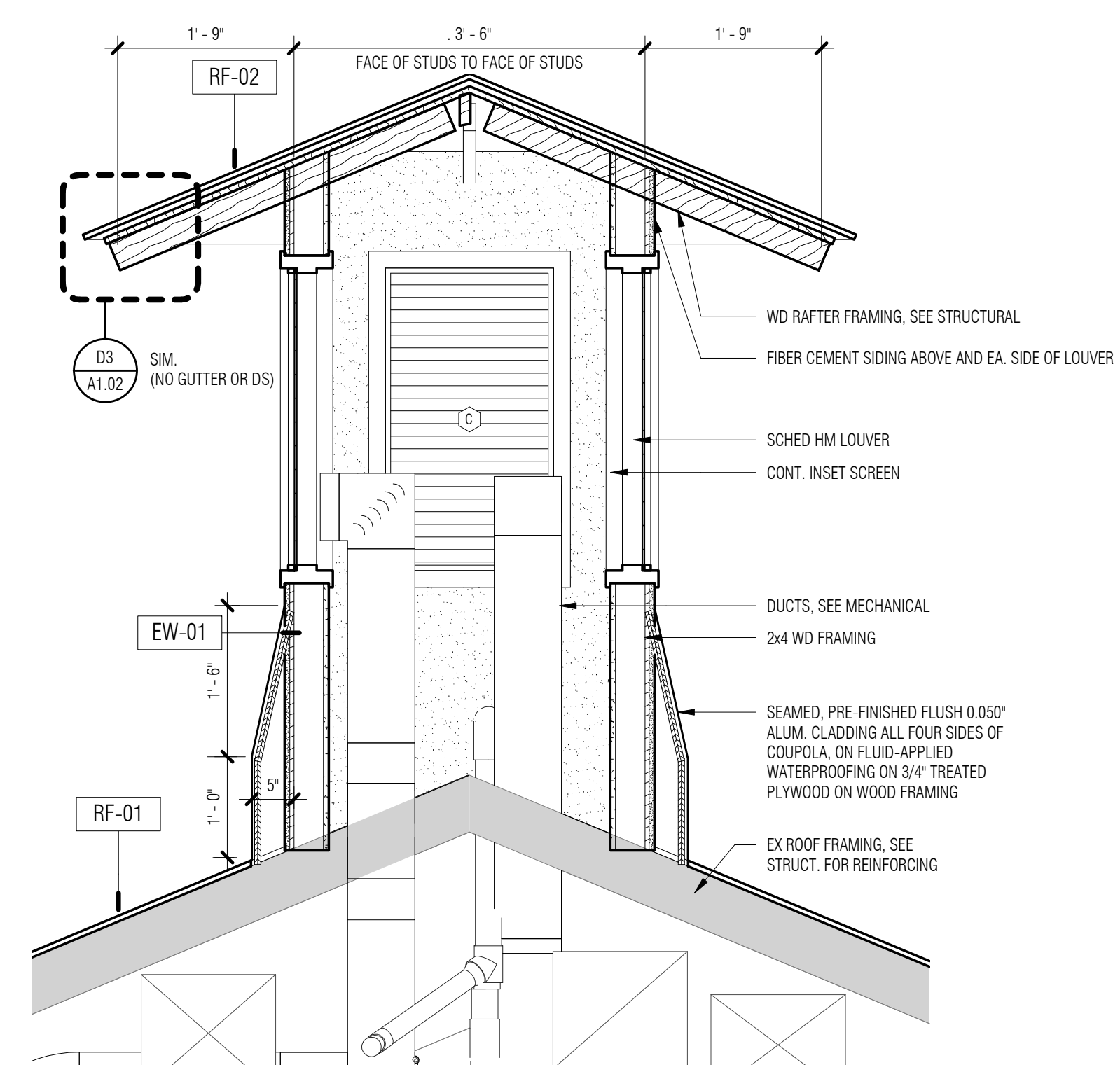
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2/14/2018 11:52:41 PM



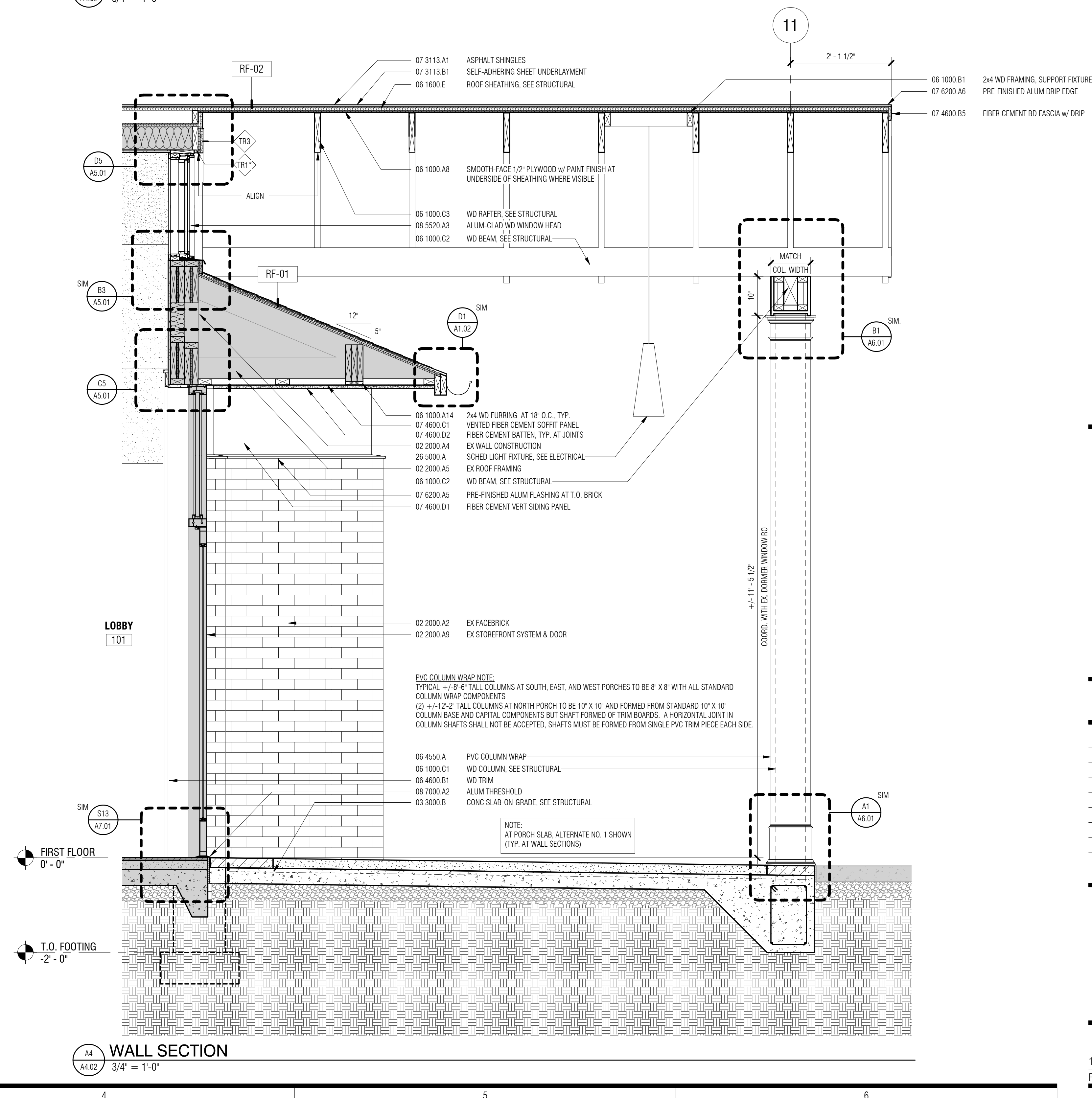
ISSUE DATE: FEBRUARY 19, 2018
PHASE: BIDDING DOCUMENTS

#	DATE	REVISION

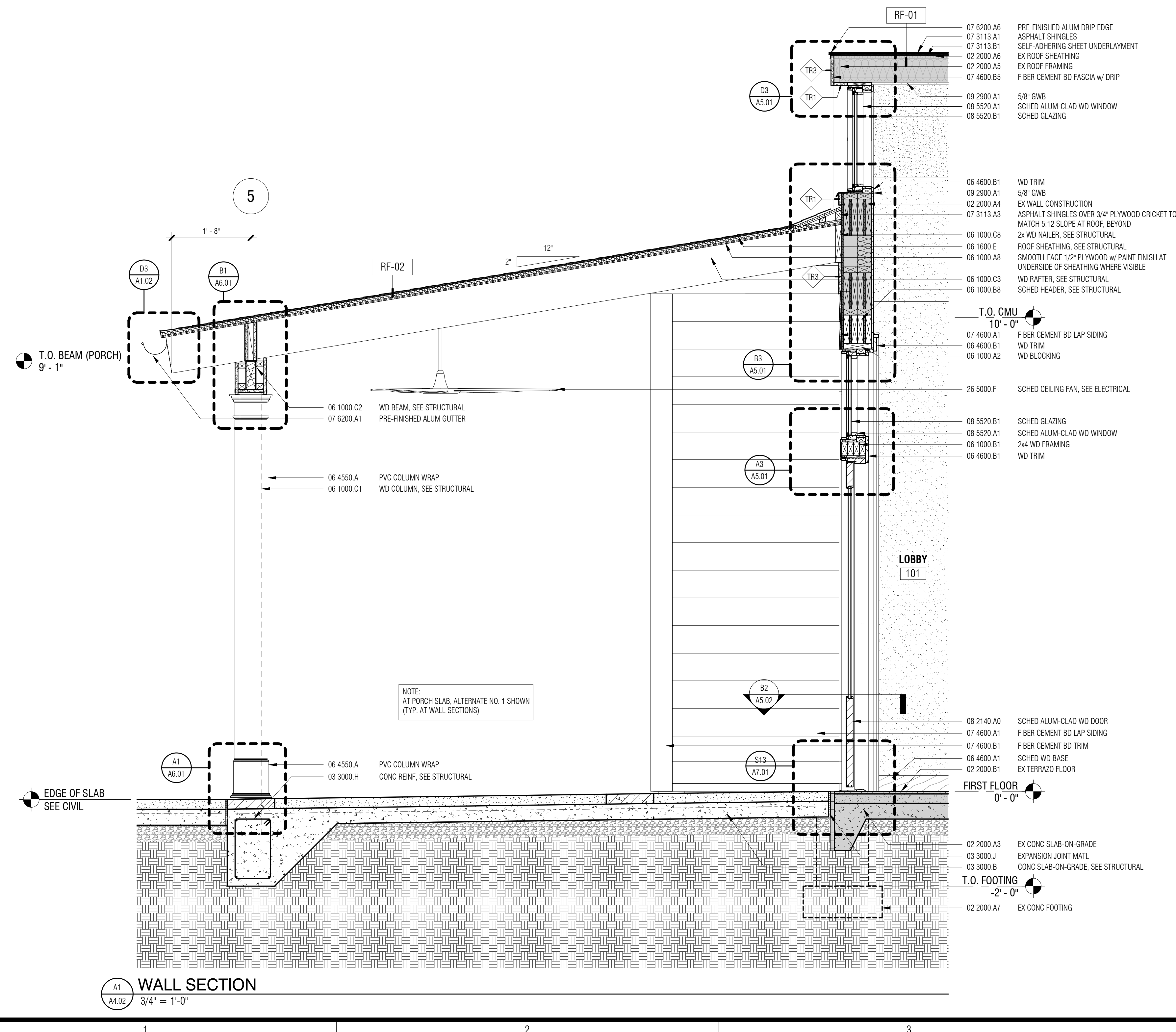
WALL SECTIONS



WALL SECTION AT COUPOLA
3/4" = 1'-0"



WALL SECTION
3/4" = 1'-0"



WALL SECTION
3/4" = 1'-0"

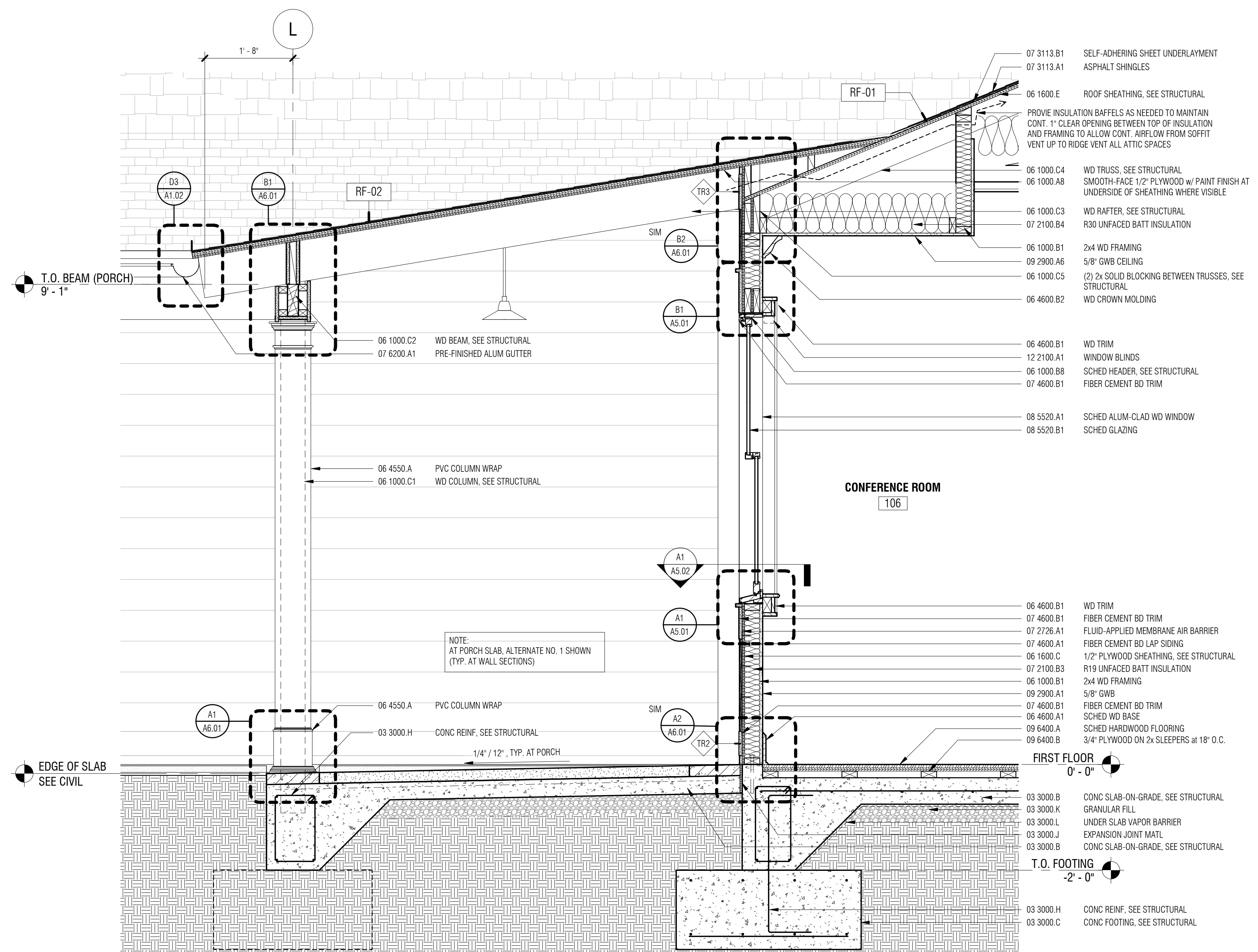
2/14/2018 11:28 PM C:\Users\jcm\WTS-Mk\Documents\1509-Colleton_Airport_A4_1.dwg

E
D
C
B
A

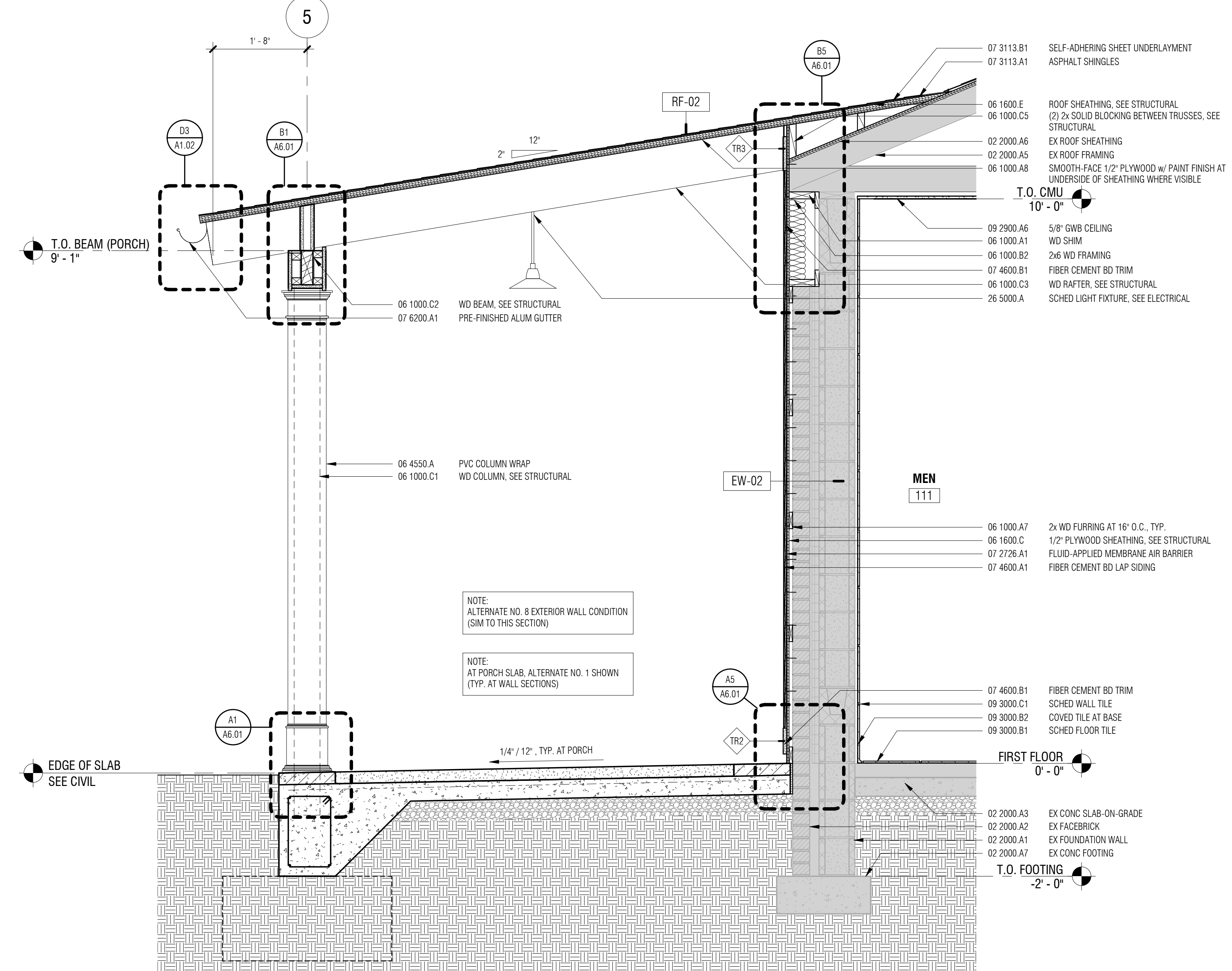


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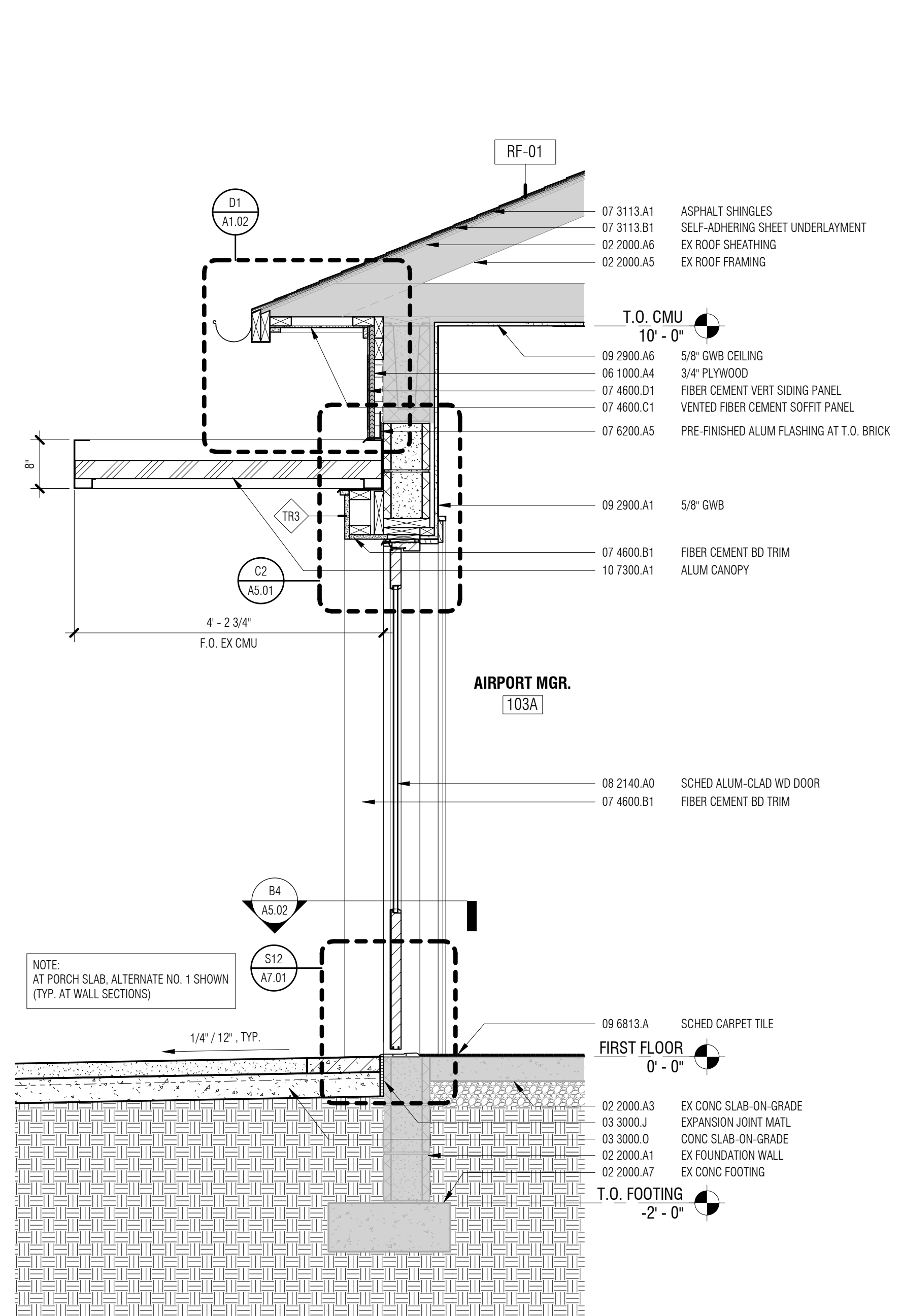
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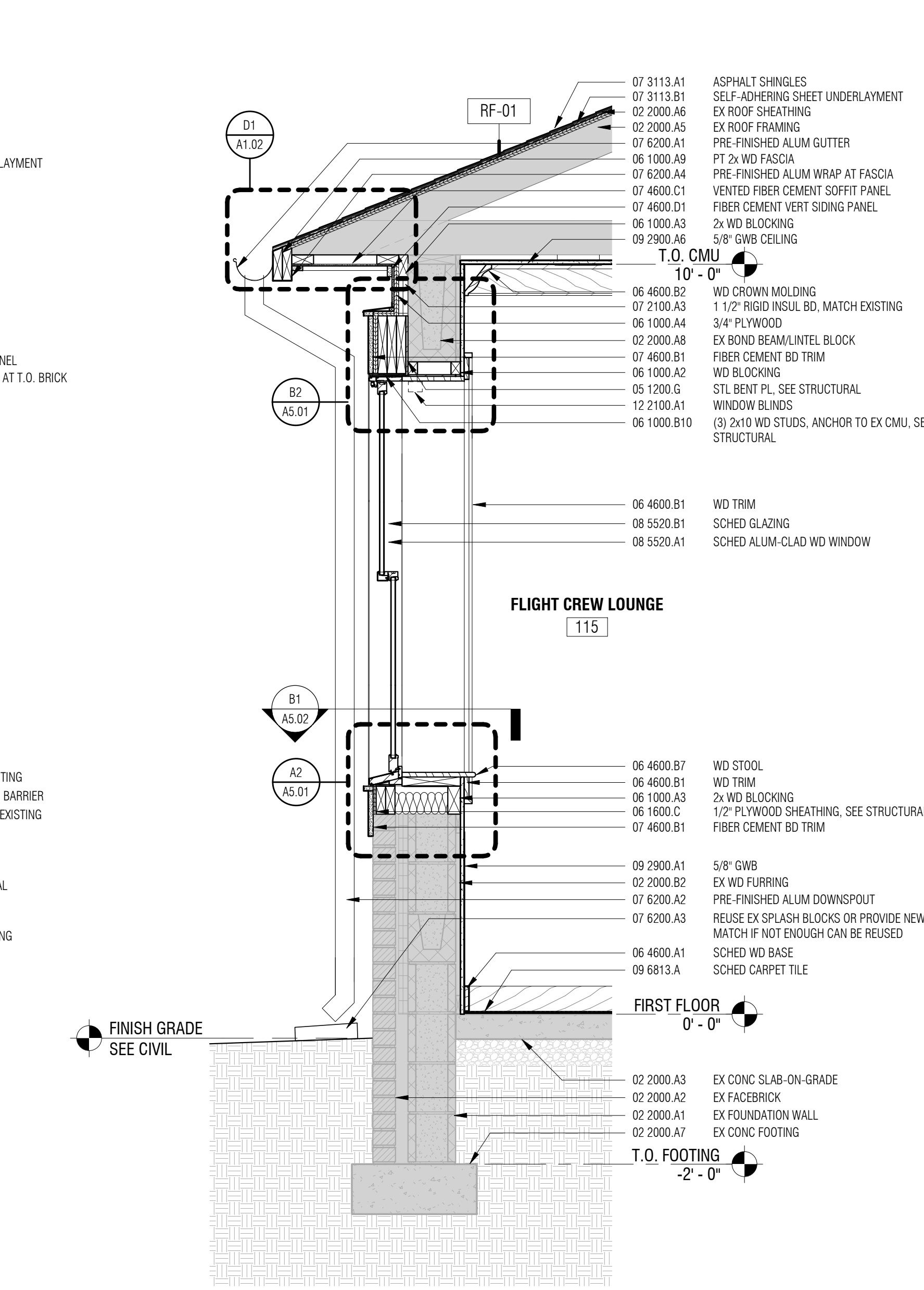
C4 WALL SECTION
3/4" = 1'-0"



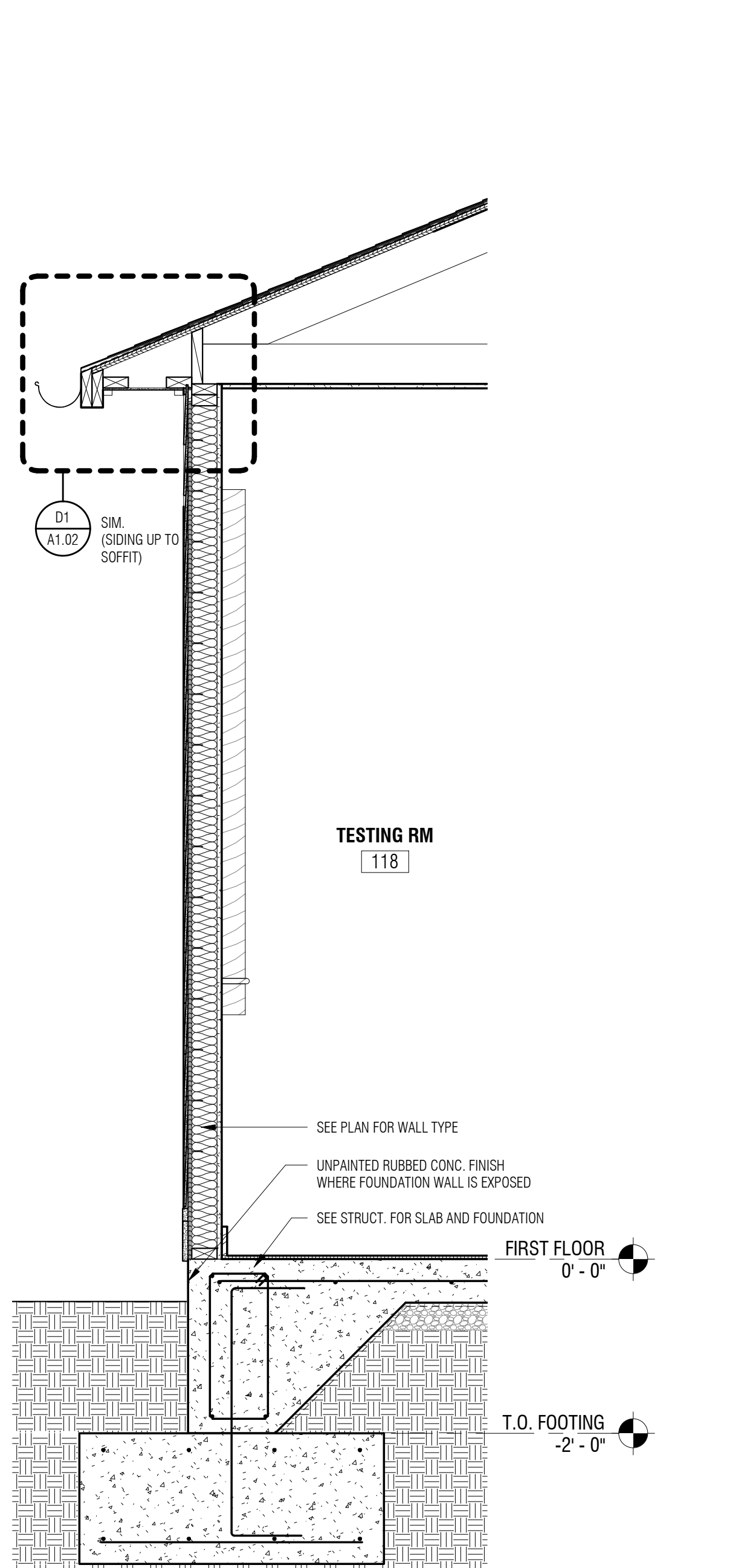
A4 WALL SECTION
3/4" = 1'-0"



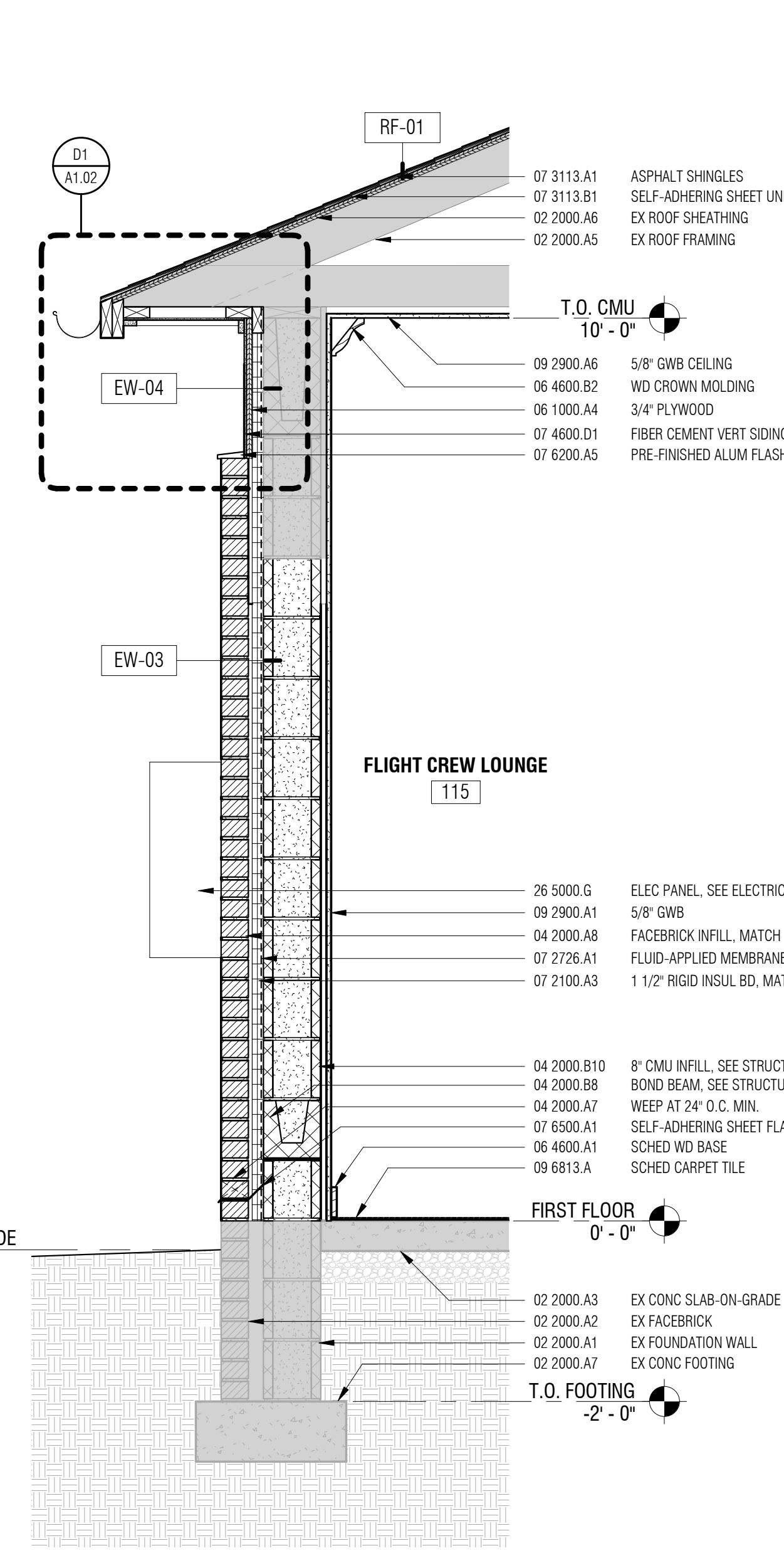
C2 WALL SECTION
3/4" = 1'-0"



A2 WALL SECTION
3/4" = 1'-0"



C1 WALL SECTION
3/4" = 1'-0"

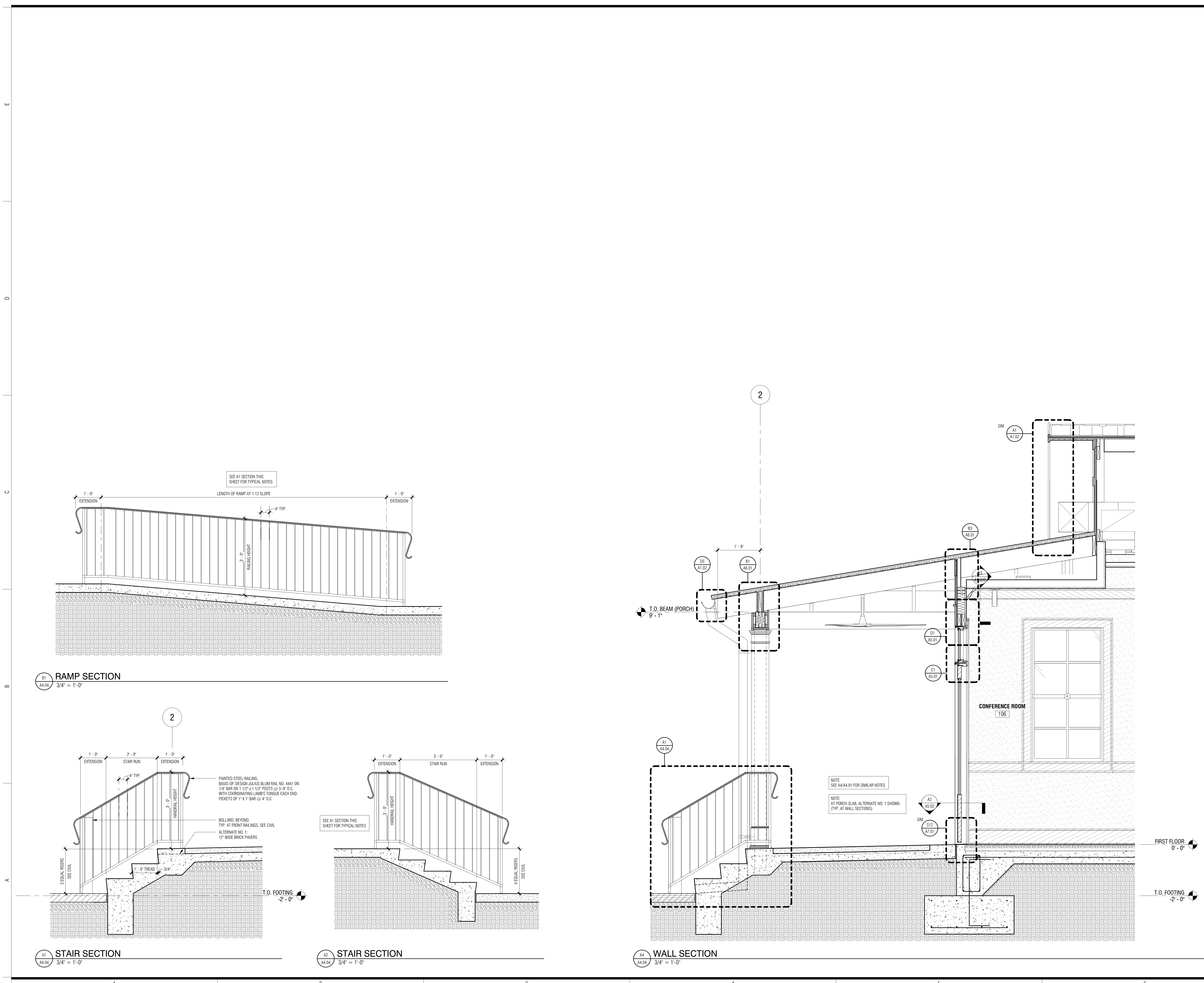


A1 WALL SECTION
3/4" = 1'-0"

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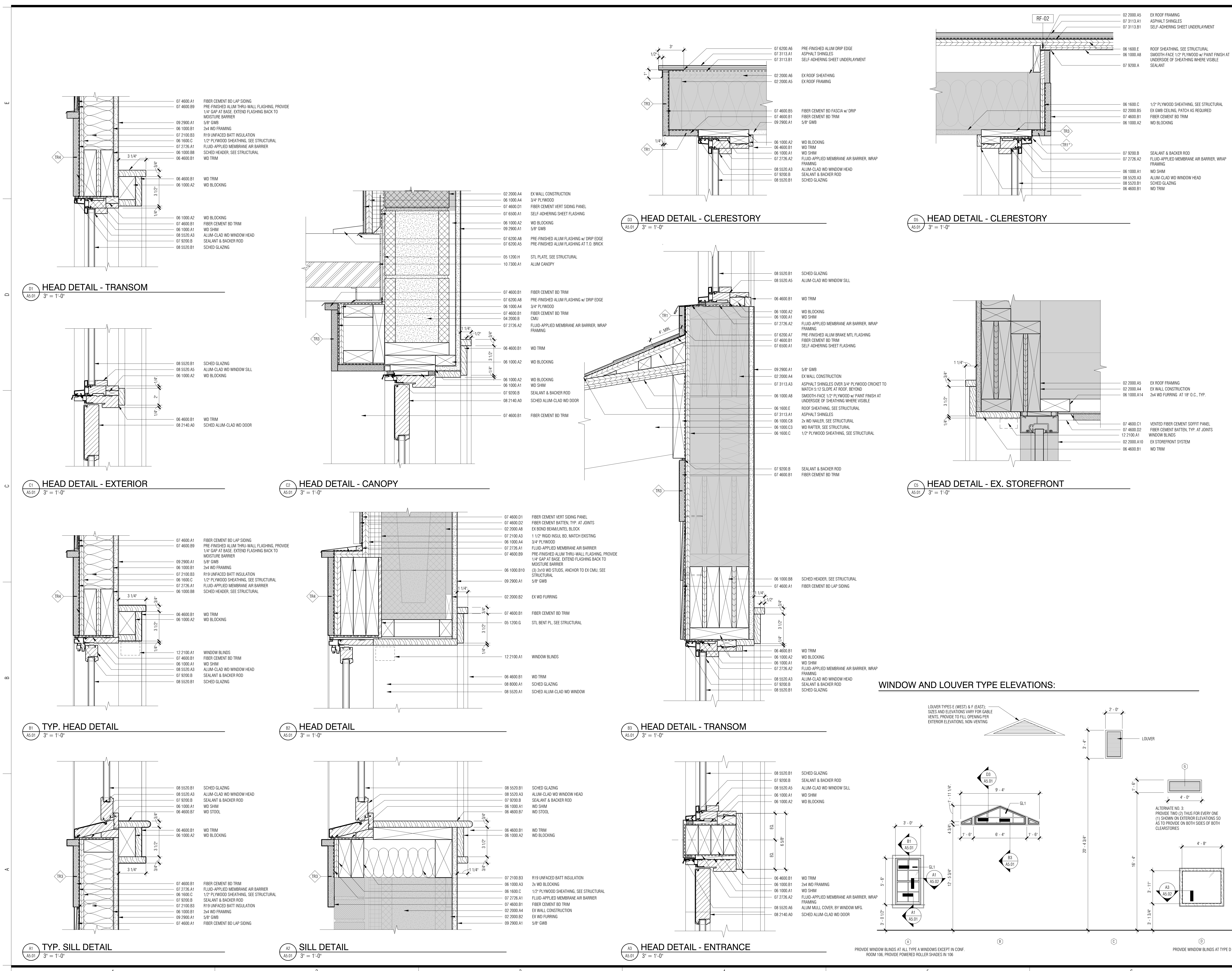
#	DATE	REVISION



2/14/2018 11:53 PM C:\Users\jcm\OneDrive\Documents\1509-Colleton Airport_A4_1.dwg

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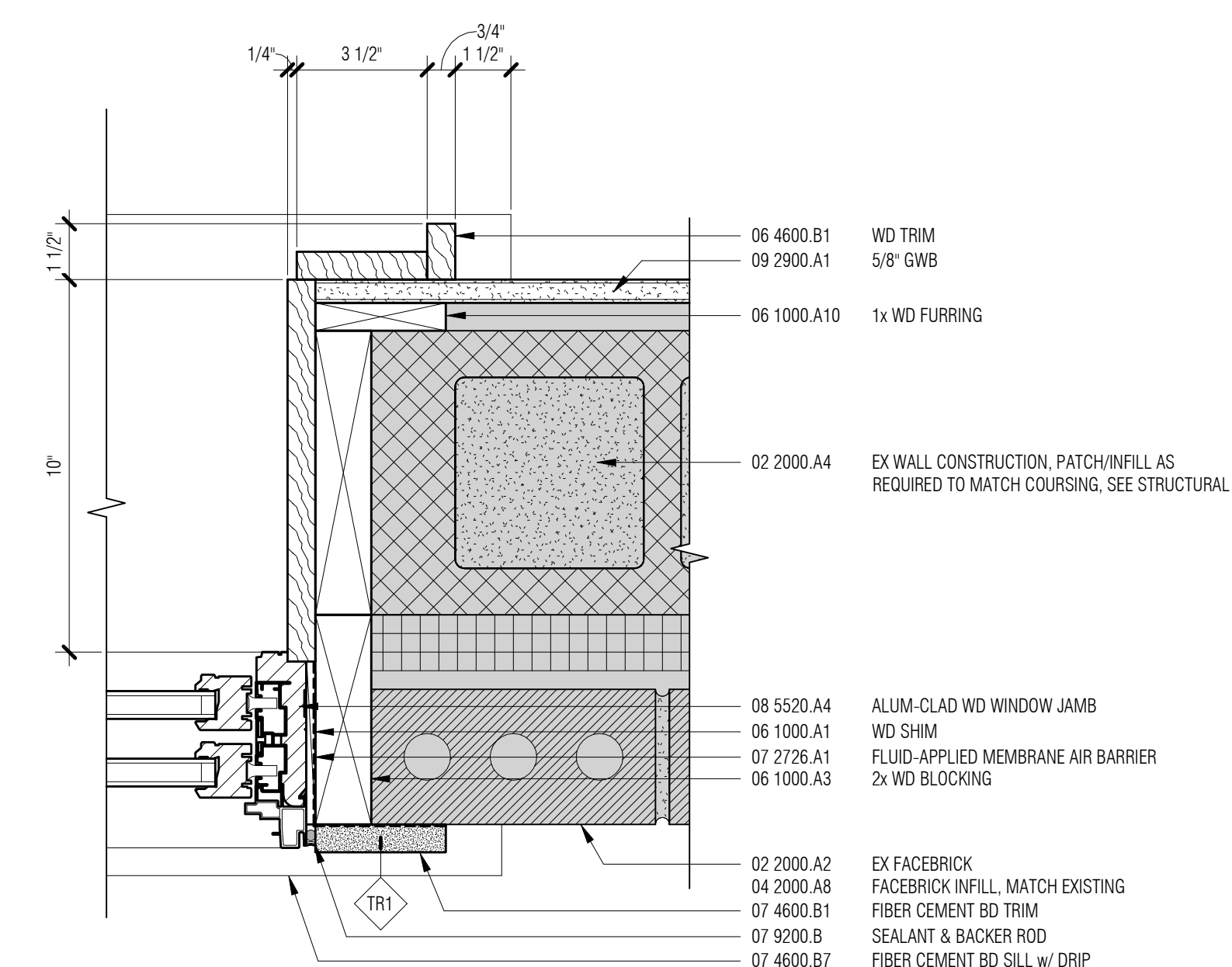
#	DATE	REVISION



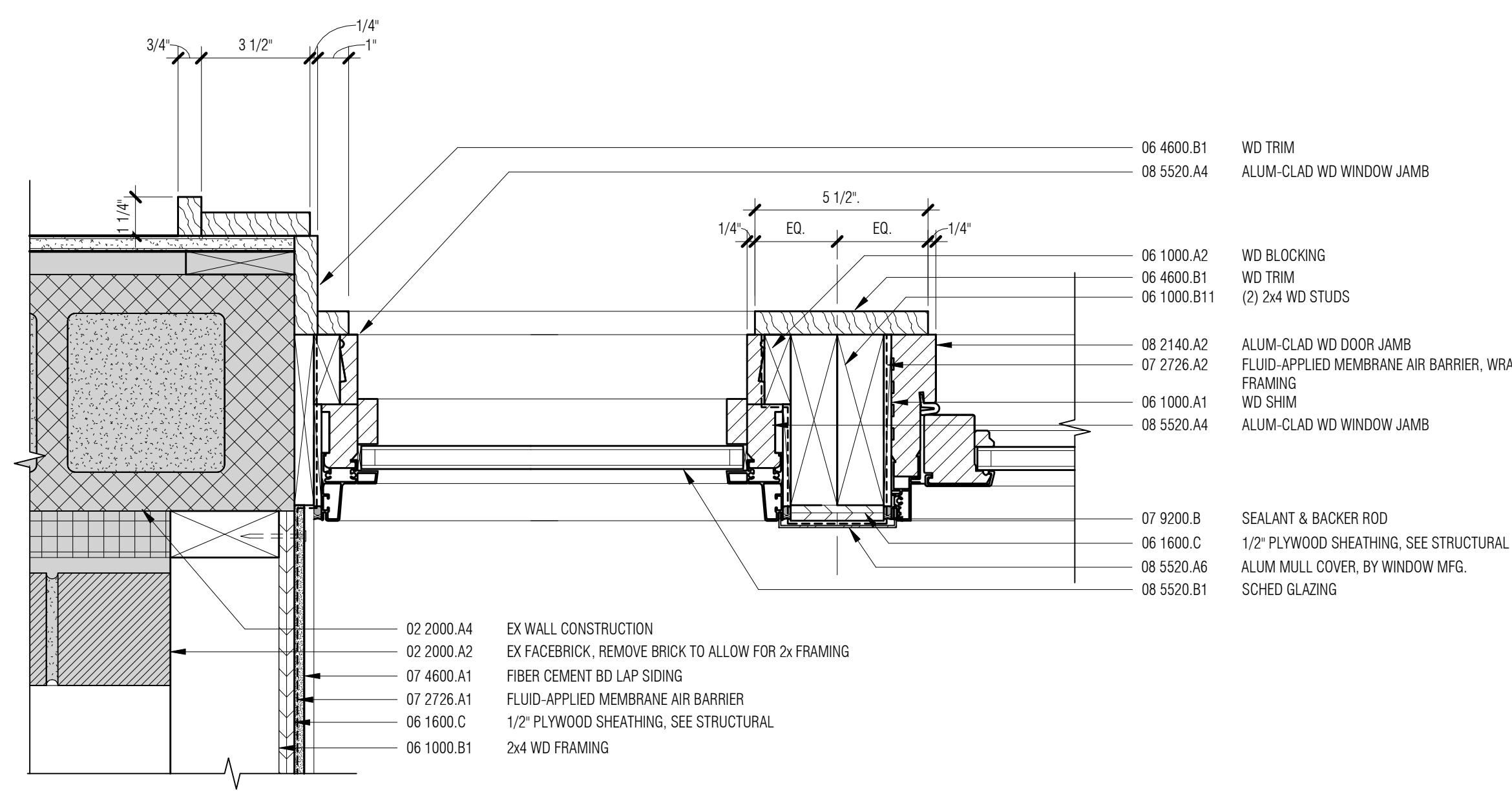
ISSUE DATE: FEBRUARY 19, 2018
PHASE: BIDDING DOCUMENTS

#	DATE	REVISION

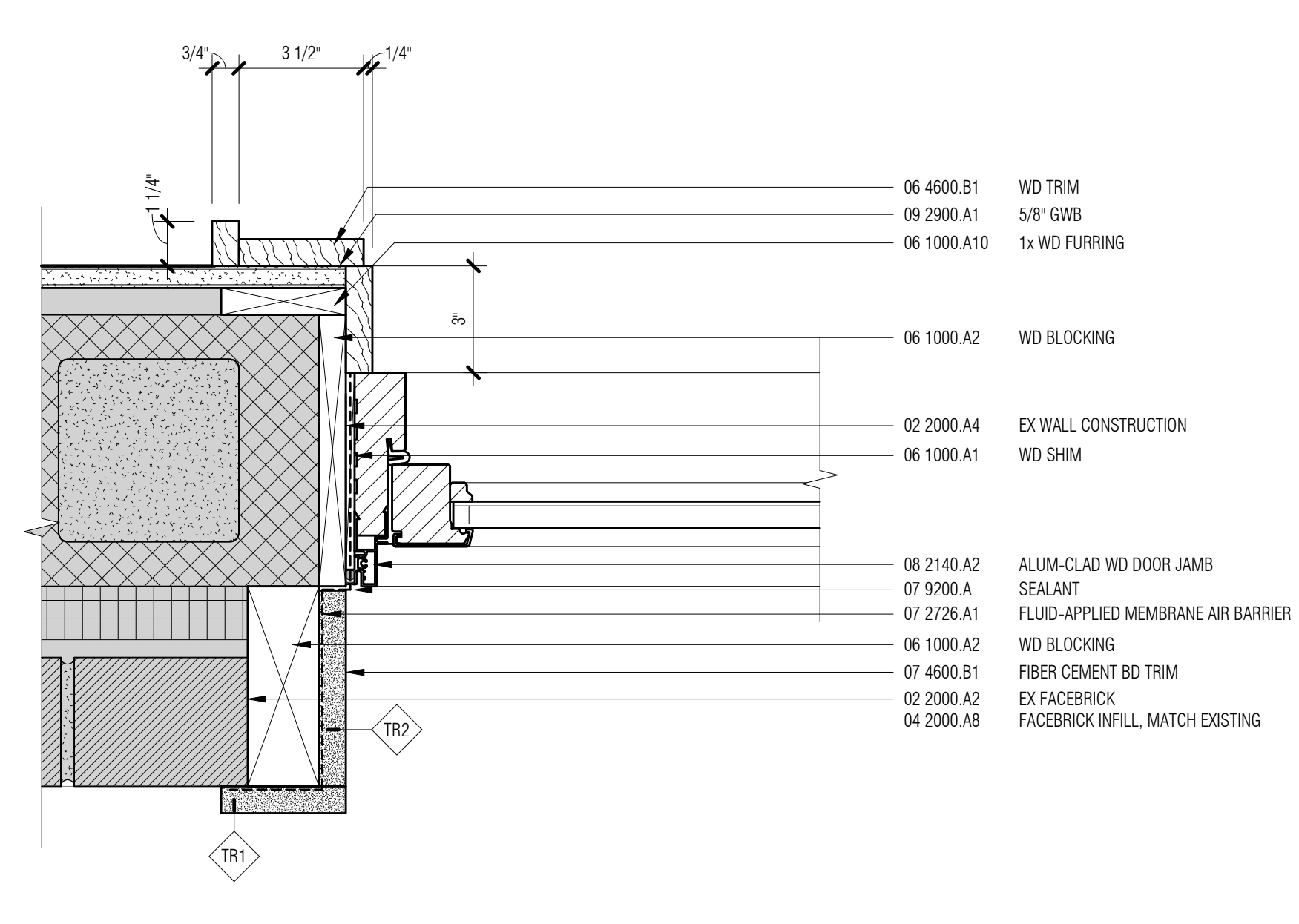
WINDOW PLAN
DETAILS



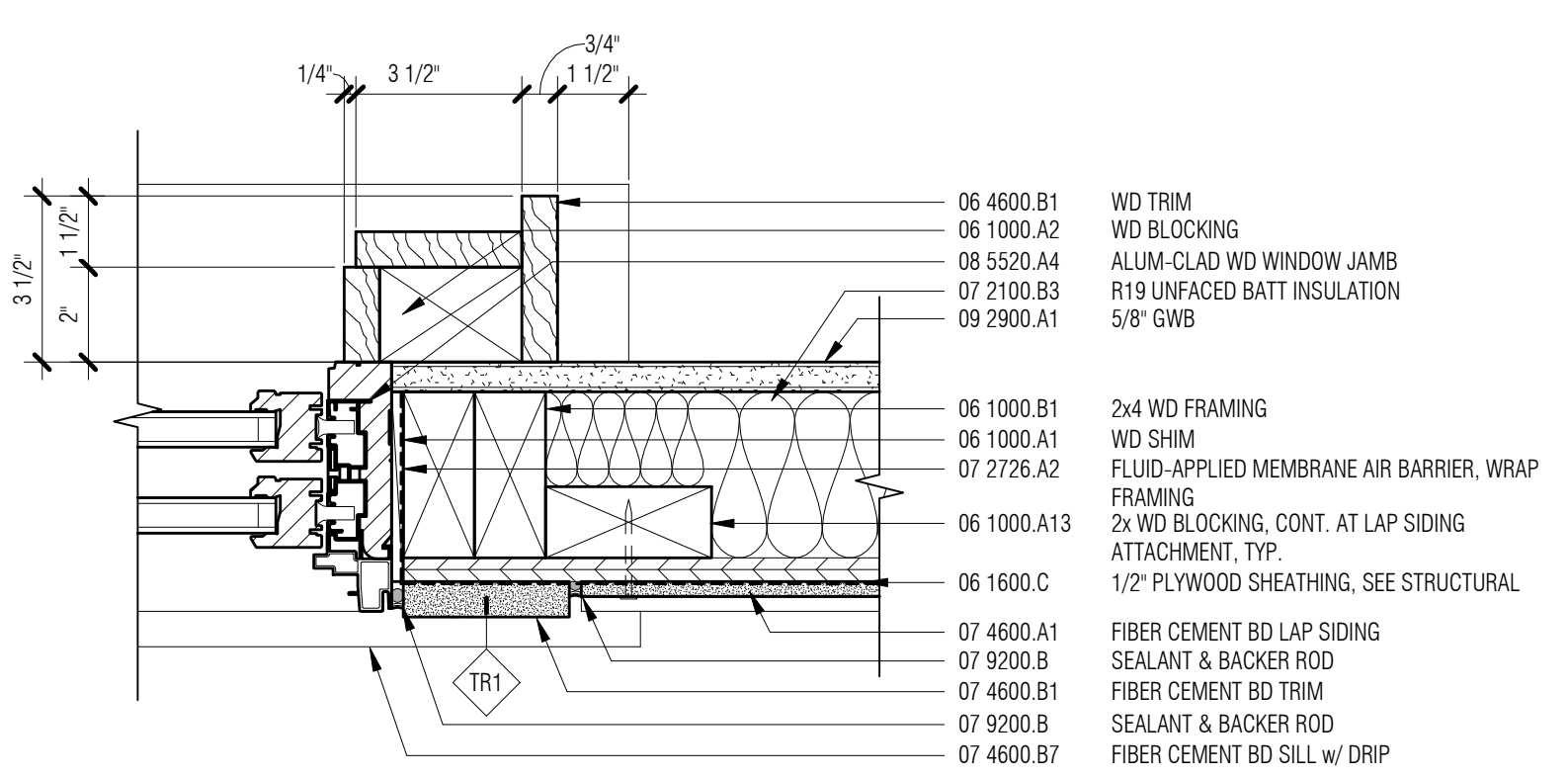
B1
A5.02
JAMB DETAIL - EXISTING
3" = 1'-0"



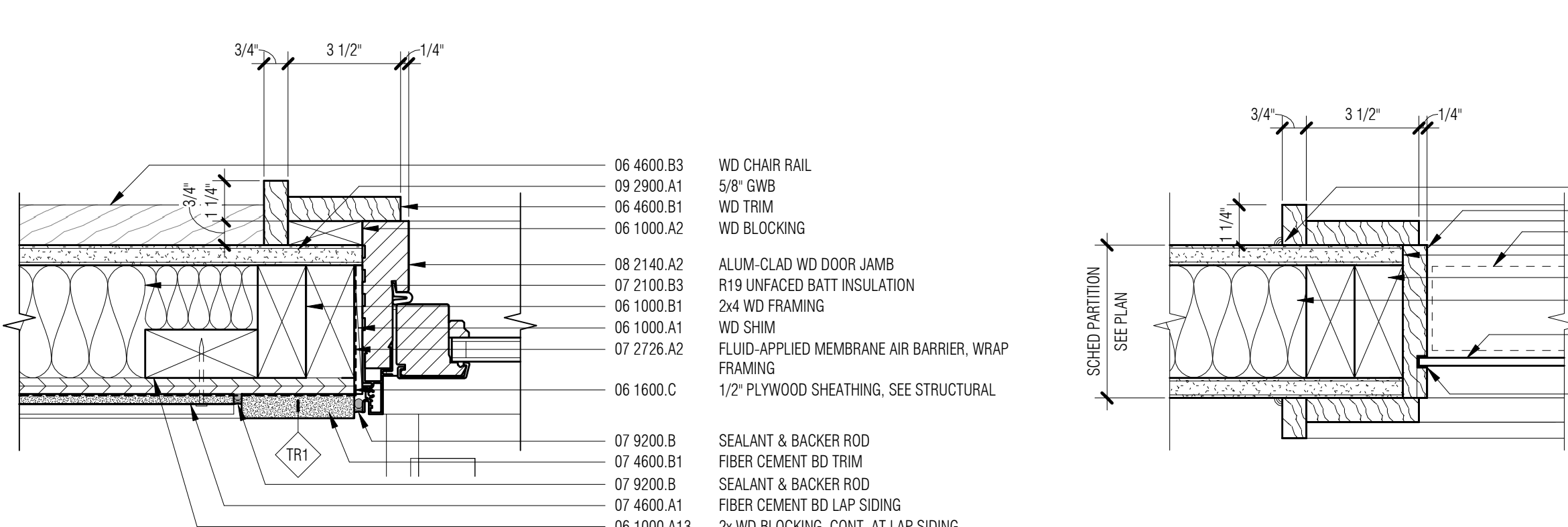
B2
A5.02
JAMB DETAIL - FRONT ENTRANCE
3" = 1'-0"



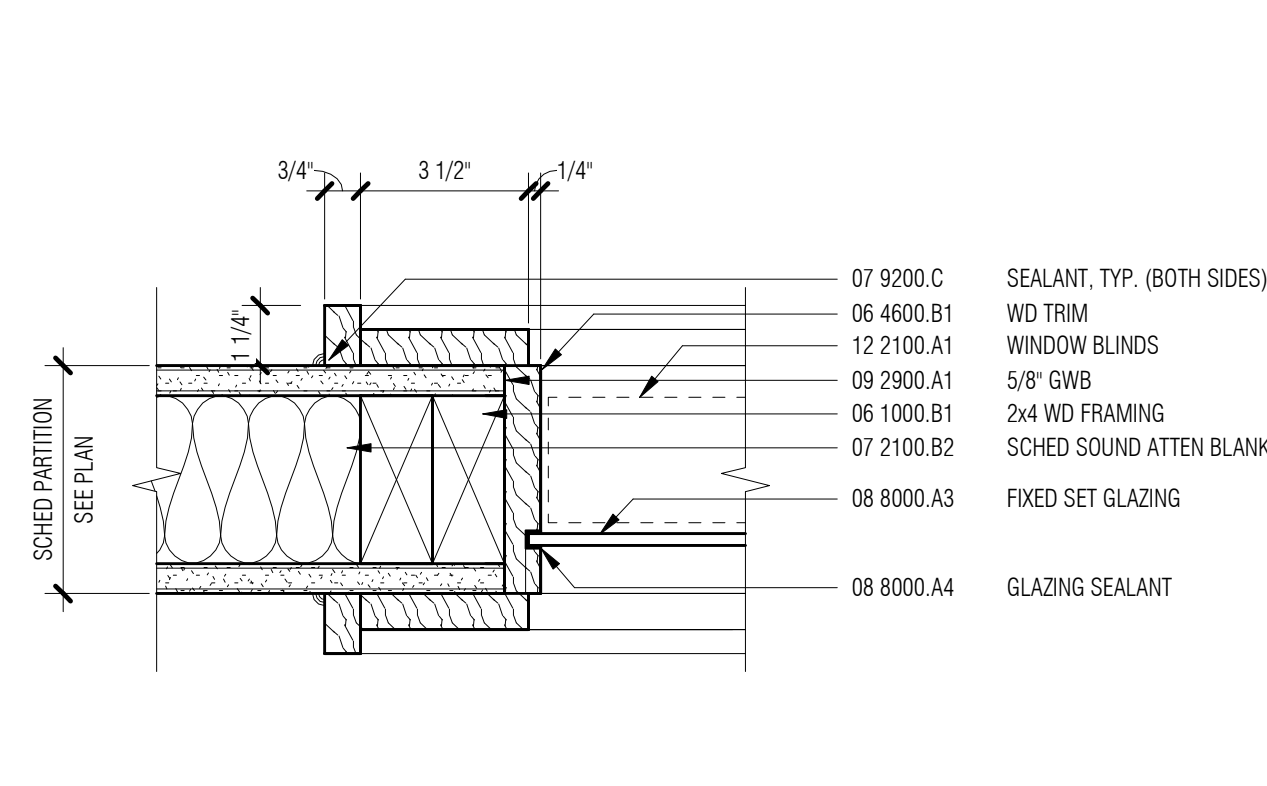
B4
A5.02
JAMB DETAIL - EXTERIOR (EXISTING)
3" = 1'-0"



A1
A5.02
TYP. JAMB DETAIL
3" = 1'-0"



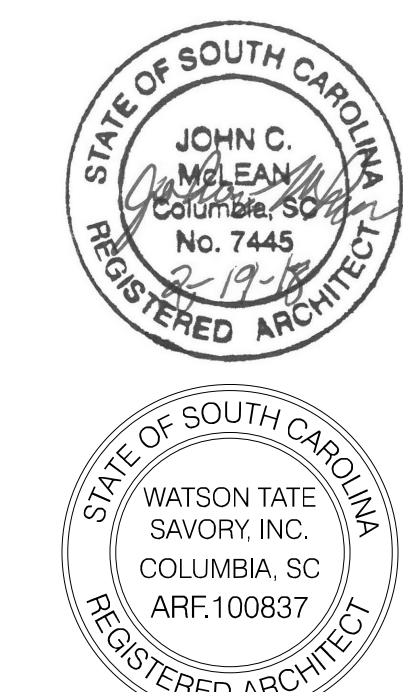
B2
A5.02
JAMB DETAIL - EXTERIOR
3" = 1'-0"



A3
A5.02
JAMB DETAIL - INTERIOR (HEAD SIM)
3" = 1'-0"

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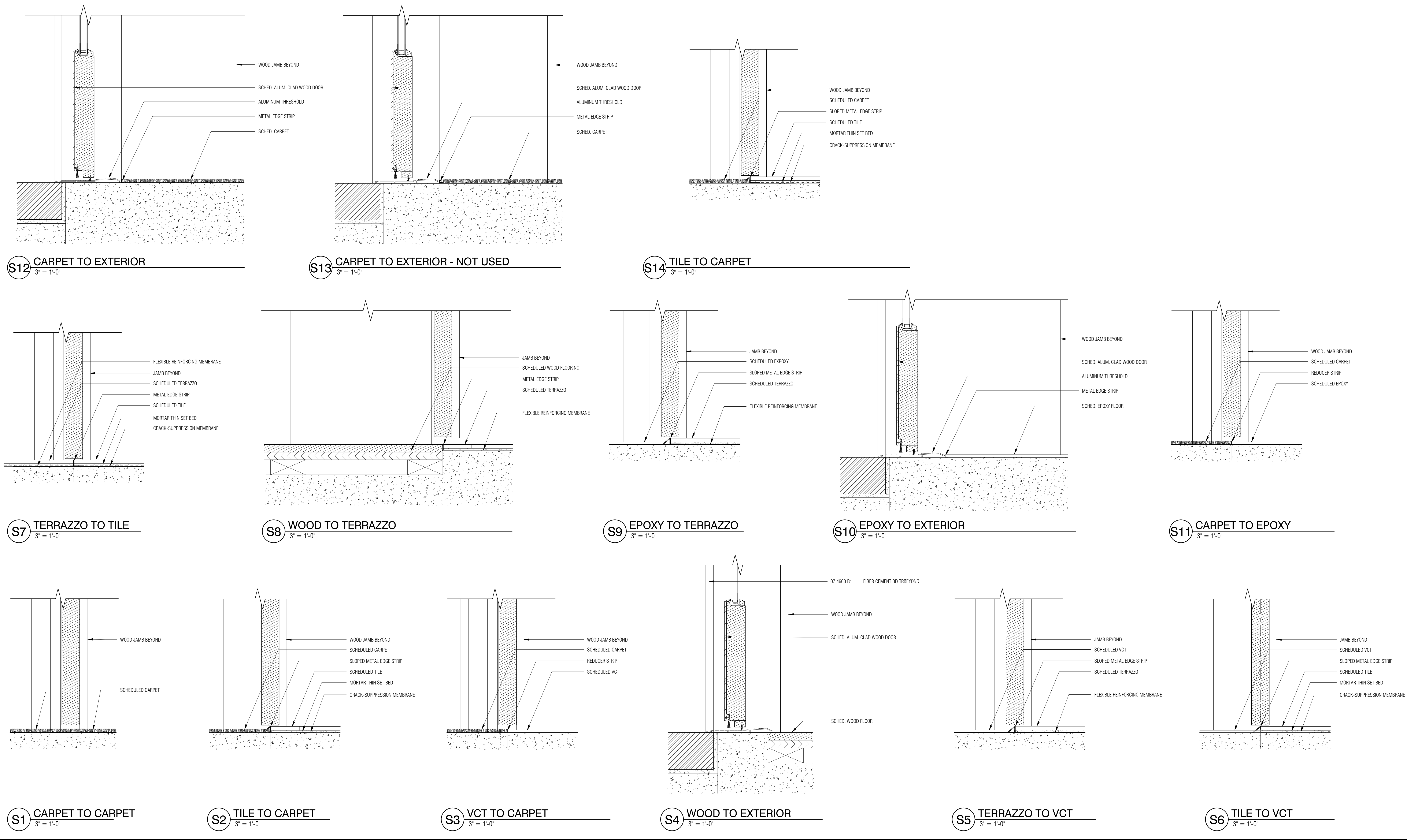
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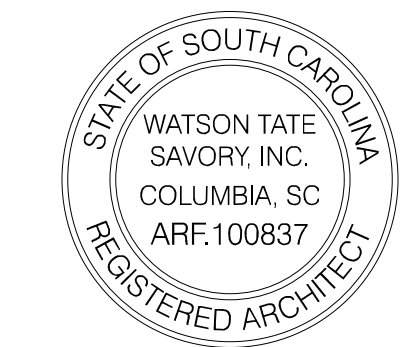
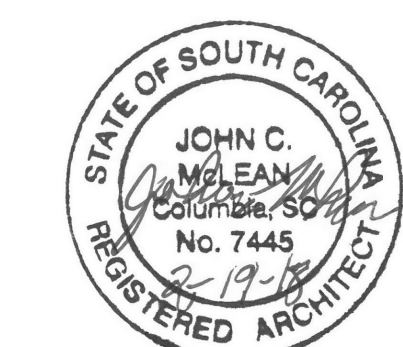
#	DATE	REVISION

DOOR DETAILS



2/14/2018 11:38 PM C:\Users\jcm\OneDrive\Documents\1509-Colleton Airport_A7.dwg

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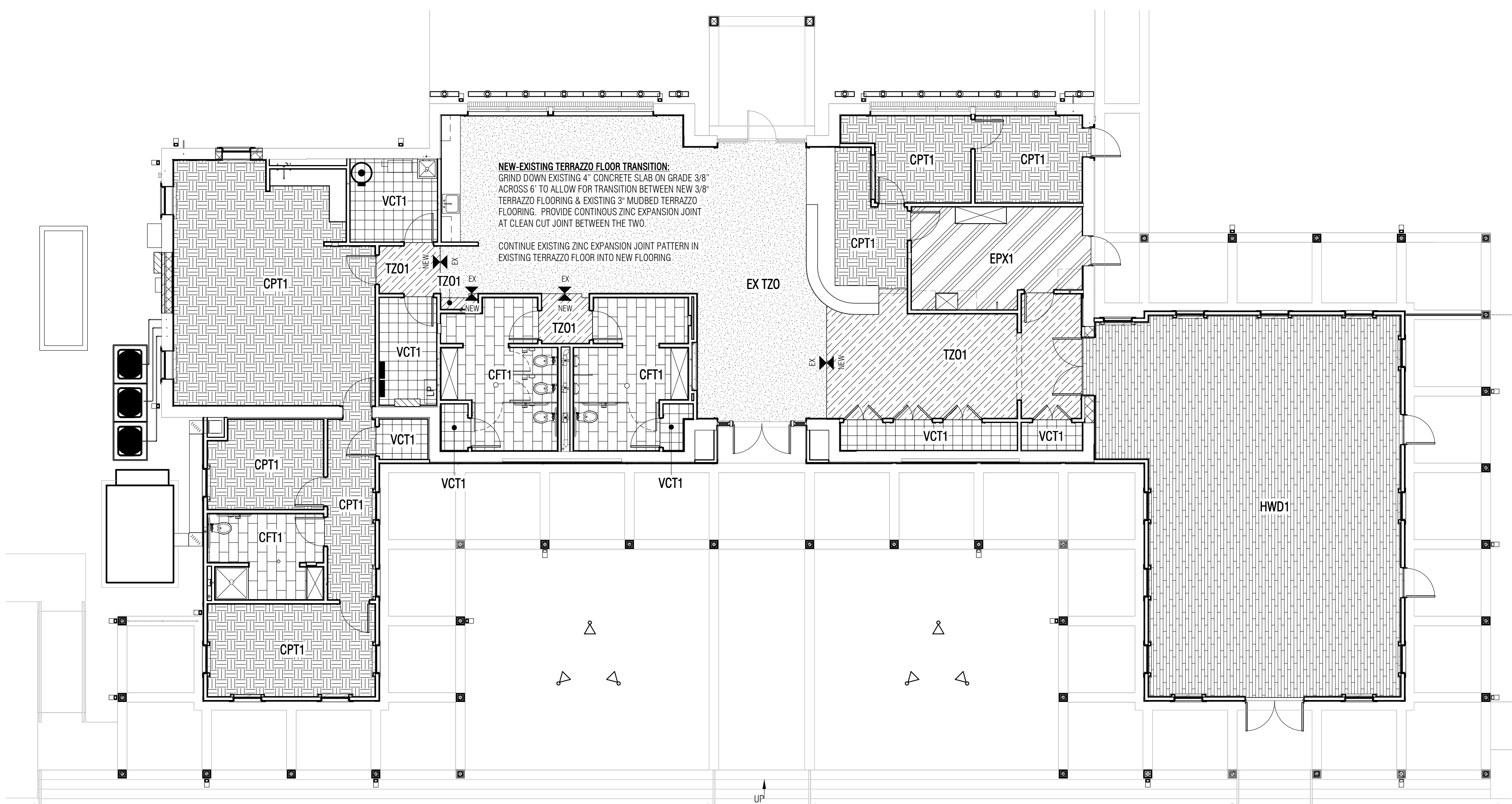
ISSUE DATE: FEBRUARY 19, 2018
PHASE: BIDDING DOCUMENTS

#	DATE	REVISION

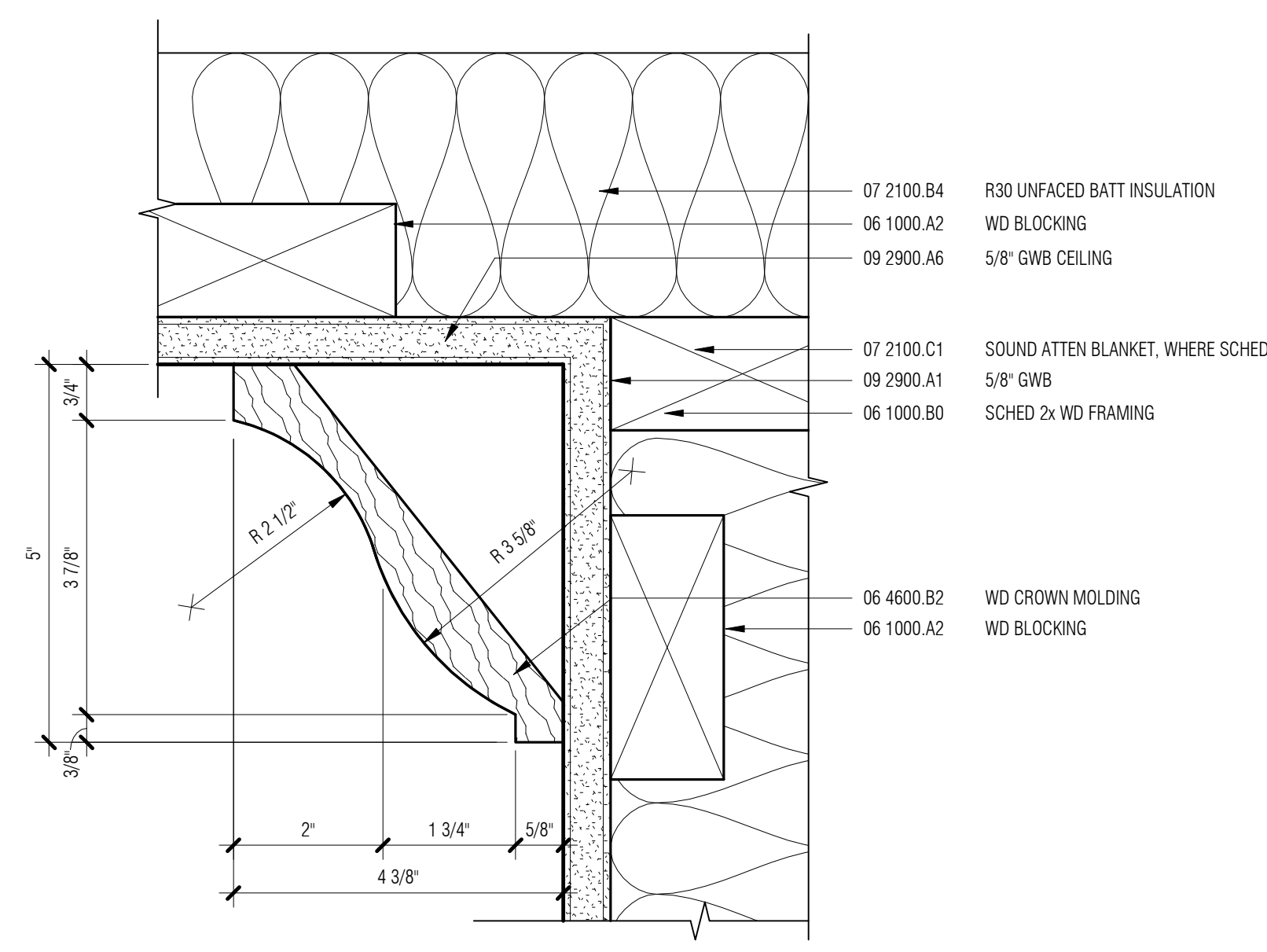
FINISH SCHEDULE,
PLAN, & DETAILS

NO.	ROOM NAME	FINISHES												REMARKS
		FLOOR	BASE	NORTH WALL		EAST WALL		SOUTH WALL		WEST WALL		CEILING		
101	LOBBY	EX TZO, TZO1	WD1	GWB	PT	GWB	PT	GWB	PT	GWB	PT	GWB	PT	
102	RECEPTION	CPT1	WD1	GWB	PT	GWB	PT	---	---	---	---	GWB	PT	
103	OPERATIONS	CPT1	WD1	GWB	PT	GWB	PT	GWB	PT	GWB	PT	GWB	PT	
103A	AIRPORT MGR.	CPT1	WD1	GWB	PT	GWB	PT	GWB	PT	GWB	PT	GWB	PT	
104	LINE CREW WK. AREA	EPX1	RB1	GWB	EPXY PT	GWB	EPXY PT	GWB	EPXY PT	GWB	EPXY PT	GWB	EPXY PT	
105	VESTIBULE	TZO1	WD1	GWB	PT	GWB	PT	GWB	PT	GWB	PT	GWB	PT	
106	CONFERENCE ROOM	HW1	WD2	GWB	PT	GWB	PT	GWB	PT	GWB	PT	ACT/GWB	---/PT	CHAIR RAIL
107	A/V	VCT1	RB1	GWB	PT	GWB	PT	PLYWD	PT	GWB	PT	GWB	PT	
108	MECH / CORE	VCT1	RB1	GWB	PT	GWB	PT	GWB	PT	GWB	PT	GWB	PT	
109	CORRIDOR	EX TZO, TZO1	WD1	---	---	---	---	GWB	PT	GWB	PT	GWB	PT	
110	PUBLIC WAITING	EX TZO	WD1	GWB	PT	---	---	---	---	GWB/CWT2	PT/---	GWB	PT	
111	MEN	CFT1	CWT1	CWT1	---	CWT1/CWT2	---	CWT1	---	CWT1	---	GWB	PT	
111A	STOR.	VCT1	RB1	GWB	PT	GWB	PT	GWB	PT	GWB	PT	GWB	PT	
112	WOMEN	CFT1	CWT1	CWT1	---	CWT1	---	CWT1	---	CWT1/CWT2	---	GWB	PT	
112A	STOR.	VCT1	RB1	GWB	PT	GWB	PT	GWB	PT	GWB	PT	GWB	PT	
113	ELEC	VCT1	RB1	GWB	PT	GWB	PT	GWB	PT	GWB	PT	GWB	PT	
114	STOR./JAN	VCT1	RB1	GWB	PT	GWB	PT	GWB	PT	GWB	PT	GWB	PT	
115	FLIGHT CREW LOUNGE	CPT1	WD1	GWB	PT	GWB	PT	GWB	PT	GWB	PT	GWB	PT	
116	CORR.	CPT1	WD1	GWB	PT	GWB	PT	GWB	PT	GWB	PT	GWB	PT	
117	STOR.	VCT1	RB1	GWB	PT	GWB	PT	GWB	PT	GWB	PT	GWB	PT	
118	TESTING RM	CPT1	WD1	GWB	PT	GWB	PT	GWB	PT	GWB	PT	GWB	PT	
119	UNISEX	CFT1	CWT1	CWT1	---	CWT1/CWT2	---	CWT1	---	CWT1	---	GWB	PT	
120	QUIET ROOM	CPT1	WD1	GWB	PT	GWB	PT	GWB	PT	GWB	PT	GWB	PT	

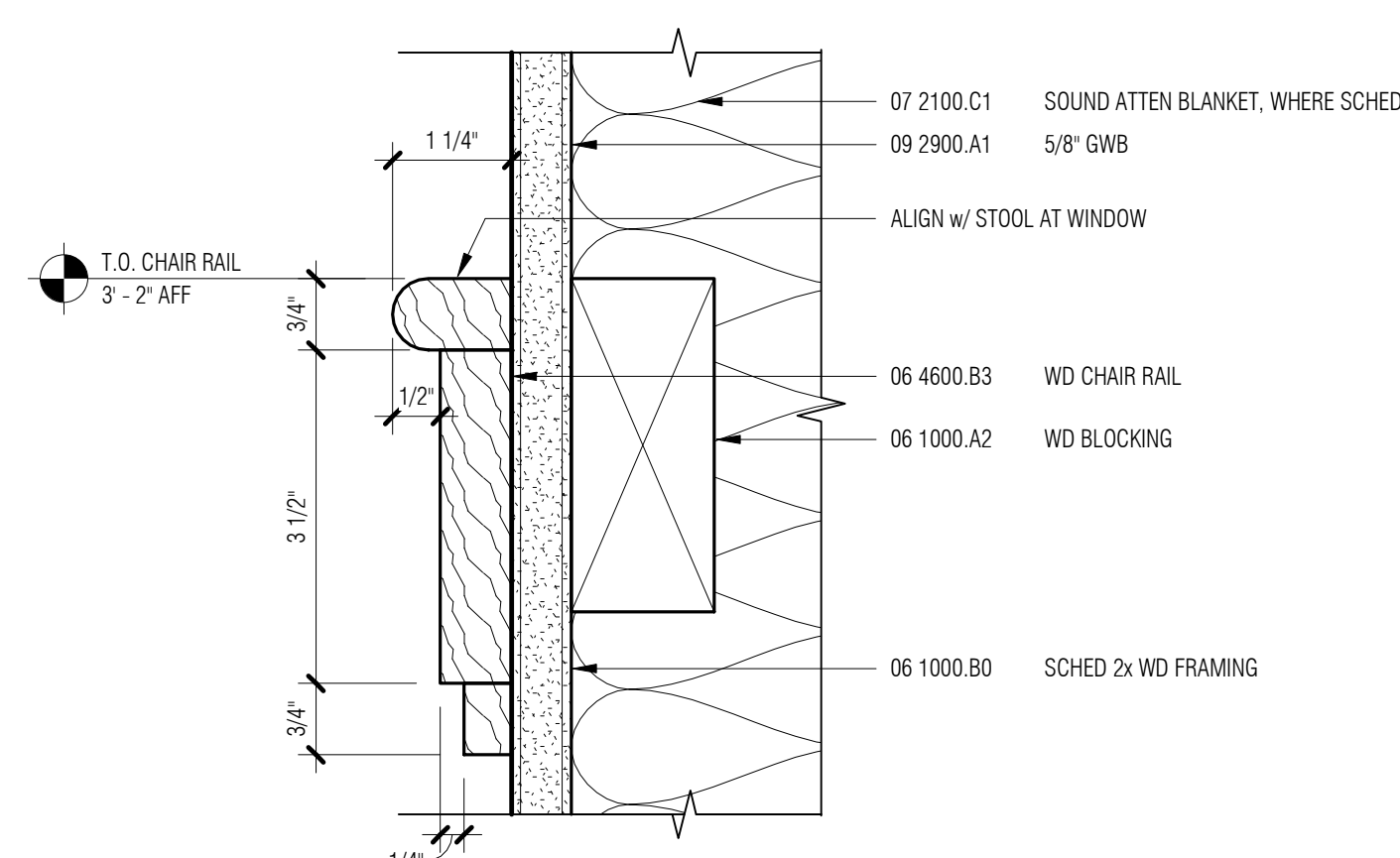
Allowances Specification Section for Carpet Allowance and Tile Allowance



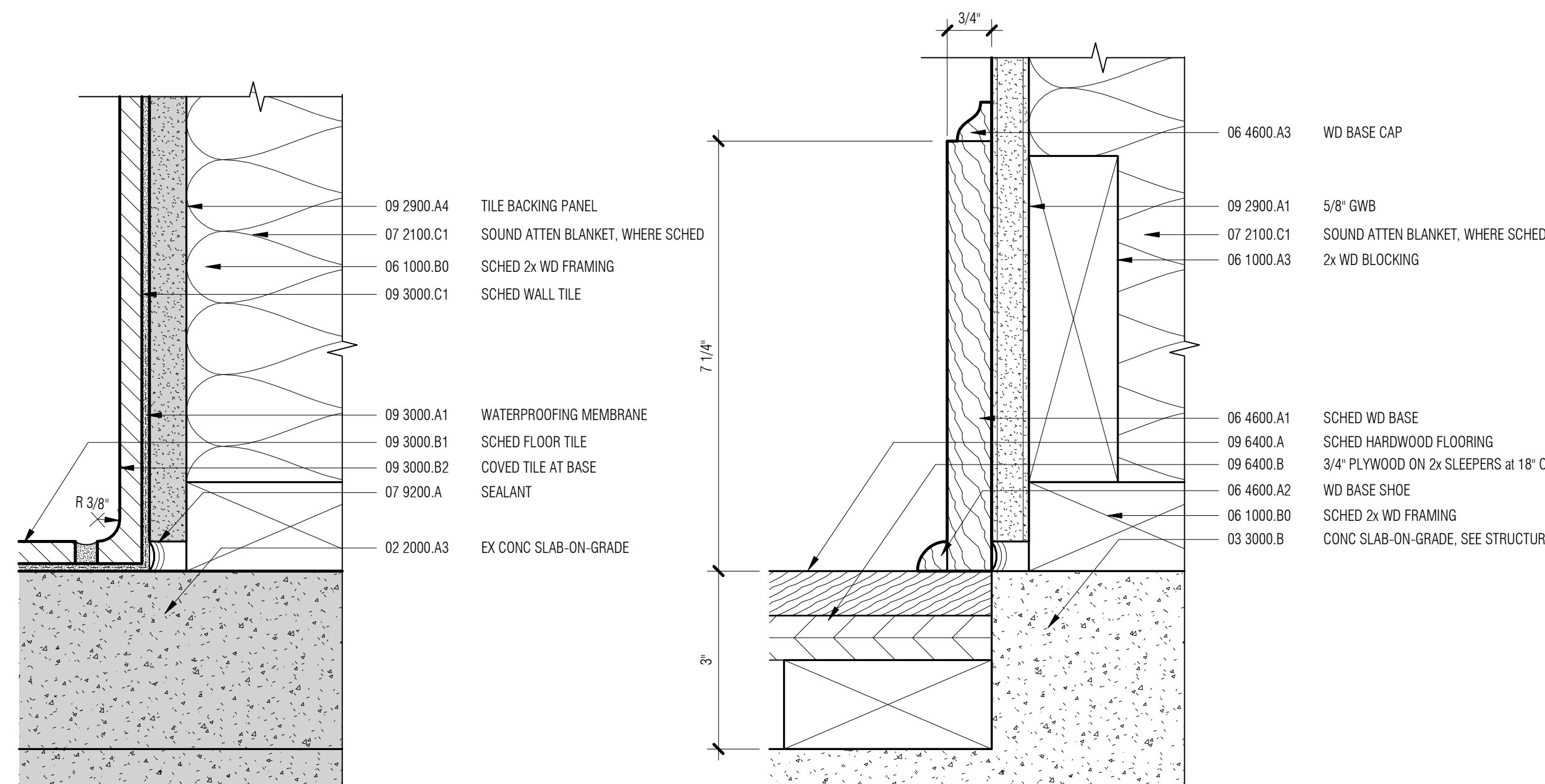
A8 FINISH FLOOR PLAN
1/8" = 1'-0"



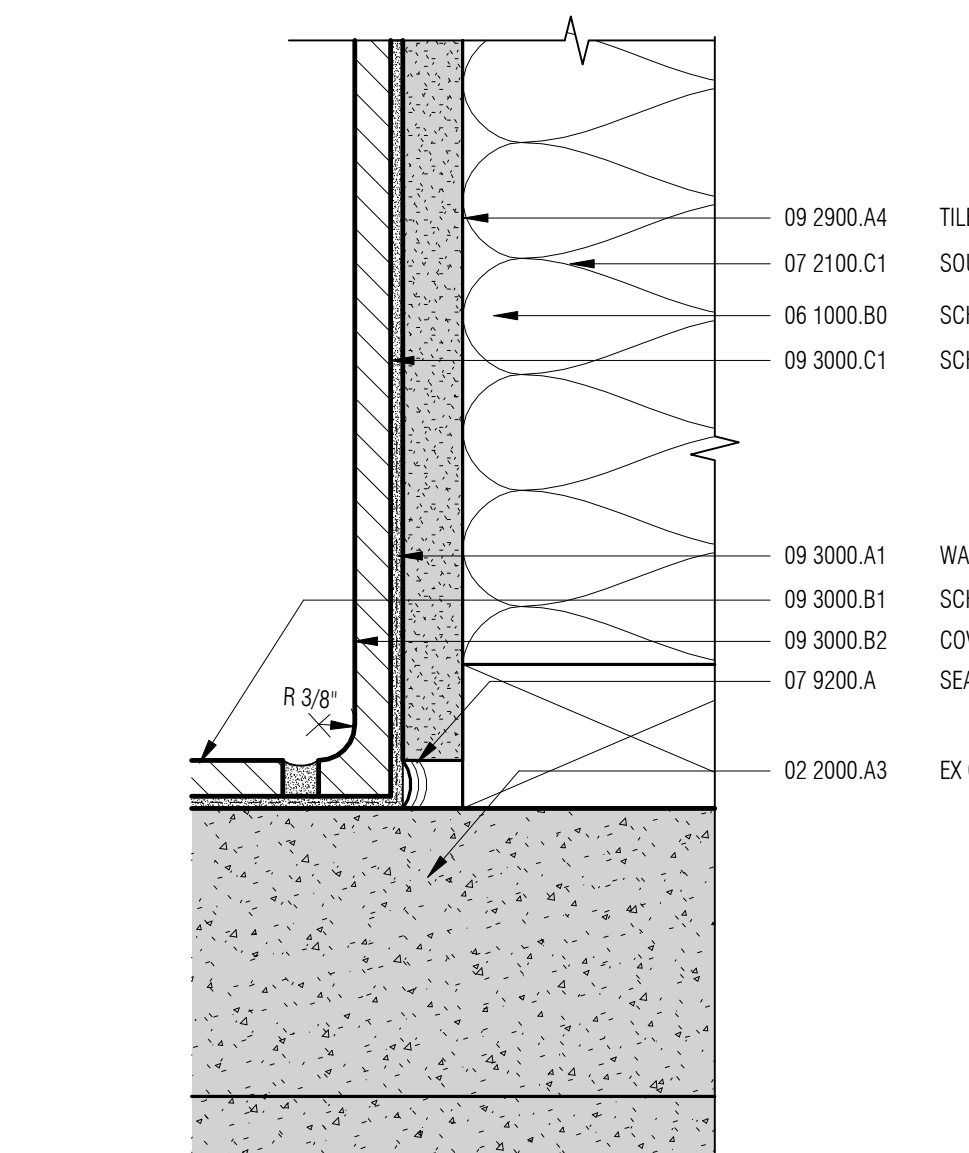
D2 TYP. TRIM DETAIL - CROWN MOULDING
6" = 1'-0"



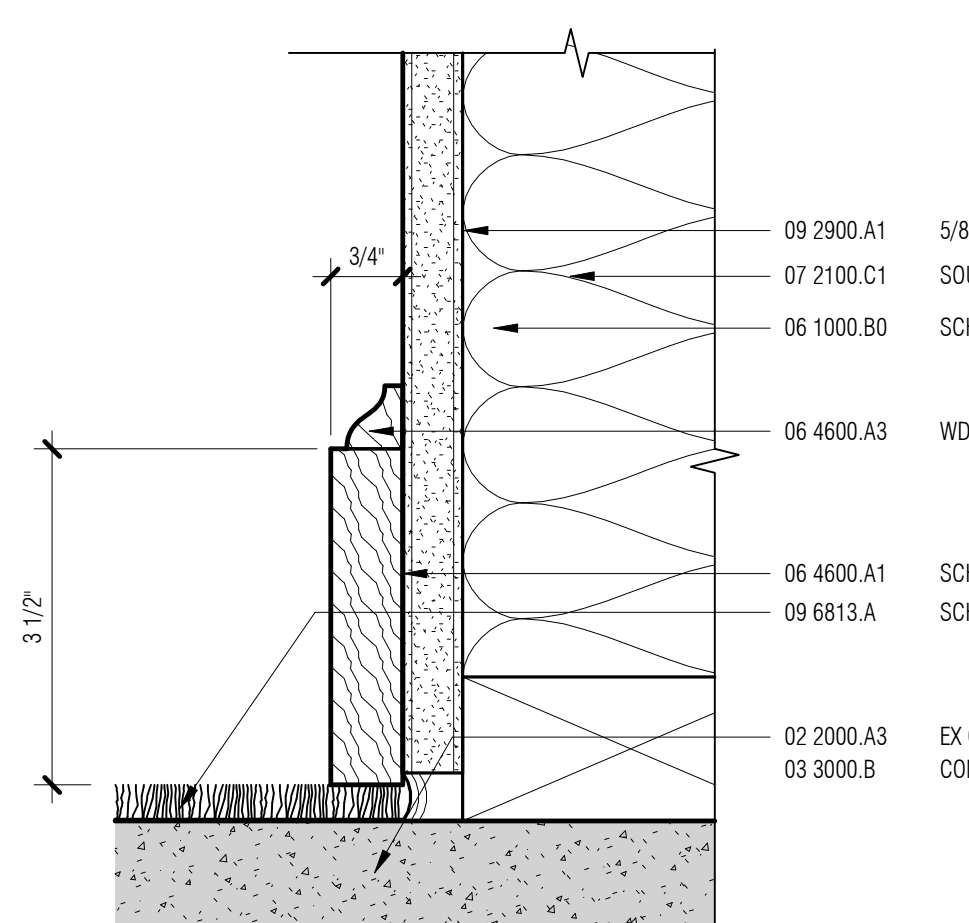
D2 TYP. TRIM DETAIL - CHAIR RAIL
6" = 1'-0"



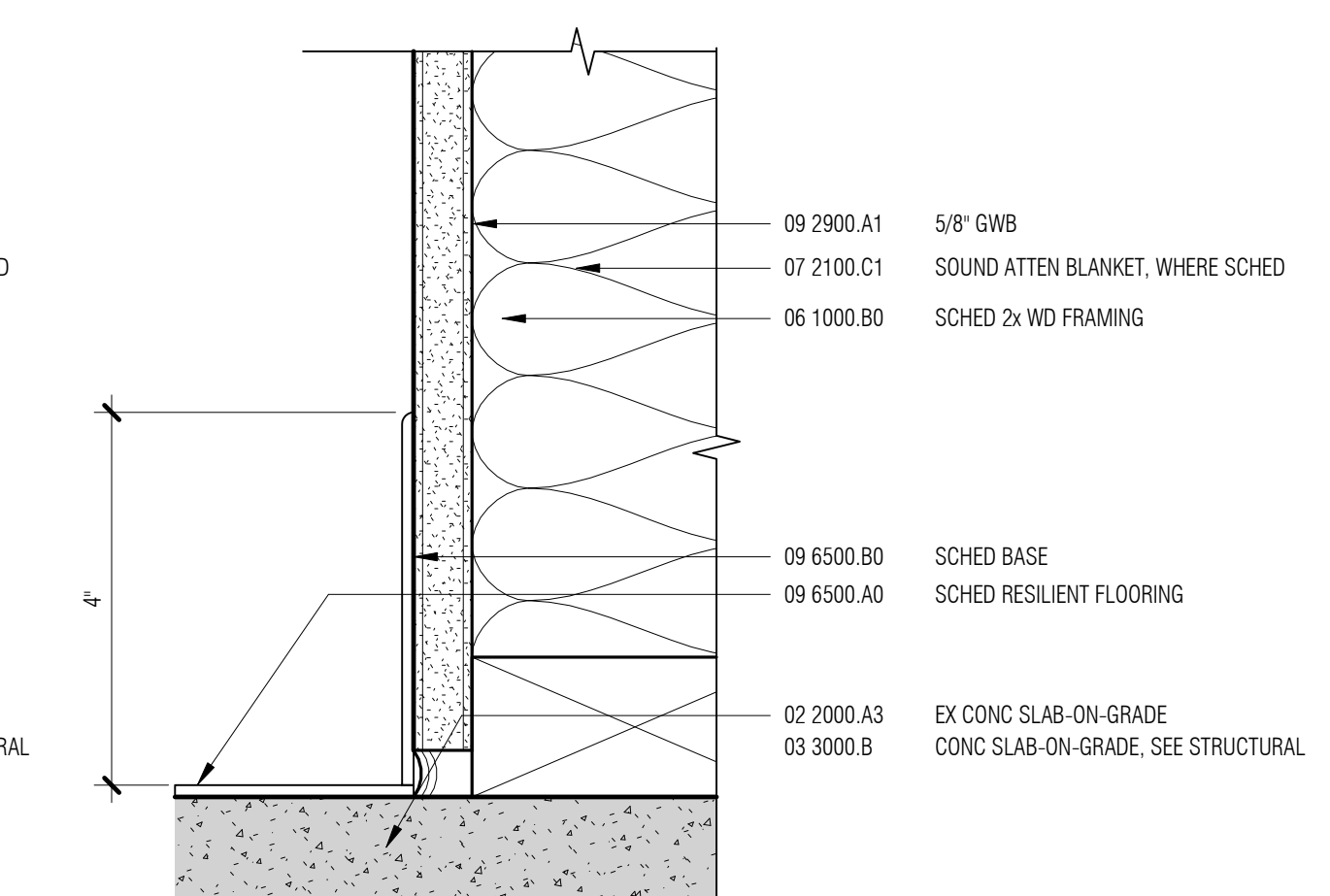
B2 TYP. BASE DETAIL - WD2
6" = 1'-0"



B1 TYP. BASE DETAIL - CWT1
6" = 1'-0"



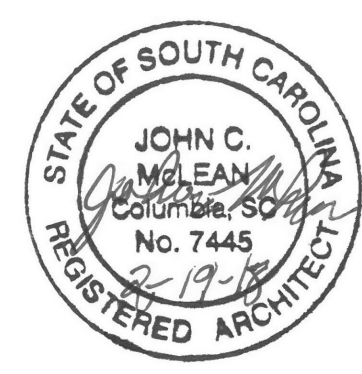
A1 TYP. BASE DETAIL - WD1
6" = 1'-0"



A2 TYP. BASE DETAIL - RB1
6" = 1'-0"

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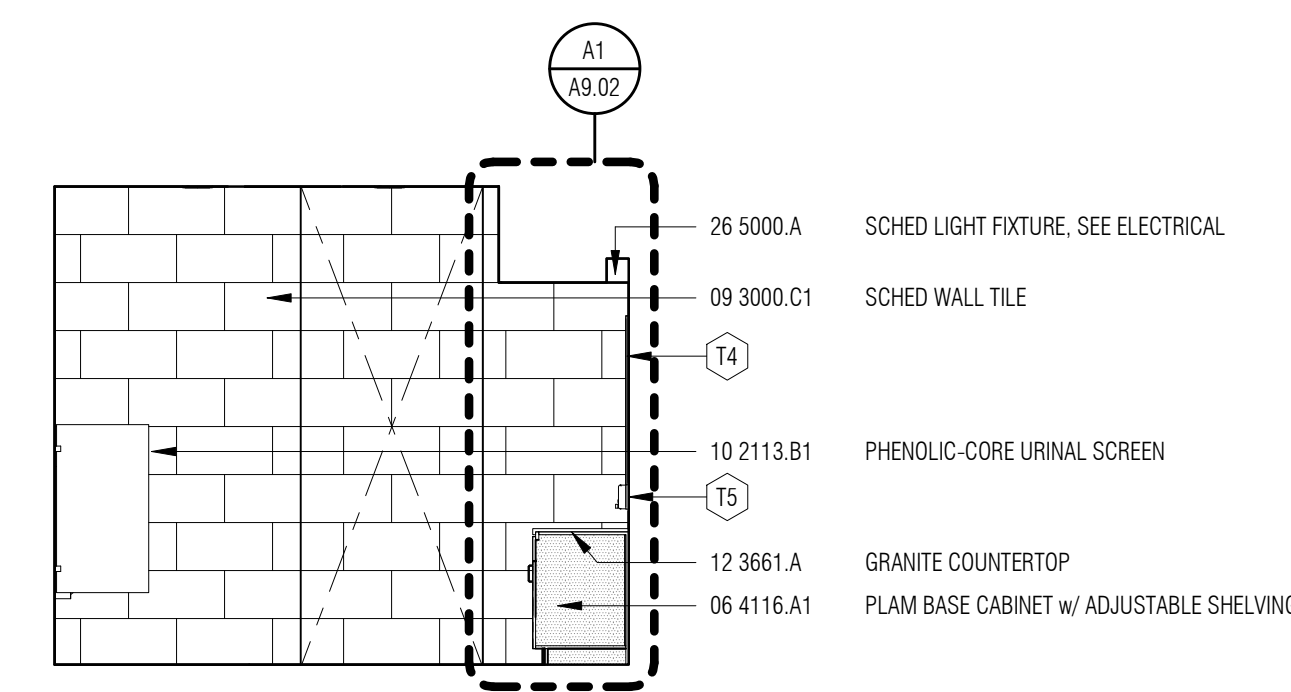


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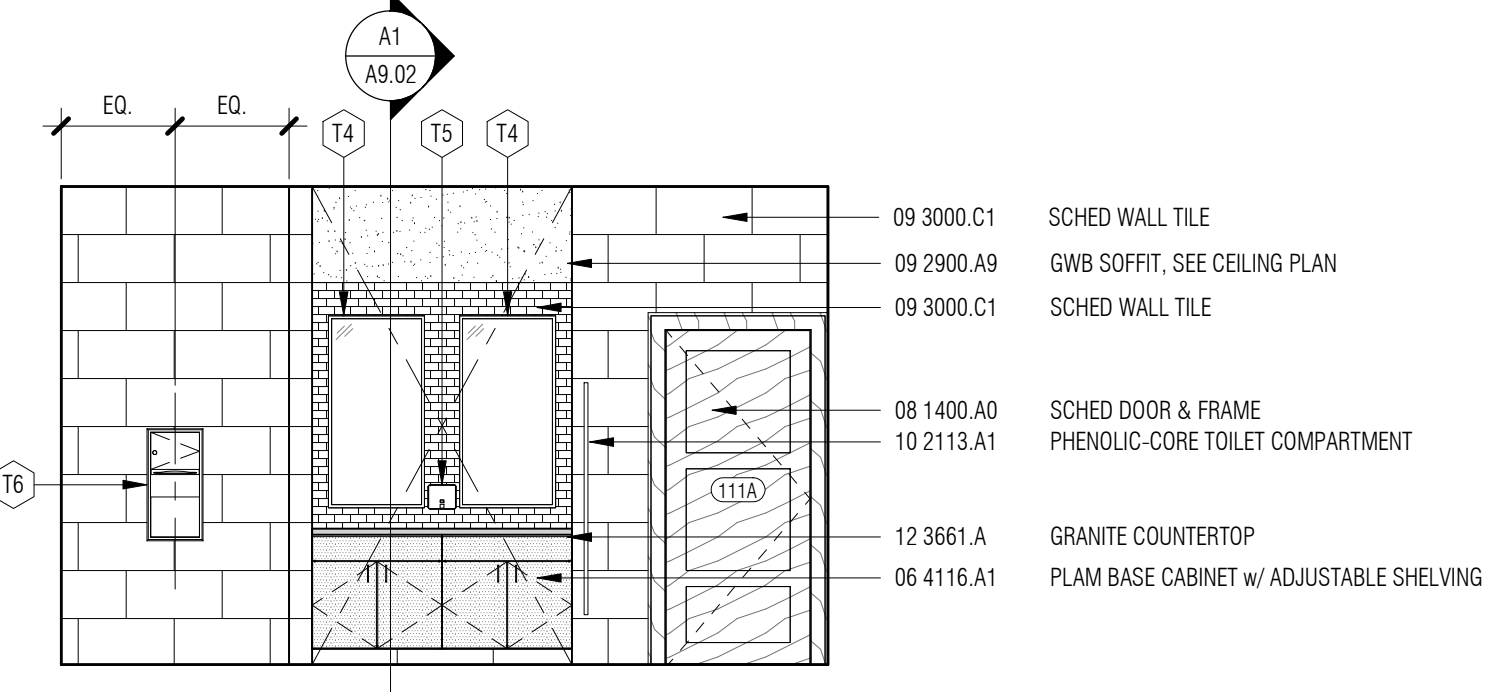
#	DATE	REVISION

ENLARGED PLANS
& ELEVATIONS

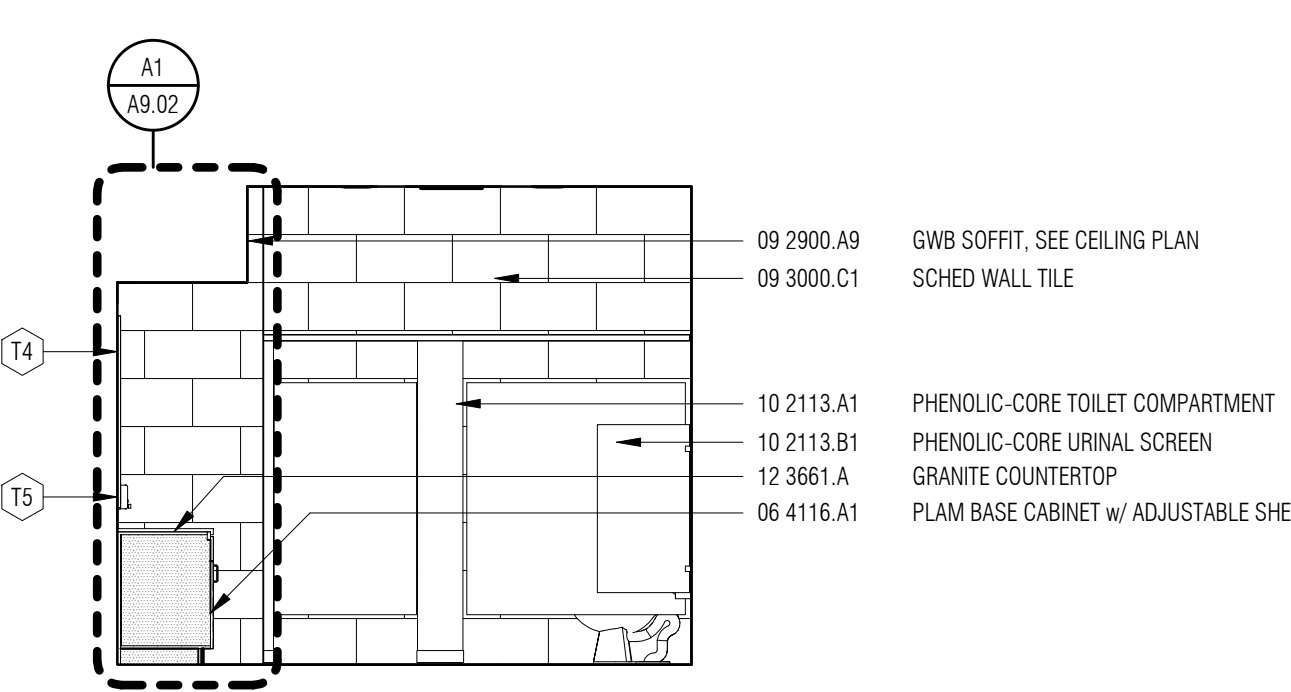
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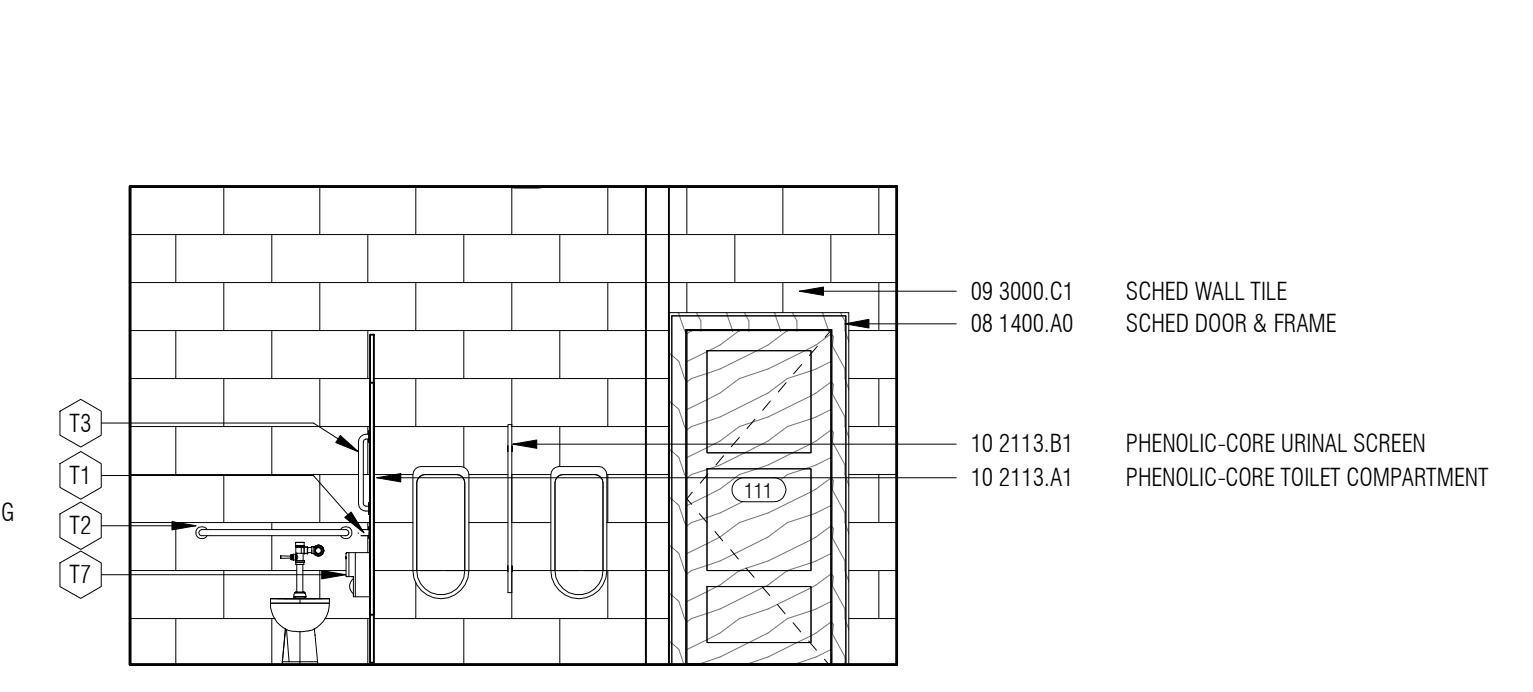
E1 NORTH ELEVATION - MEN 111
1/4" = 1'-0"



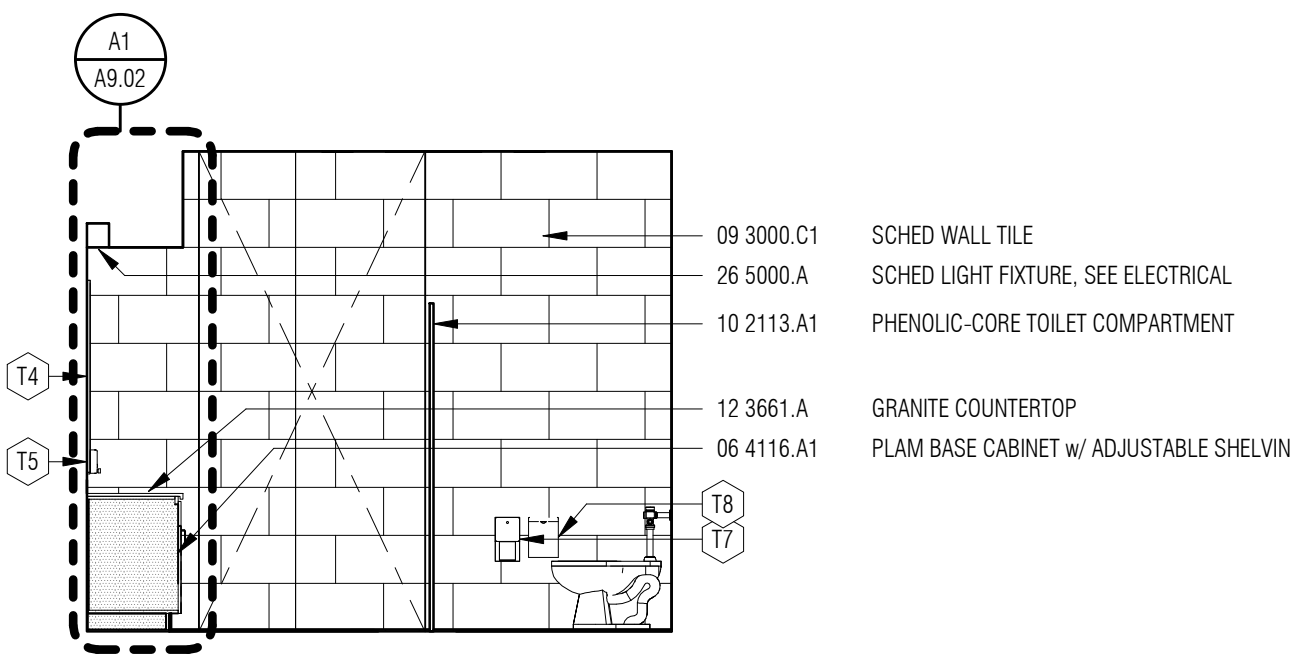
E2 EAST ELEVATION - MEN 111
1/4" = 1'-0"



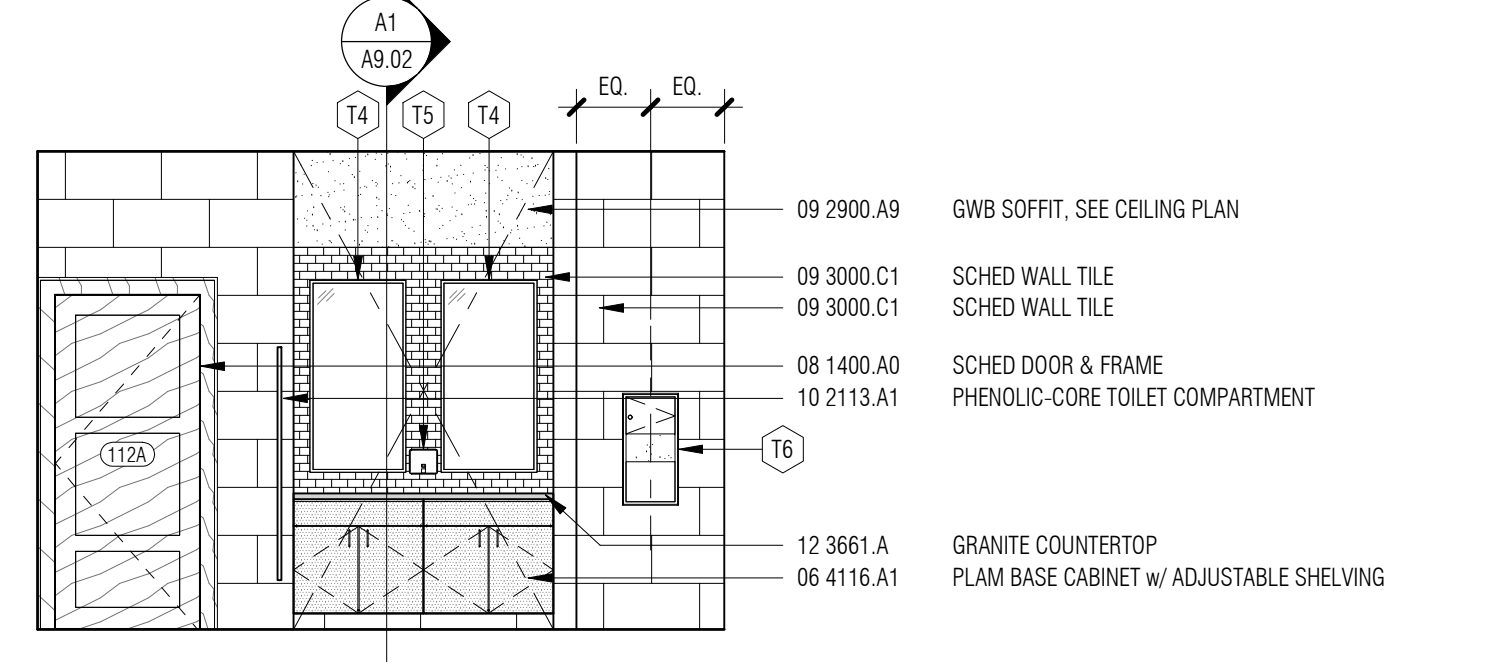
E3 SOUTH ELEVATION - MEN 111
1/4" = 1'-0"



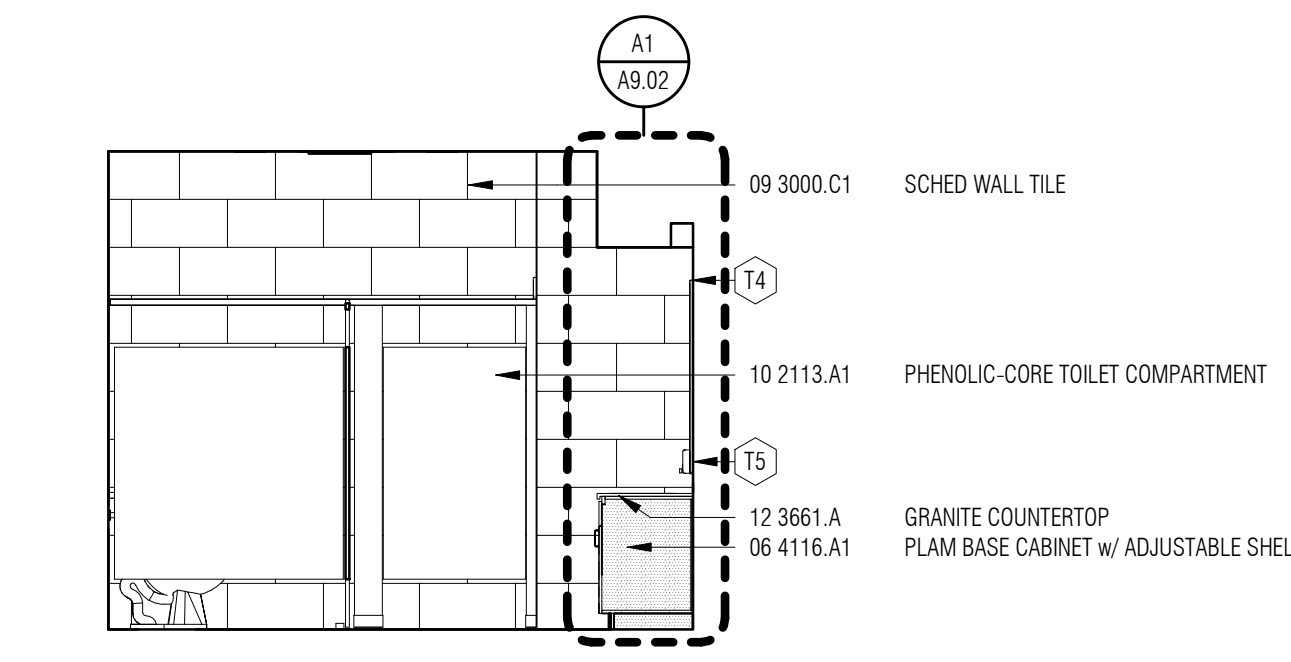
E4 WEST ELEVATION - MEN 111
1/4" = 1'-0"



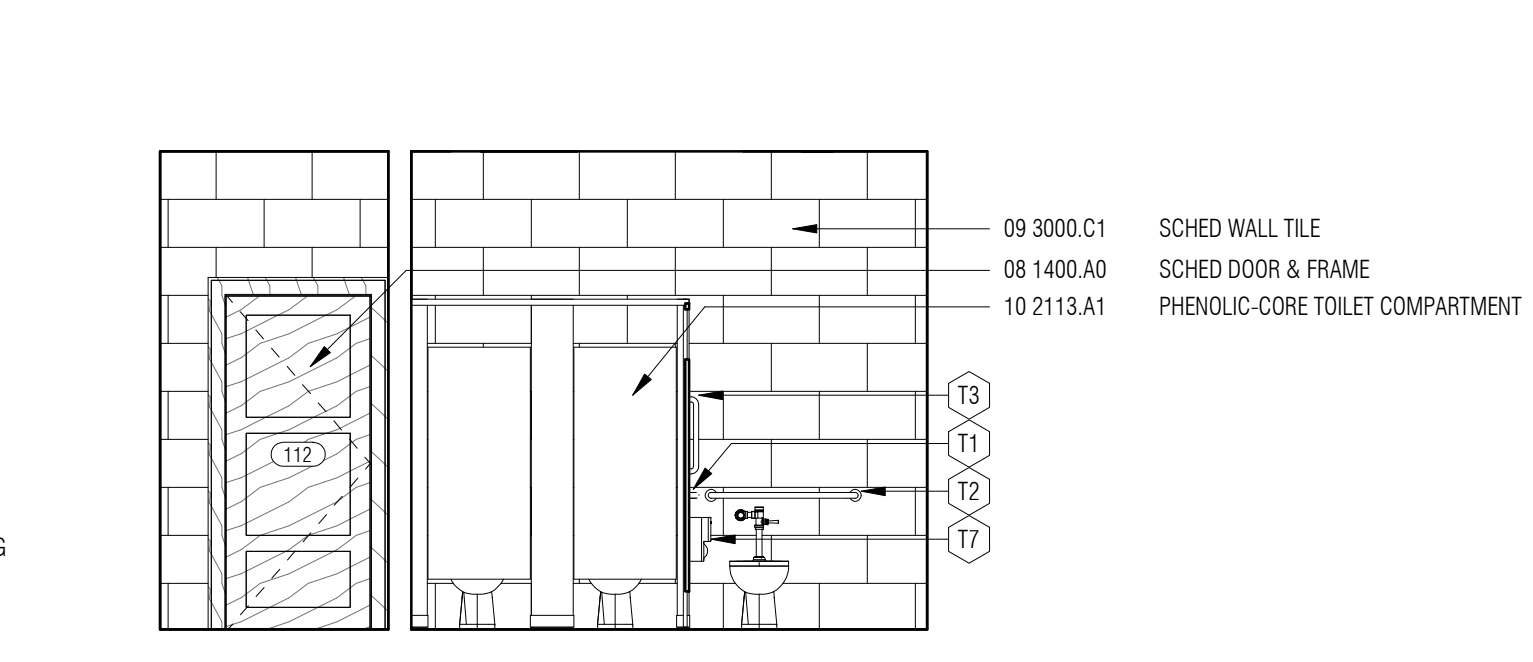
D1 NORTH ELEVATION - WOMEN 112
1/4" = 1'-0"



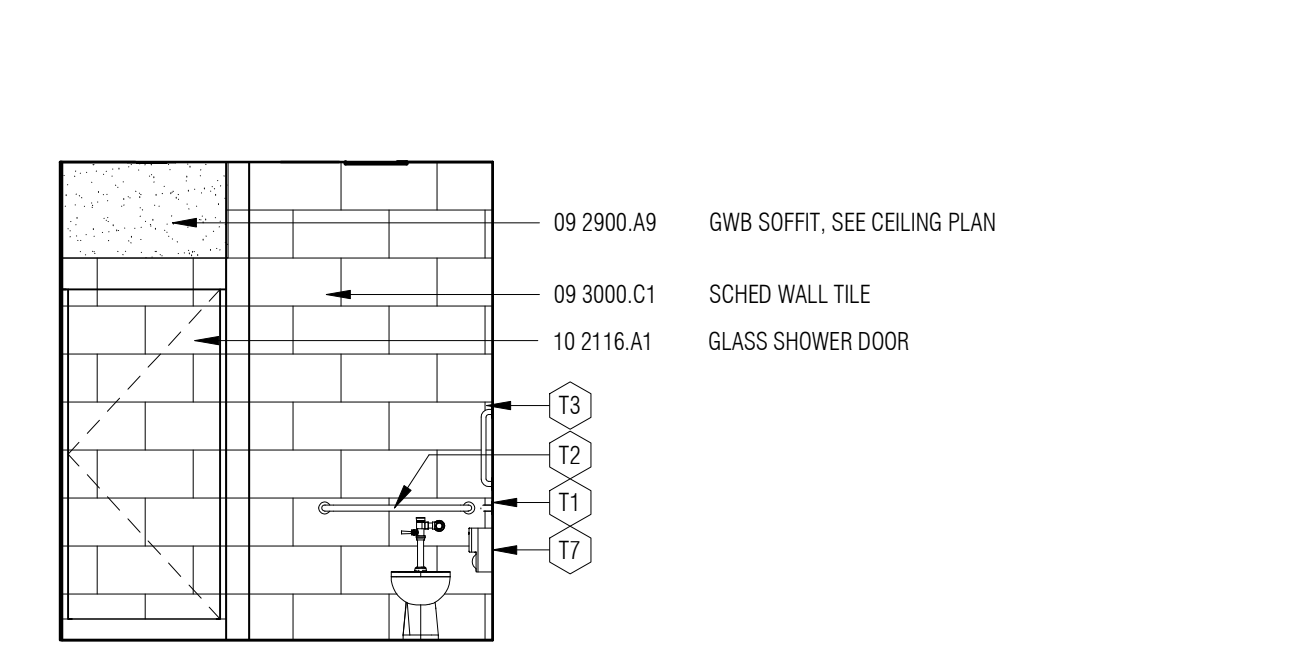
D2 WEST ELEVATION - WOMEN 112
1/4" = 1'-0"



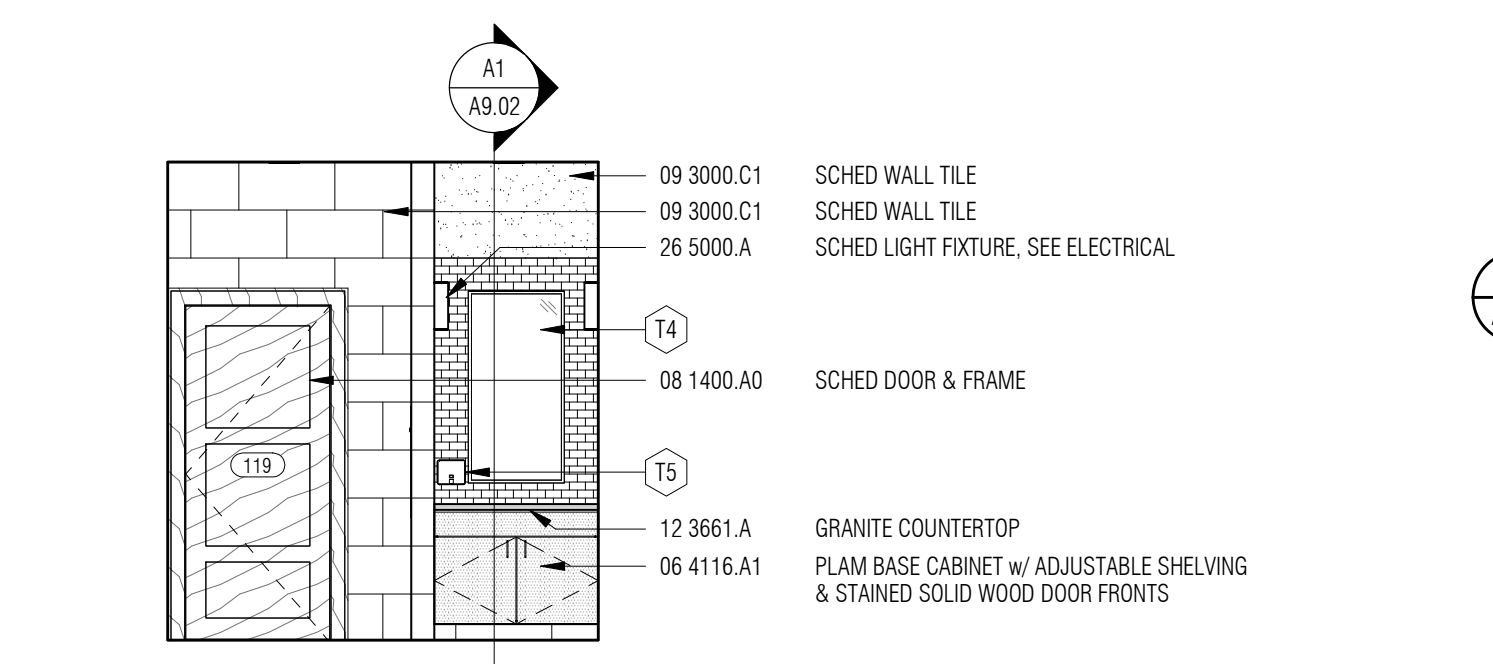
D3 SOUTH ELEVATION - WOMEN 112
1/4" = 1'-0"



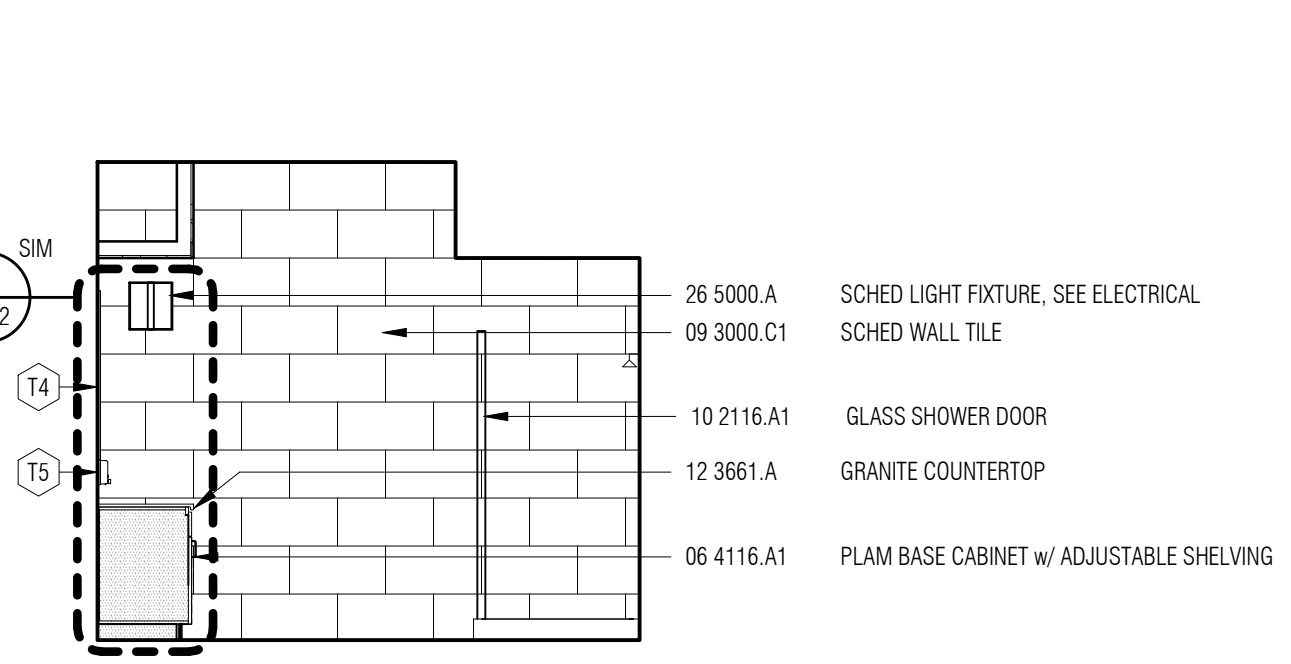
D4 EAST ELEVATION - WOMEN 112
1/4" = 1'-0"



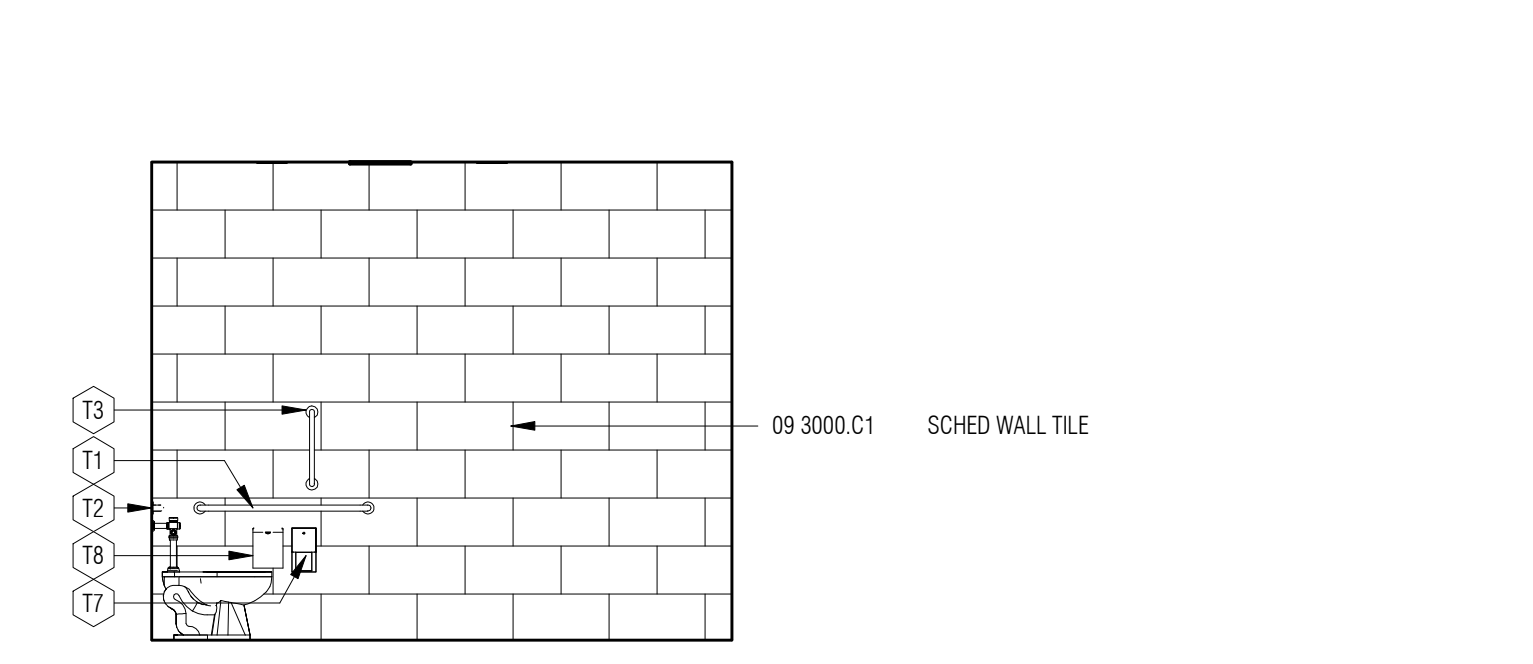
C1 WEST ELEVATION - UNISEX 119
1/4" = 1'-0"



C2 EAST ELEVATION - UNISEX 119
1/4" = 1'-0"

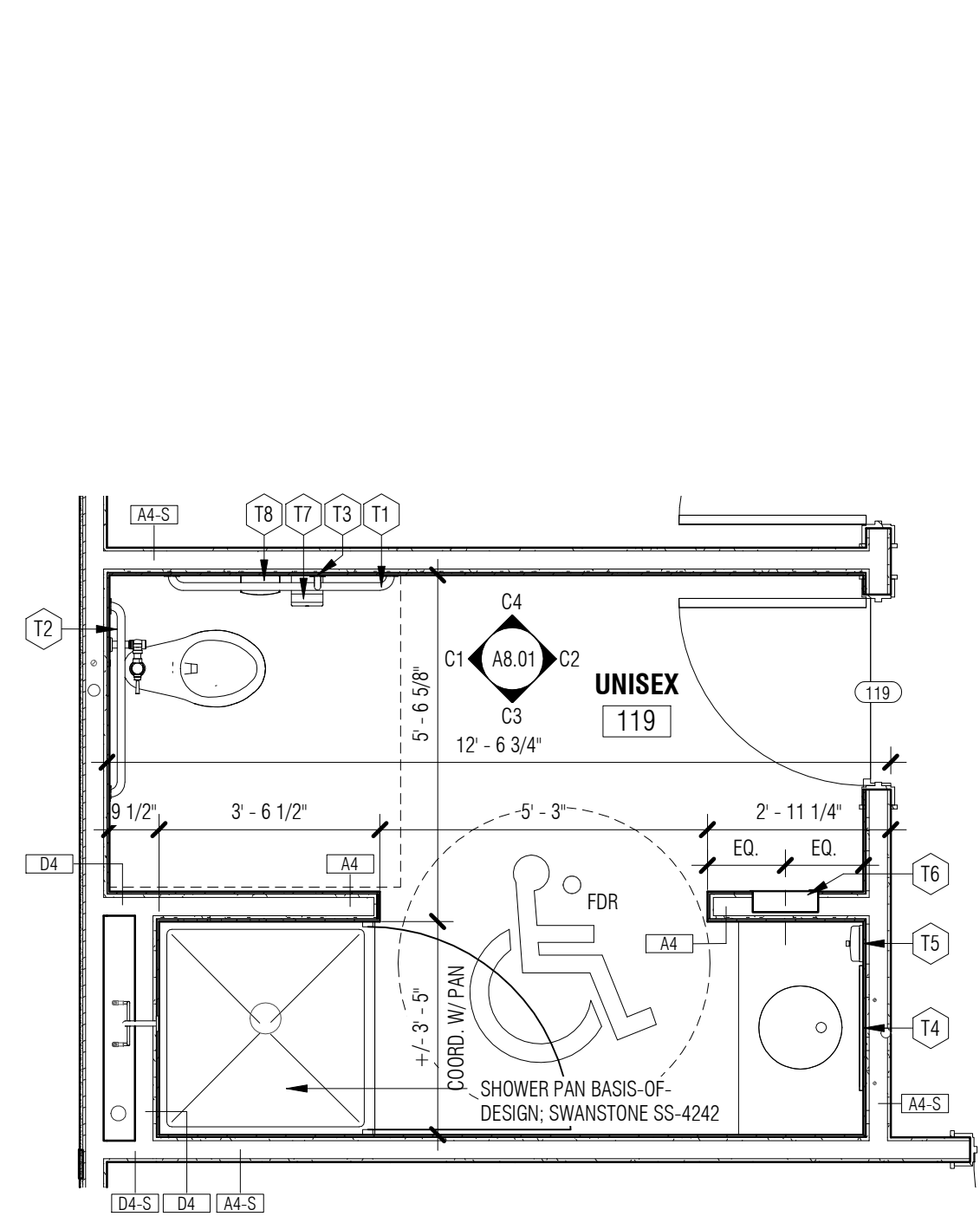


C3 SOUTH ELEVATION - UNISEX 119
1/4" = 1'-0"

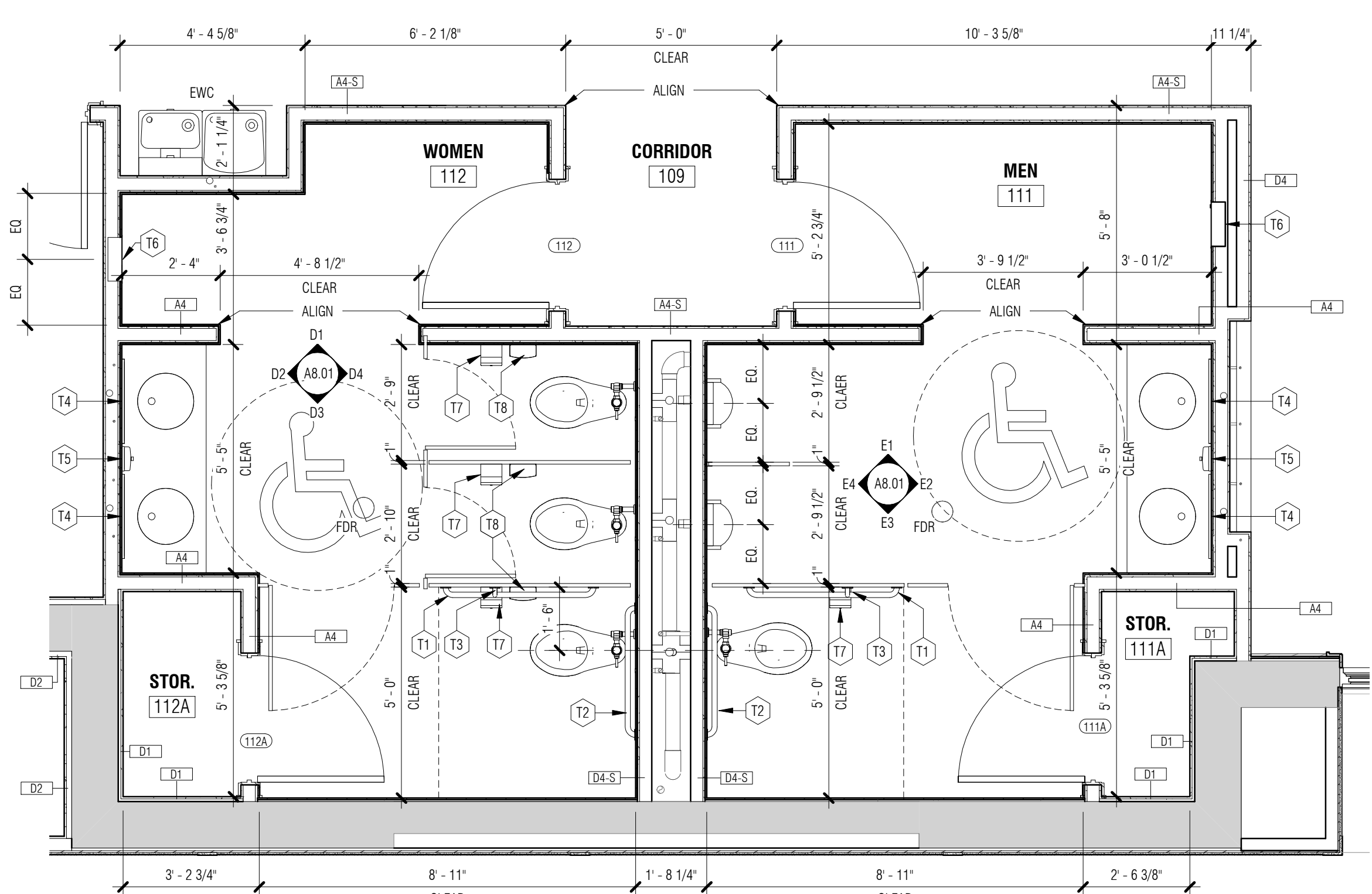


C4 NORTH ELEVATION - UNISEX 119
1/4" = 1'-0"

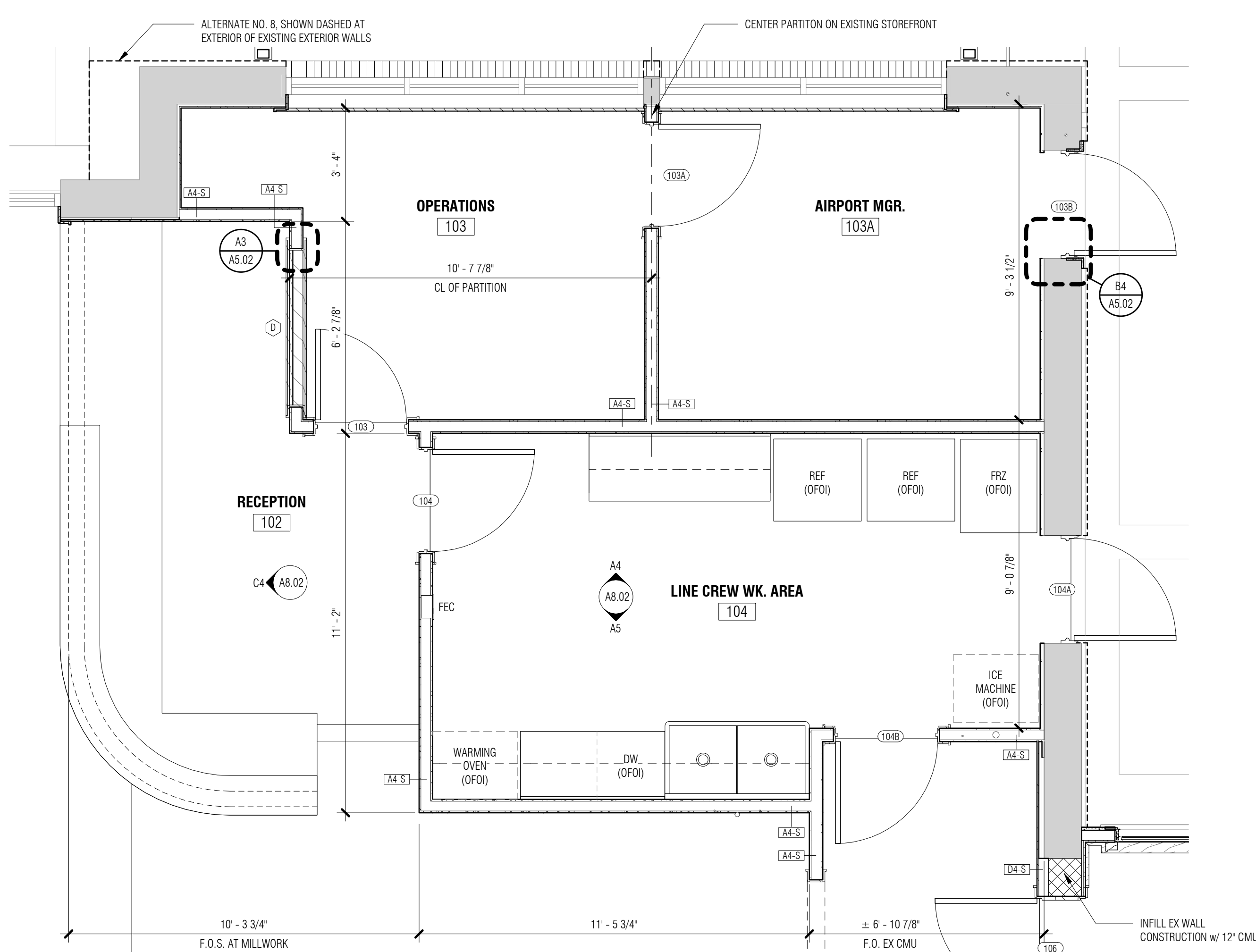
TOILET ACCESSORIES				
NO.	ITEM	MOUNTING HEIGHT	MFG.	MODEL NO.
T1	42" STAINLESS STL GRAB BAR w/ SATIN FINISH (HORIZ MOUNTED)	34" TO T.O. BAR	BOBRICK	B-5806 x 42
T2	36" STAINLESS STL GRAB BAR w/ SATIN FINISH (HORIZ MOUNTED)	34" TO T.O. BAR	BOBRICK	B-5806 x 36
T3	18" STAINLESS STL GRAB BAR w/ SATIN FINISH (VERT MOUNTED)	40" TO B.O. BAR	BOBRICK	B-5806 x 18
T4	MIRROR w/ STAINLESS STL ANGLE FRAME	3'-4" TO REFLECTIVE SURFACE	BOBRICK	B-290 2448
T5	STAINLESS STL SOAP DISPENSER (SURFACE-MOUNTED)	48" TO OPERABLE PART	BOBRICK	B-4112
T6	STAINLESS STL PAPER TOWEL/WASTE UNIT (RECESSED)	48" TO OPERABLE PART	BOBRICK	B-396
T7	STAINLESS STL TOILET TISSUE DISPENSER (SURFACE-MOUNTED)	28" TO T.O. DISPENSER	BOBRICK	B-2888
T8	STAINLESS STL SANITARY NAPKIN DISPOSAL (SURFACE-MOUNTED)	30" TO T.O. UNIT	BOBRICK	B-270
T9	MOP & BROOM HOLDER (SURFACE-MOUNTED)	72" TO T.O. UNIT	BOBRICK	B-223 x 24



A1 ENLARGED FLOOR PLAN - UNISEX 119
3/8" = 1'-0"



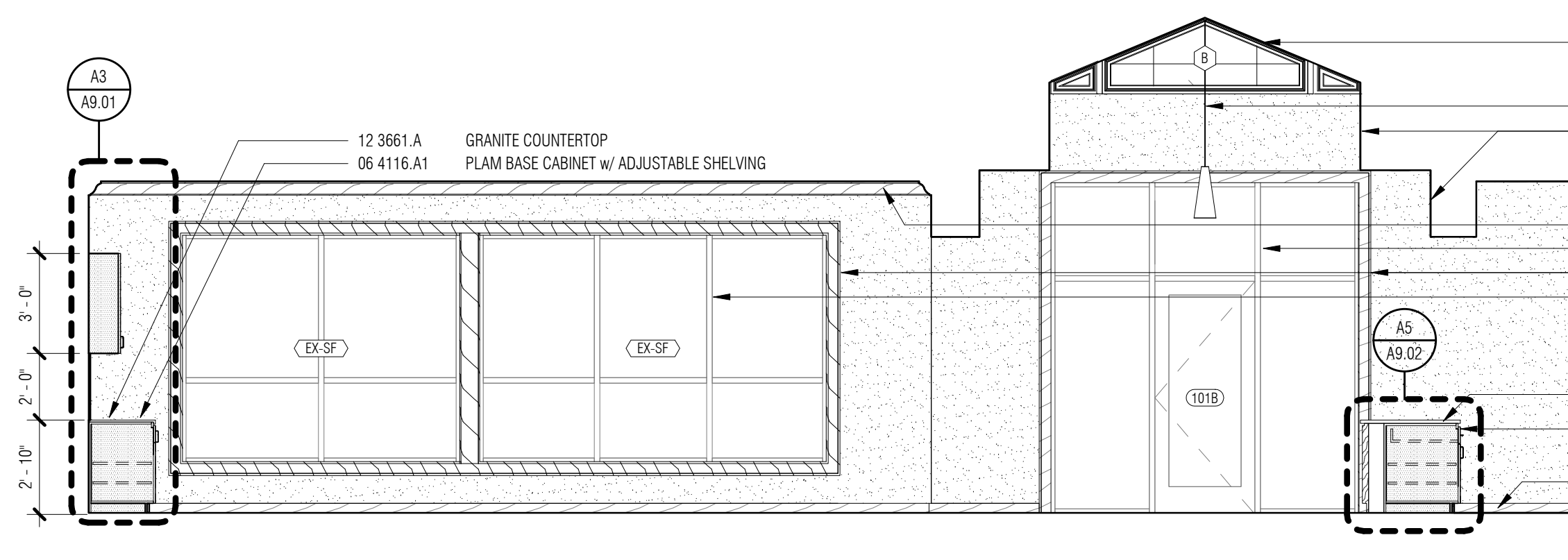
A2 ENLARGED FLOOR PLAN - TOILETS
3/8" = 1'-0"



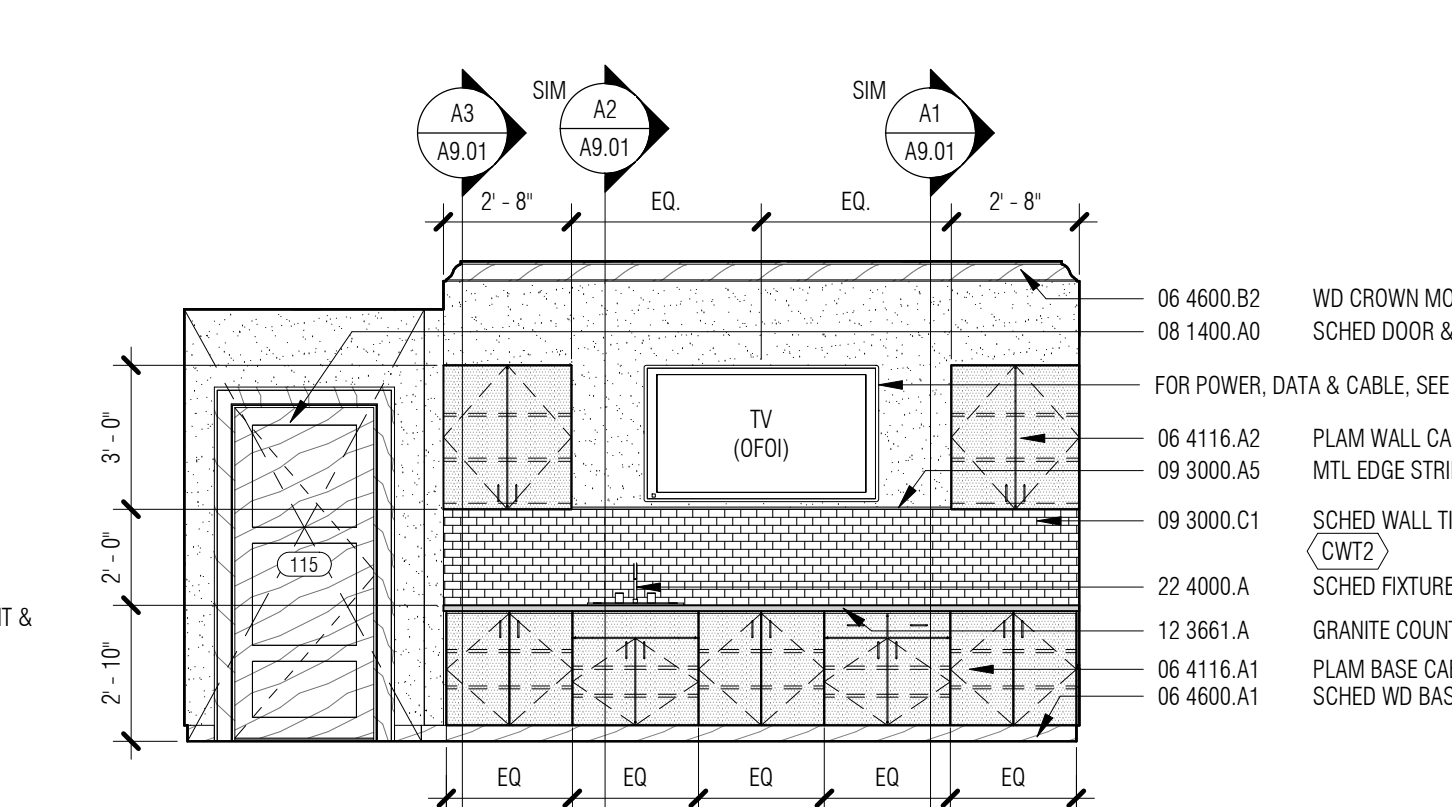
A4 ENLARGED FLOOR PLAN
3/8" = 1'-0"

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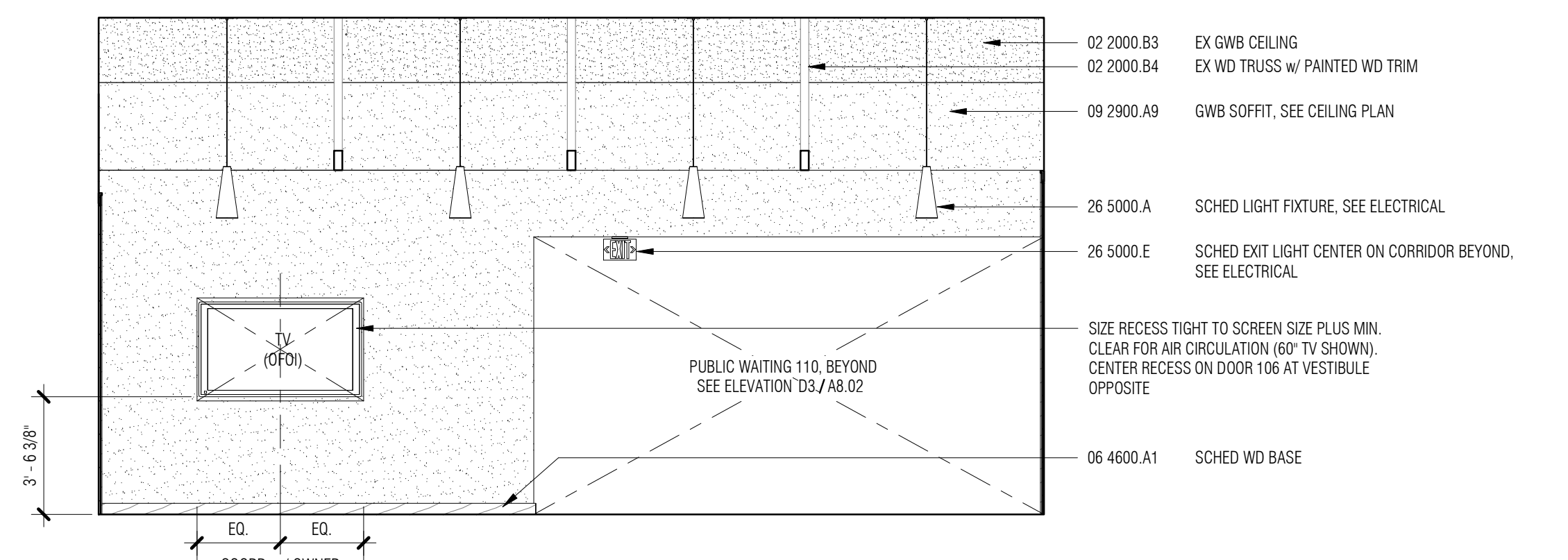
#	DATE	REVISION



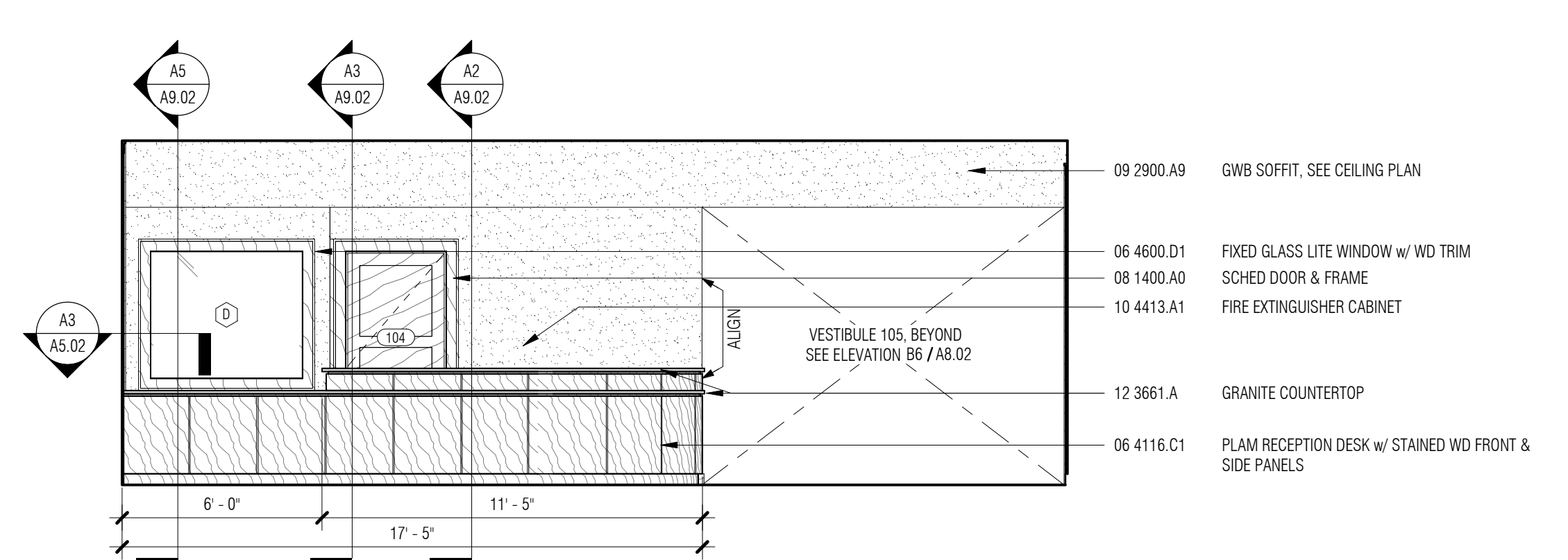
D1 NORTH ELEVATION - PUBLIC WAITING 110
A8.02 1/4" = 1'-0"



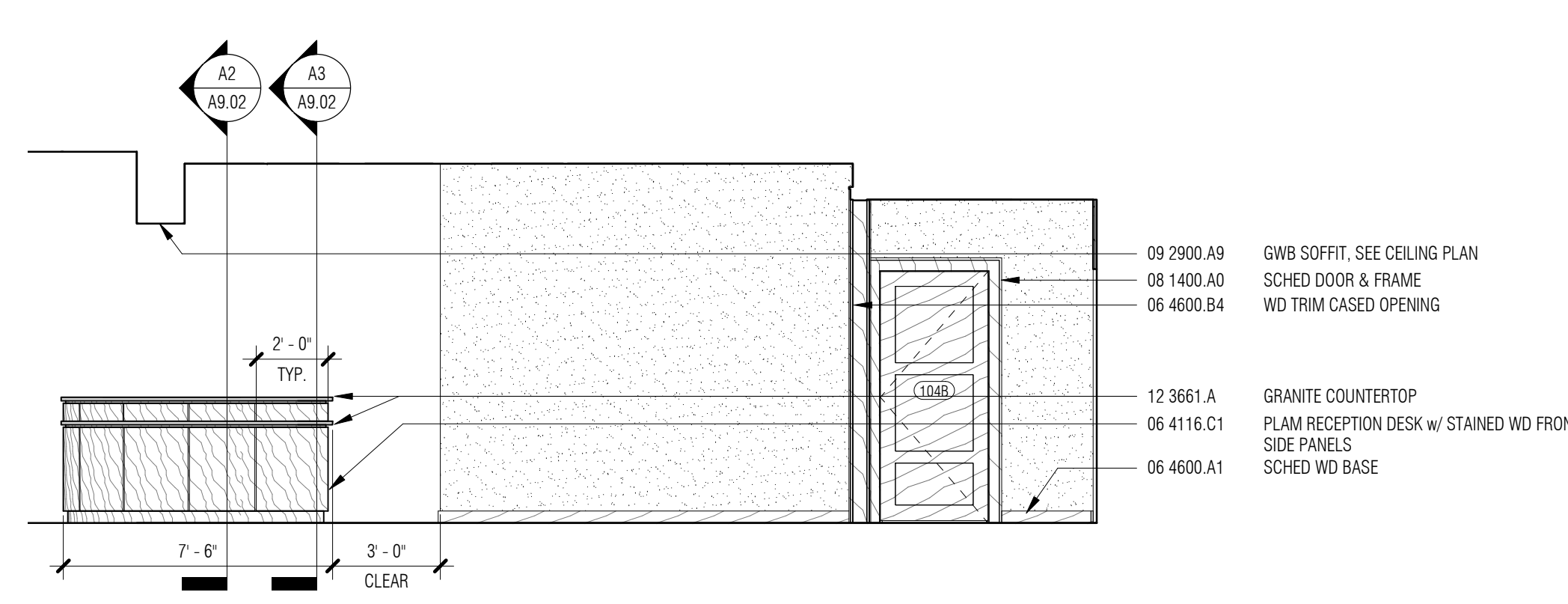
D3 WEST ELEVATION - PUBLIC WAITING 110
A8.02 1/4" = 1'-0"



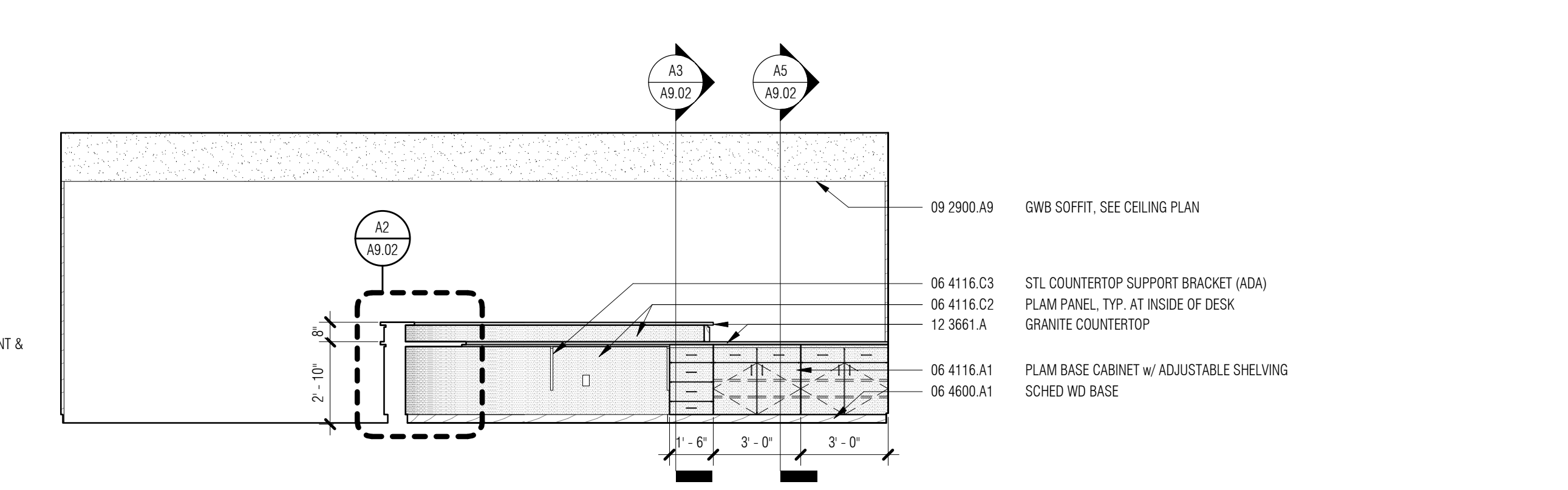
D5 WEST ELEVATION - LOBBY 101
A8.02 1/4" = 1'-0"



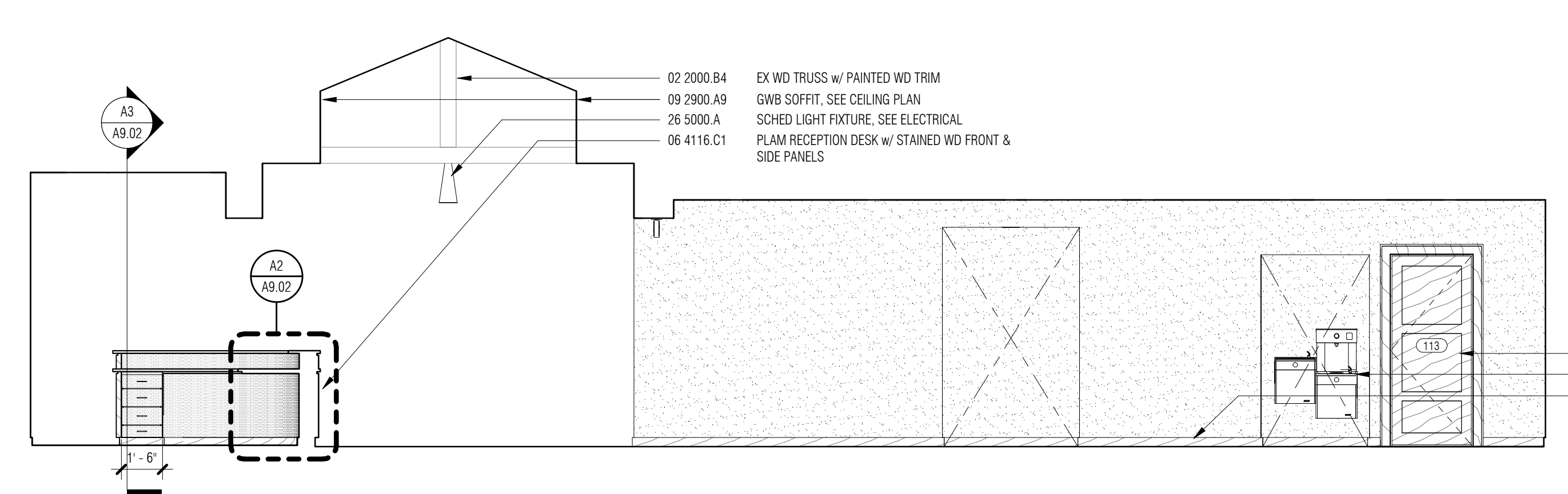
D1 EAST ELEVATION - LOBBY 101
A8.02 1/4" = 1'-0"



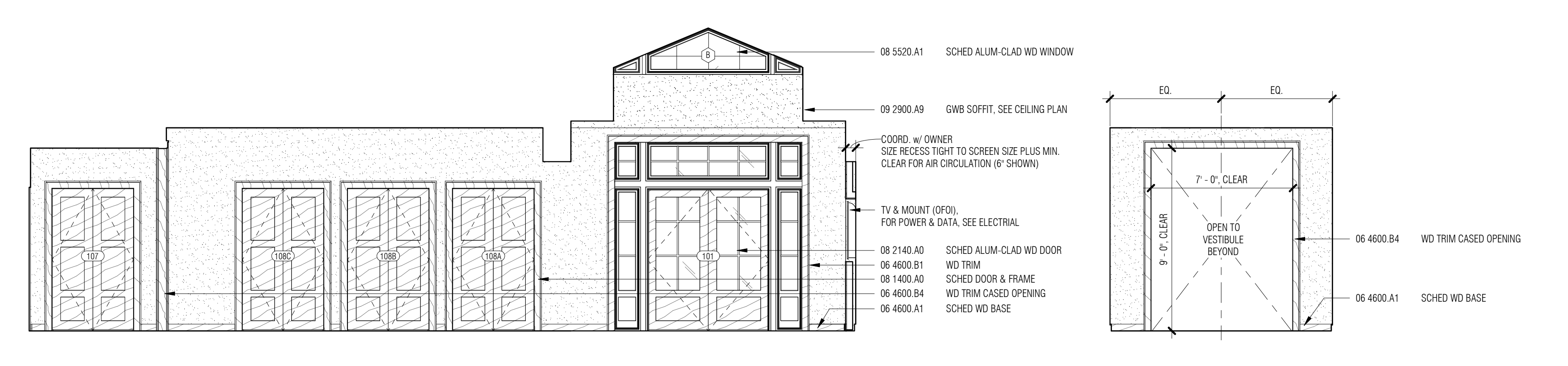
D3 NORTH ELEVATION - VESTIBULE 105
A8.02 1/4" = 1'-0"



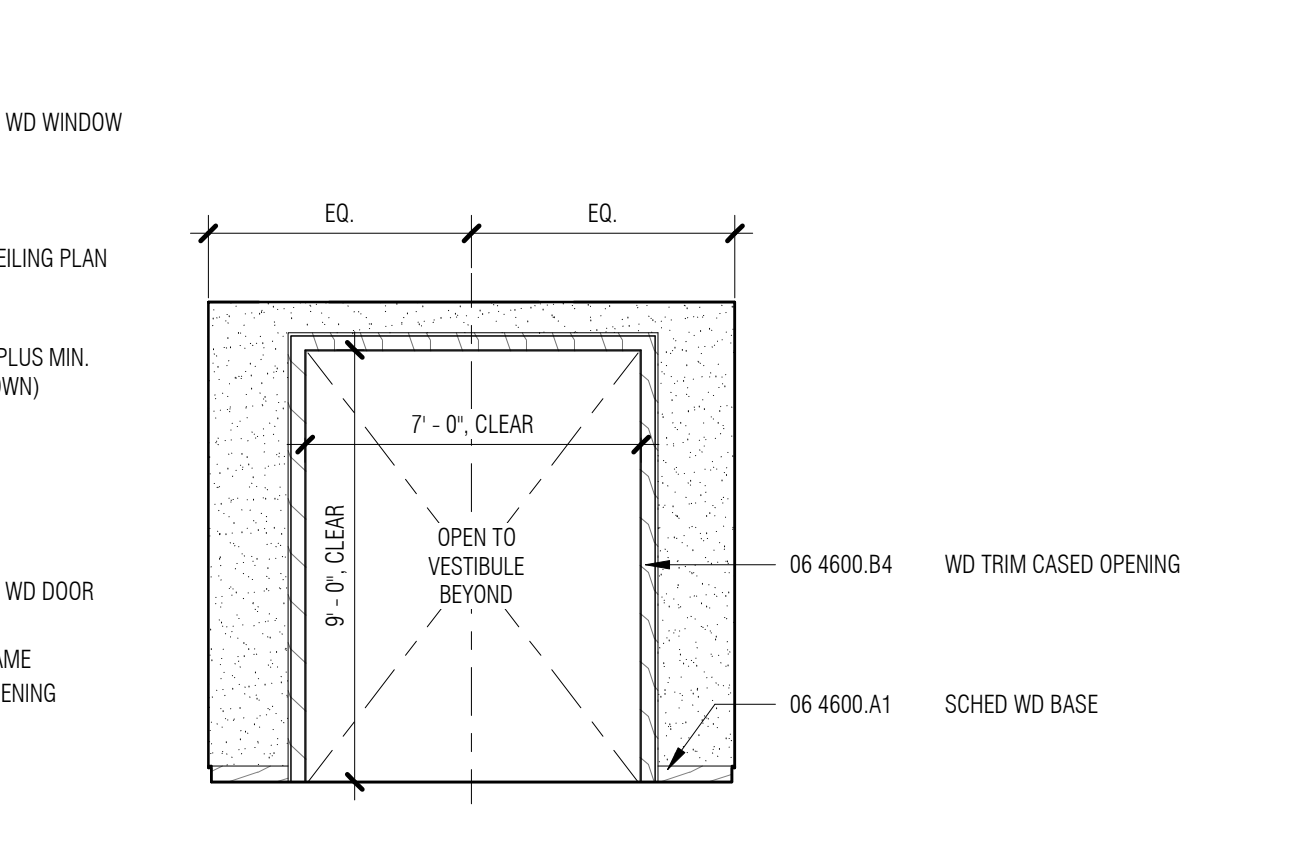
D4 WEST ELEVATION - RECEPTION 102
A8.02 1/4" = 1'-0"



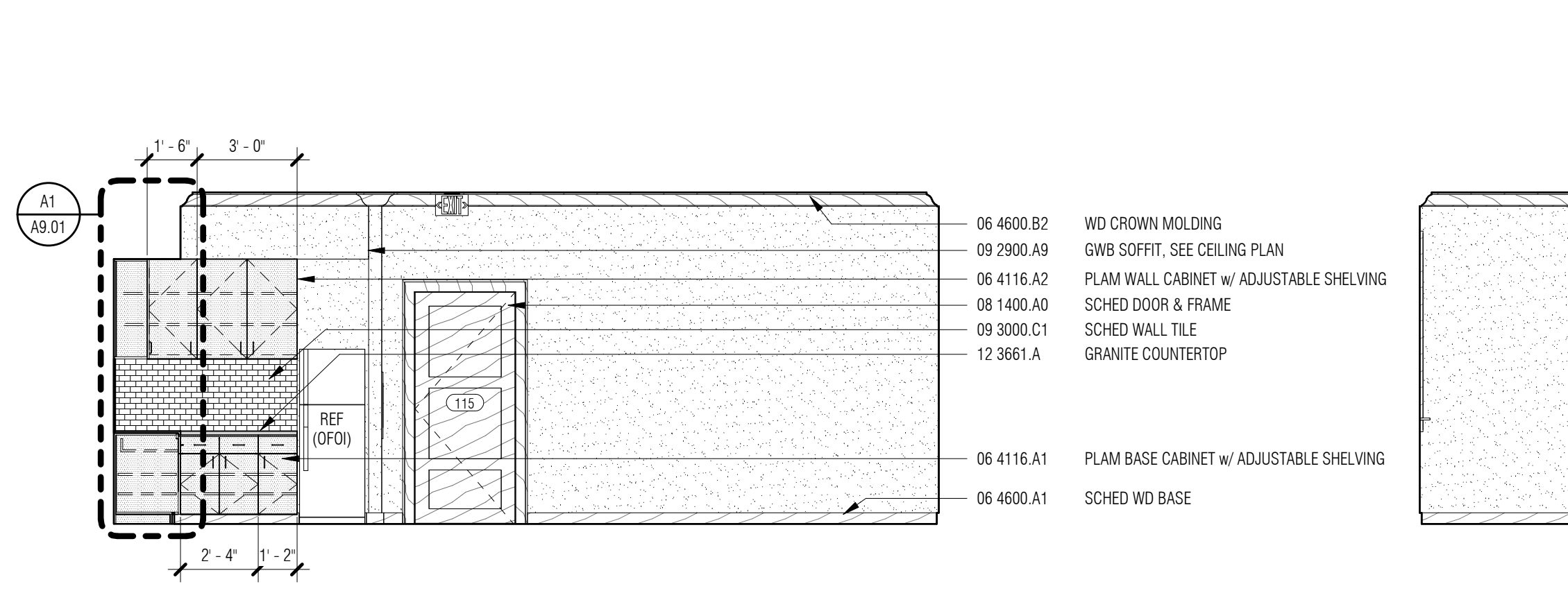
B1 SOUTH ELEVATION - CORRIDOR 109
A8.02 1/4" = 1'-0"



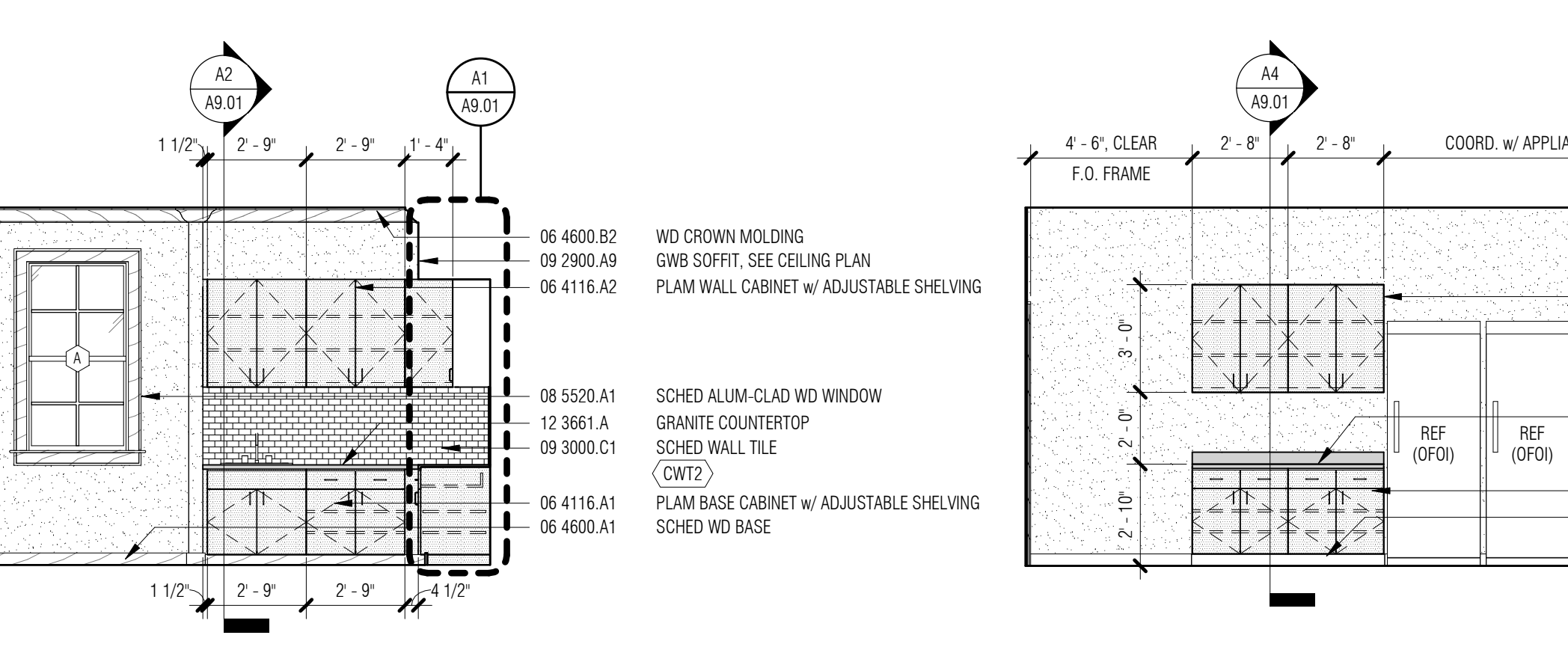
B3 SOUTH ELEVATION - LOBBY 101
A8.02 1/4" = 1'-0"



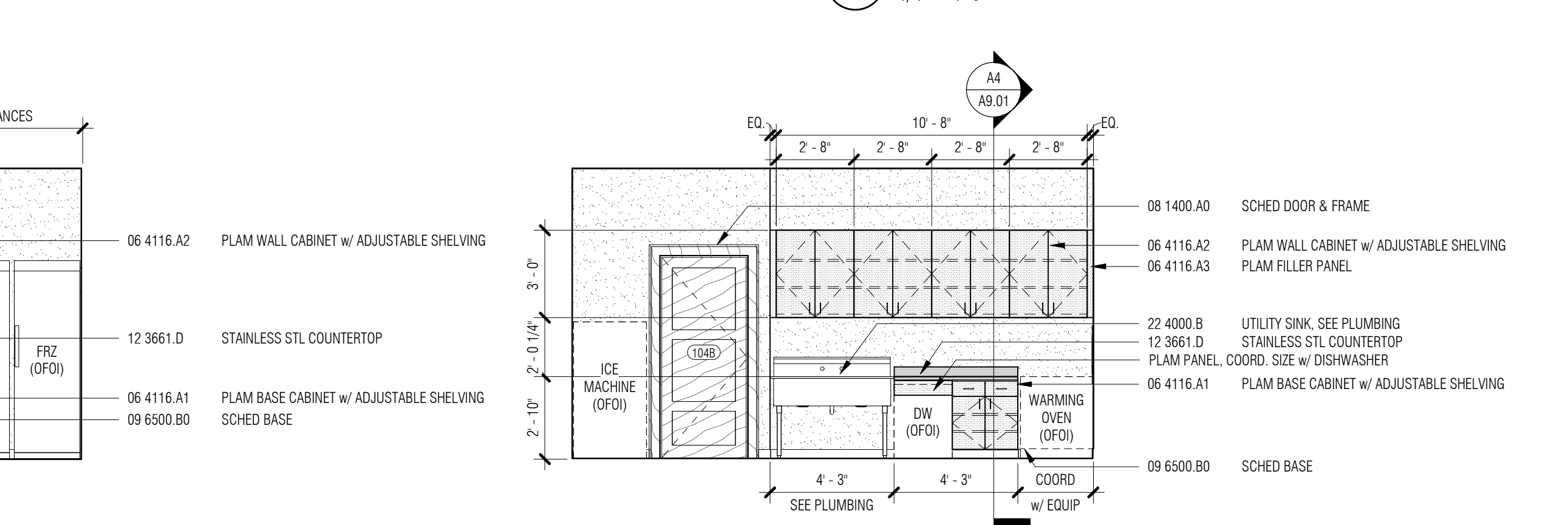
B6 EAST ELEVATION - VESTIBULE 105
A8.02 1/4" = 1'-0"



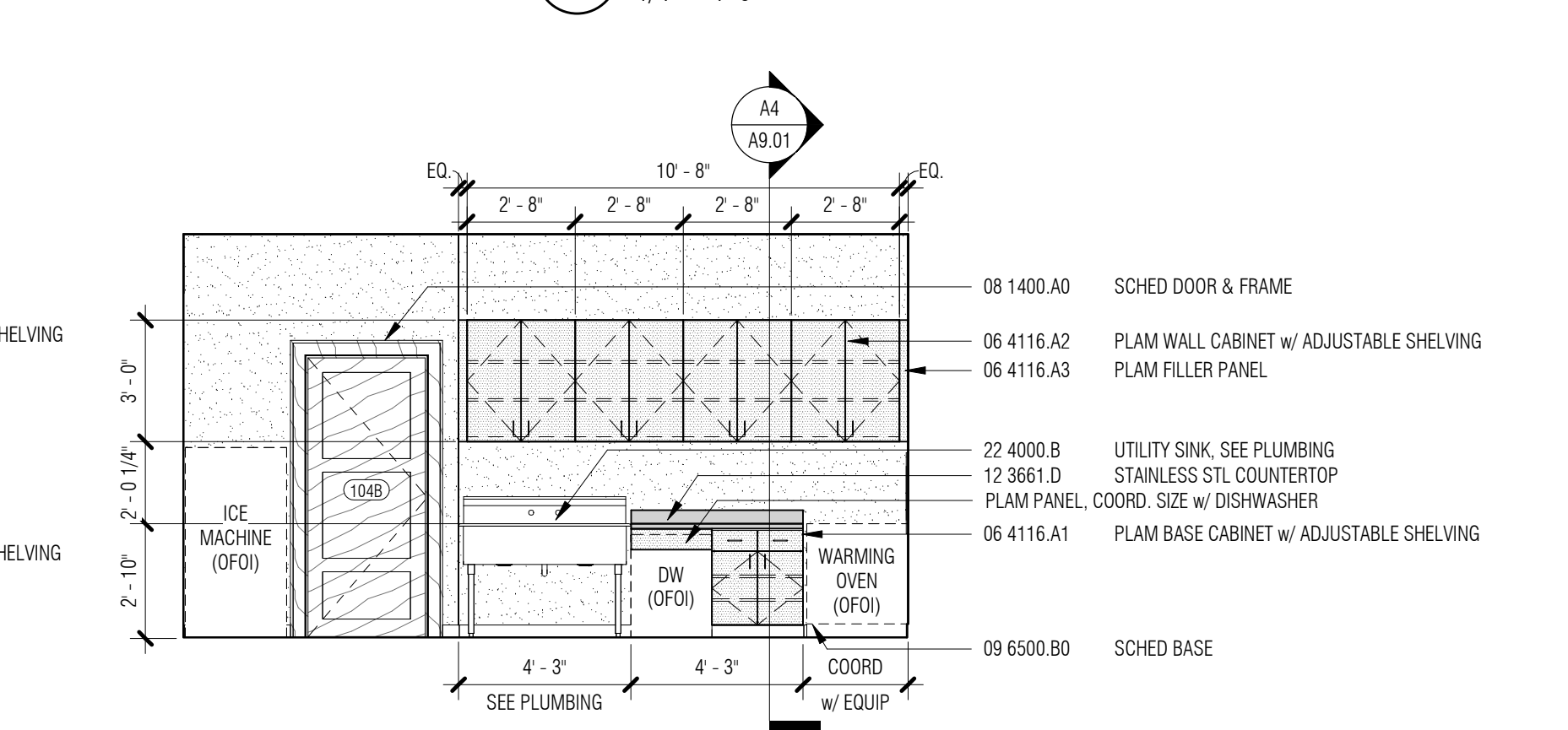
A1 EAST ELEVATION - FLIGHT CREW LOUNGE 115
A8.02 1/4" = 1'-0"



A2 NORTH ELEVATION - FLIGHT CREW LOUNGE 115
A8.02 1/4" = 1'-0"

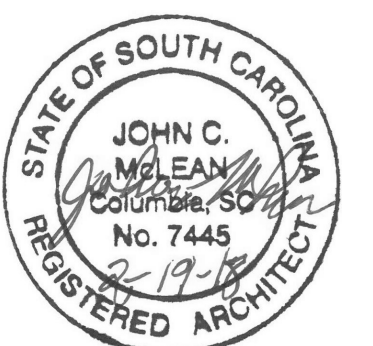


A4 NORTH ELEVATION - LINE CREW WORK AREA 104
A8.02 1/4" = 1'-0"



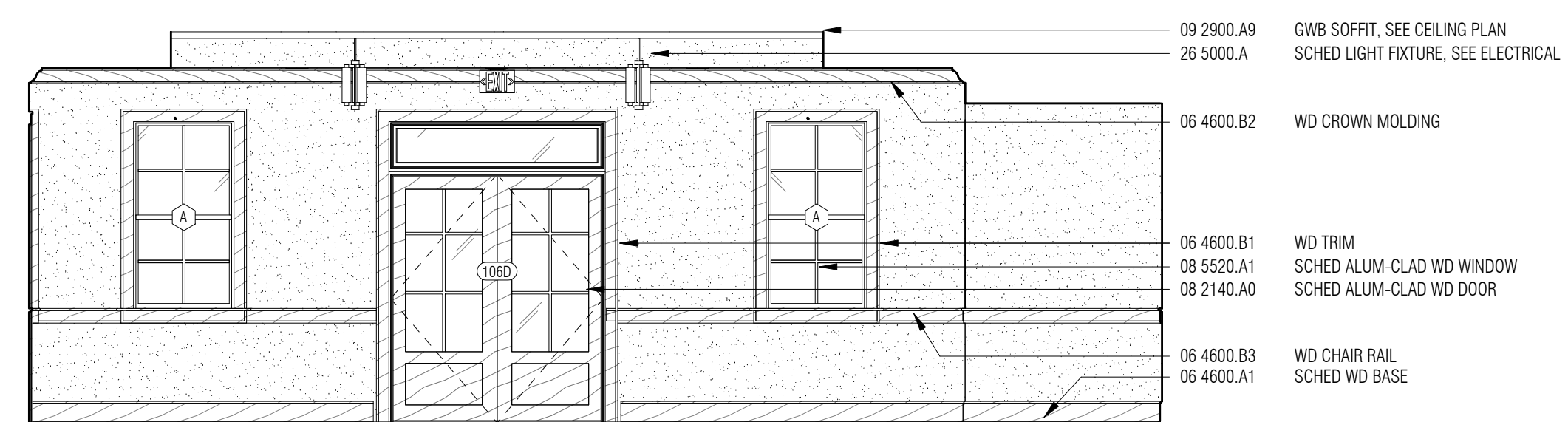
A5 SOUTH ELEVATION - LINE CREW WORK AREA 104
A8.02 1/4" = 1'-0"

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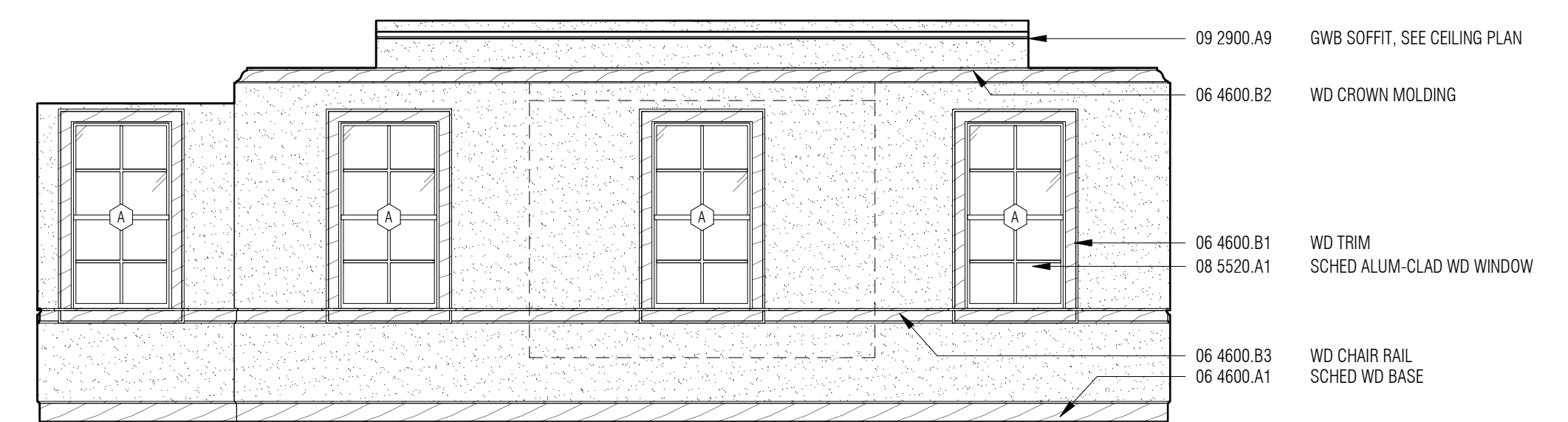


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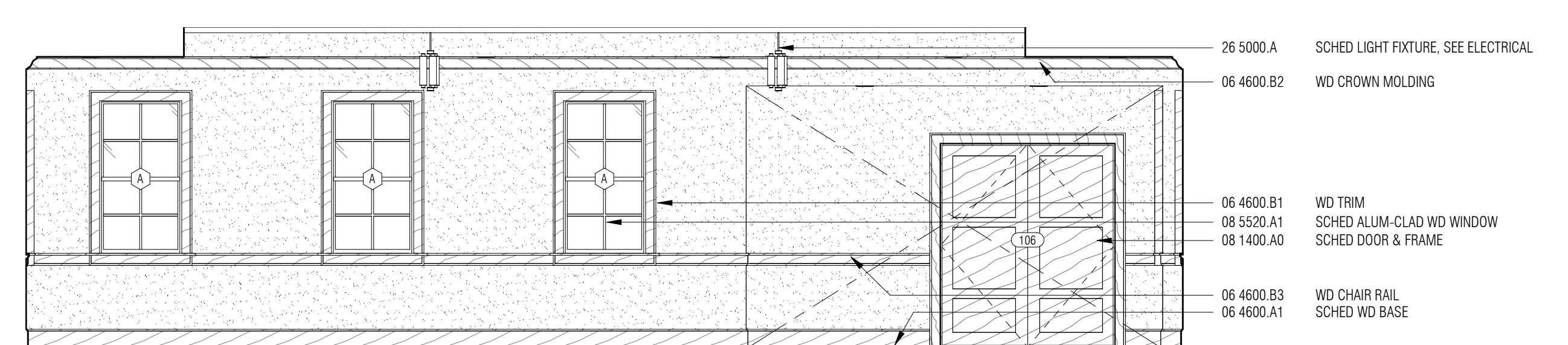
B1 SOUTH ELEVATION - CONFERENCE RM 106
A8.03 1/4" = 1'-0"



B2 NORTH ELEVATION - CONFERENCE RM 106
A8.03 1/4" = 1'-0"



A1 EAST ELEVATION - CONFERENCE RM 106
A8.03 1/4" = 1'-0"



A3 WEST ELEVATION - CONFERENCE RM 106
A8.03 1/4" = 1'-0"

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E

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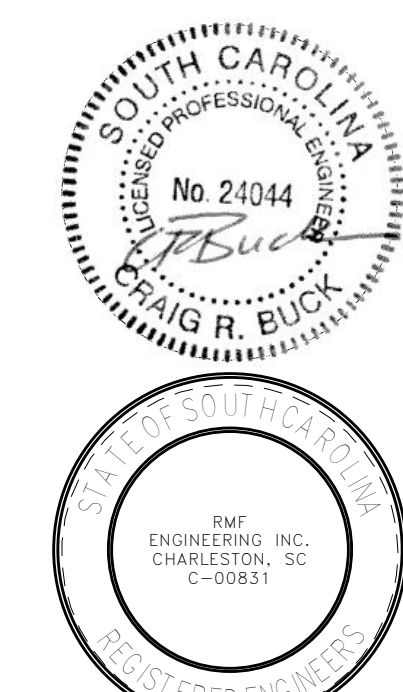
2

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6



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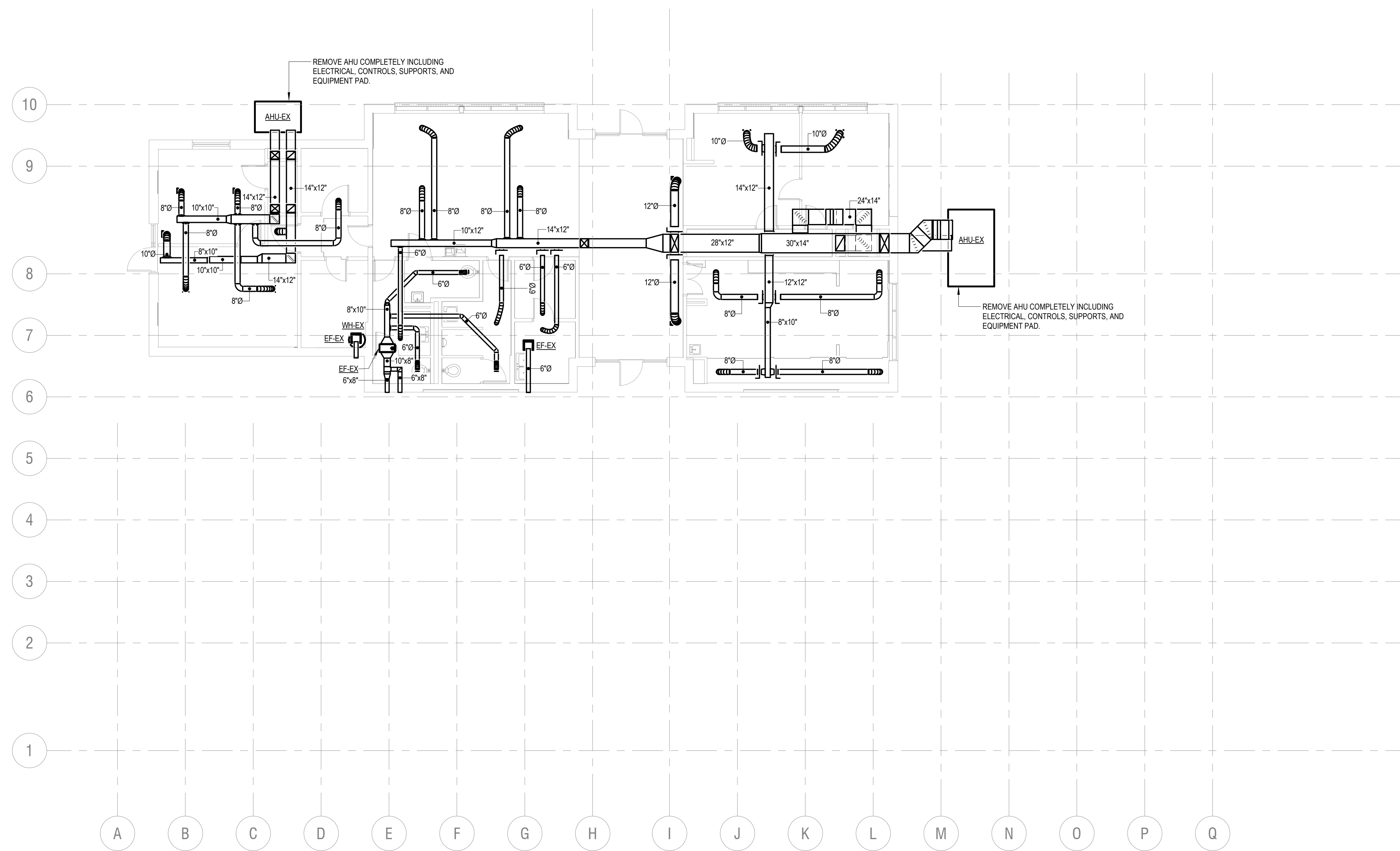
DEMO -
MECHANICAL
DUCTWORK PLAN

MD1.01

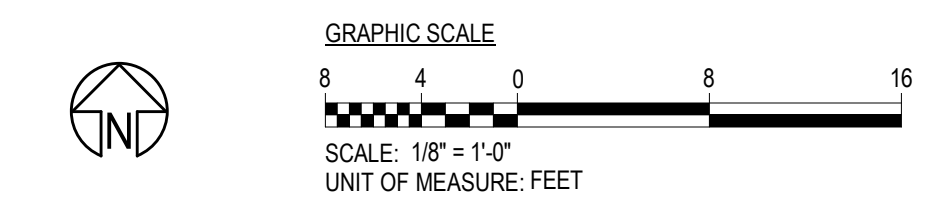
1509
FIRM PROJECT NO. SHEET

GENERAL NOTES

- REMOVE ALL EQUIPMENT, DUCTWORK, HANGERS, CONTROLS, AND AIR DEVICES ASSOCIATED WITH THE EXISTING HVAC SYSTEM.

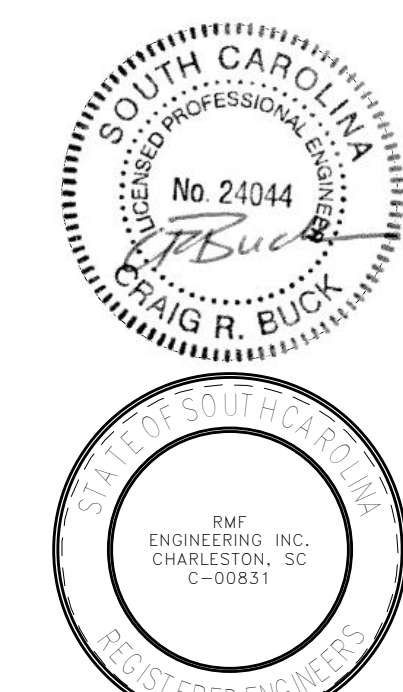


DEMO - MECHANICAL DUCTWORK PLAN
SCALE: 1/8" = 1'-0"



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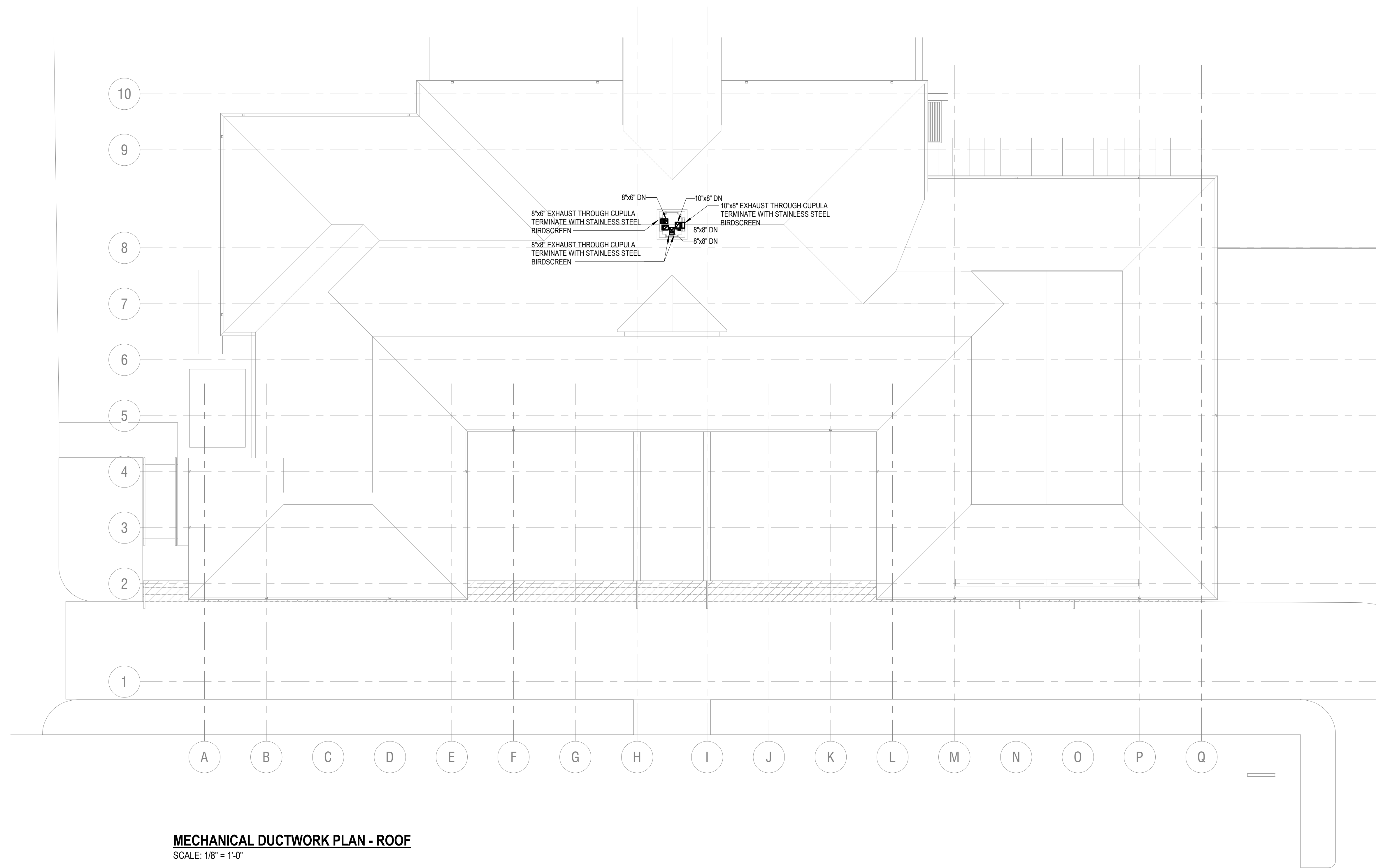
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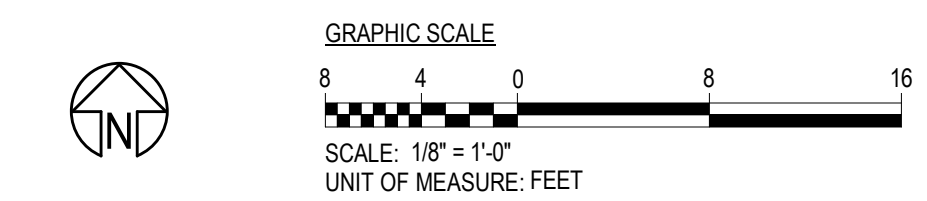
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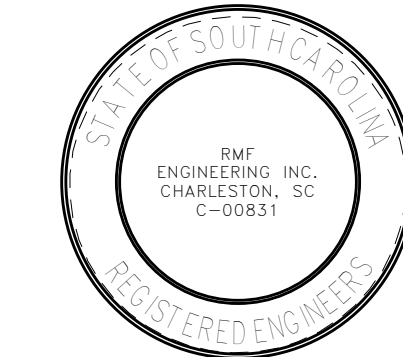
MECHANICAL
DUCTWORK PLAN
- ROOF



MECHANICAL DUCTWORK PLAN - ROOF
SCALE: 1/8" = 1'-0"



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MECHANICAL
PIPING PLAN

1509
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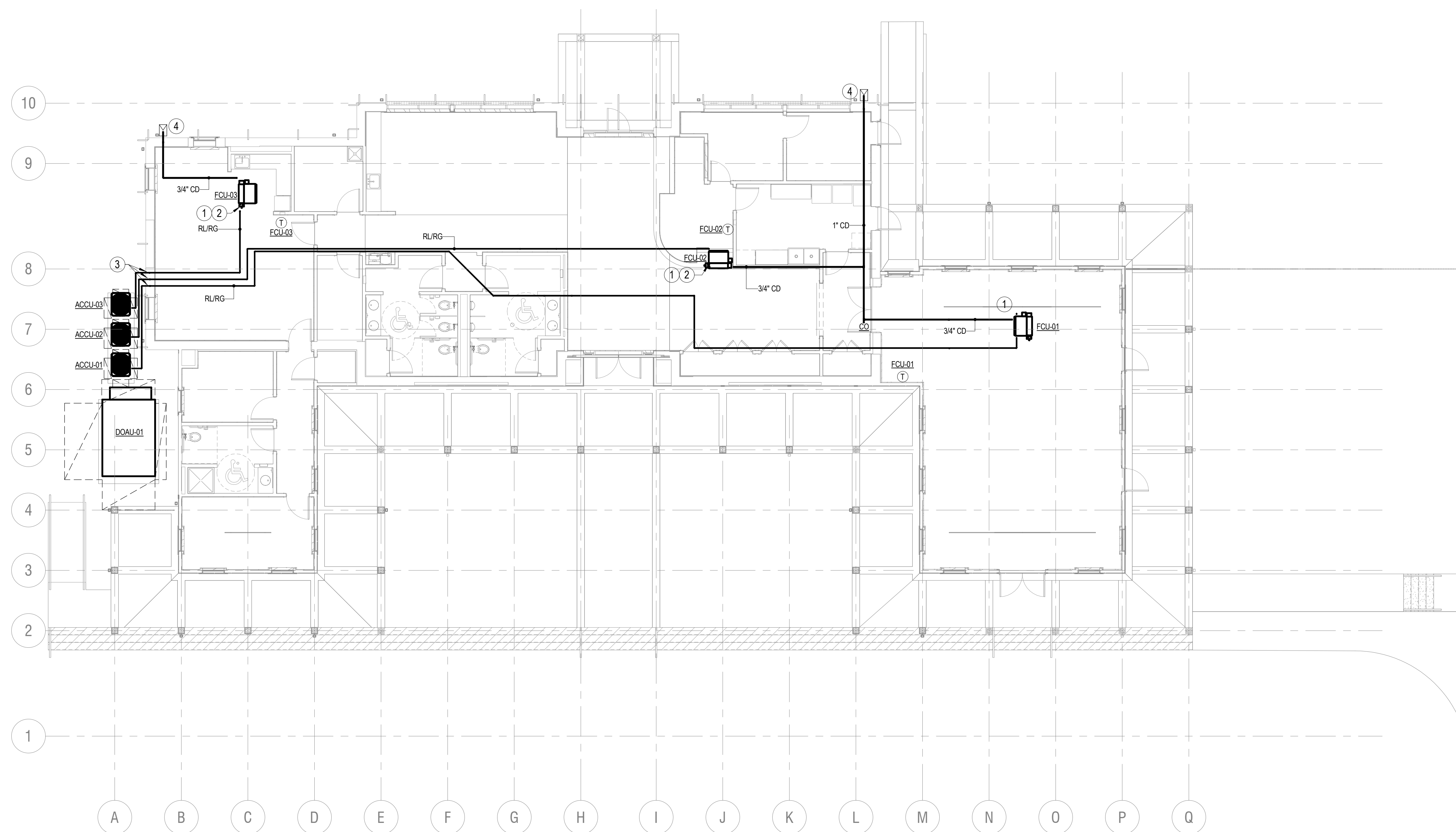
M2.01

GENERAL NOTES

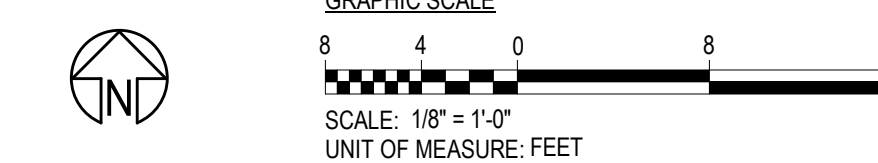
- REFRIGERANT LIQUID AND GAS PIPING IS REQUIRED. FOR CLARITY, ONLY ONE PIPE IS SHOWN.

DRAWING NOTES

- PROVIDE AUXILIARY DRAIN PAN. REFER TO DETAIL 2 ON M5.02
- PROVIDE REMOVABLE PANEL FOR ACCESS TO FAN COIL UNIT.
- PROVIDE WATER TIGHT PIPE SLEEVE AT REFRIGERANT PIPING. ROUTE PIPES UP IN WALL CAVITY.
- CONDENSATE PIPE EXITS THE BUILDING 3'-0" ABOVE GRADE. PROVIDE WATER TIGHT PIPE SLEEVE AND ROUTE PIPE DOWN TO 6" ABOVE SPLASH BLOCK.

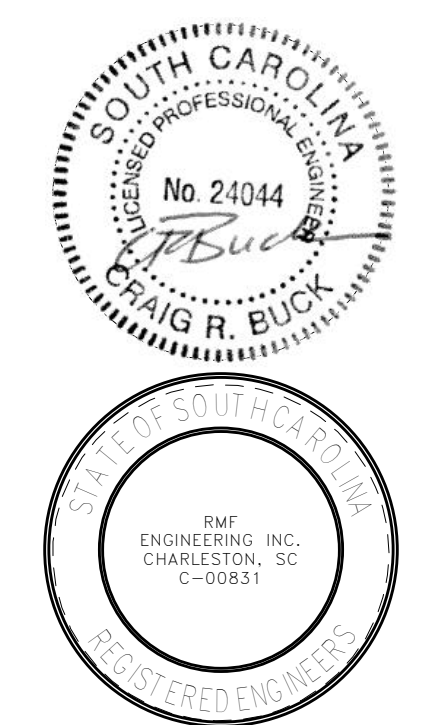


MECHANICAL PIPING PLAN - LEVEL 01
SCALE: 1/8" = 1'-0"



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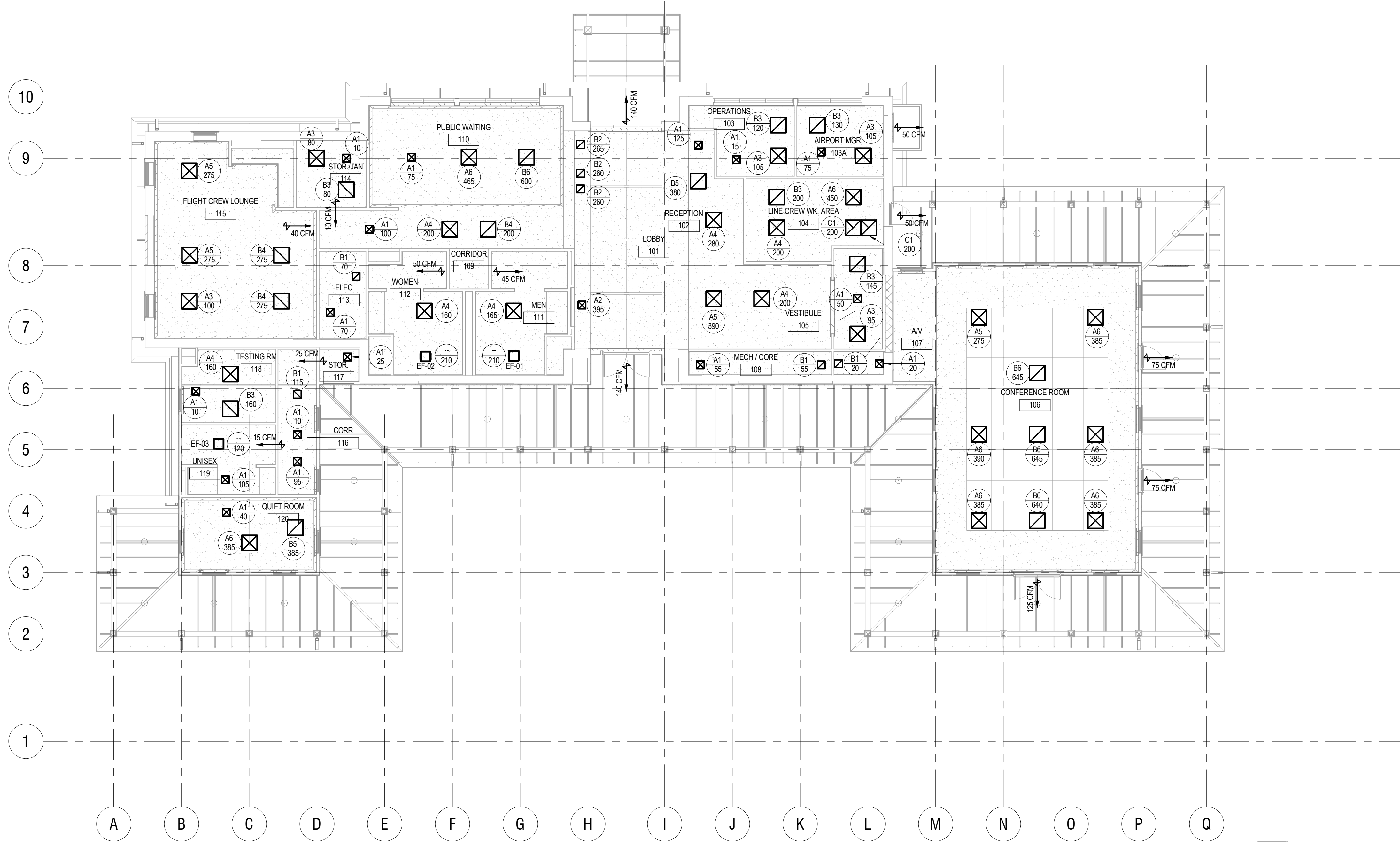
ISSUE DATE: FEBRUARY 19, 2018
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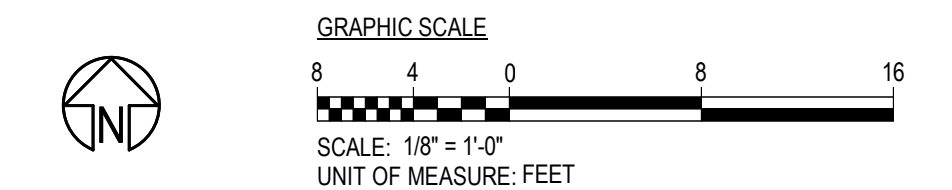
MECHANICAL AIR
DEVICE PLAN

1509
FIRM PROJECT NO. SHEET

M3.01



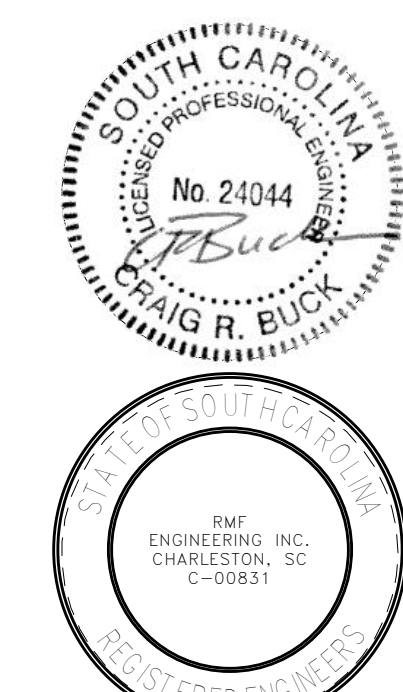
AIR DEVICE PLAN
SCALE: 1/8" = 1'-0"



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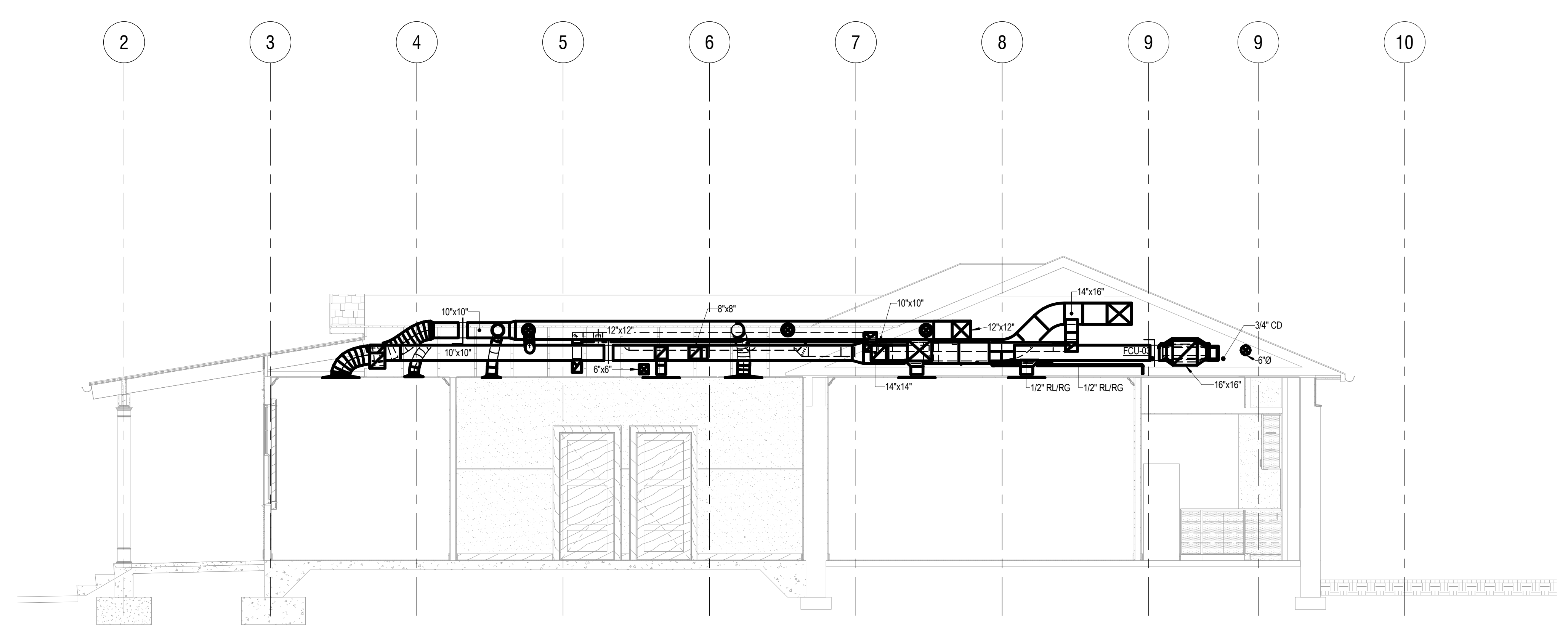
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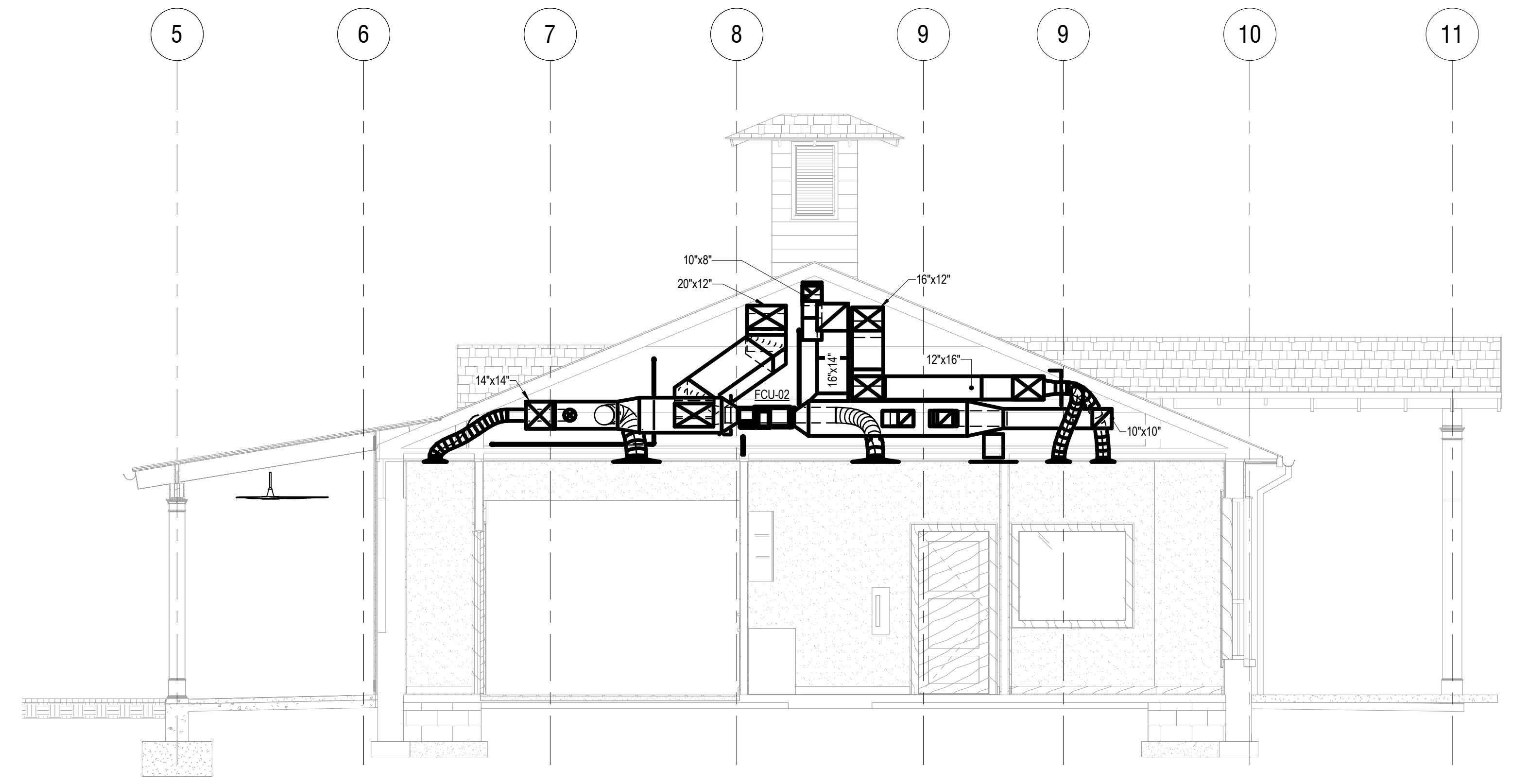
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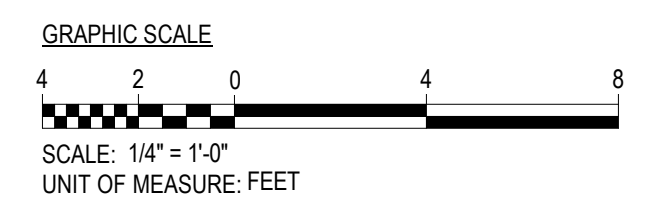
MECHANICAL
SECTION VIEWS



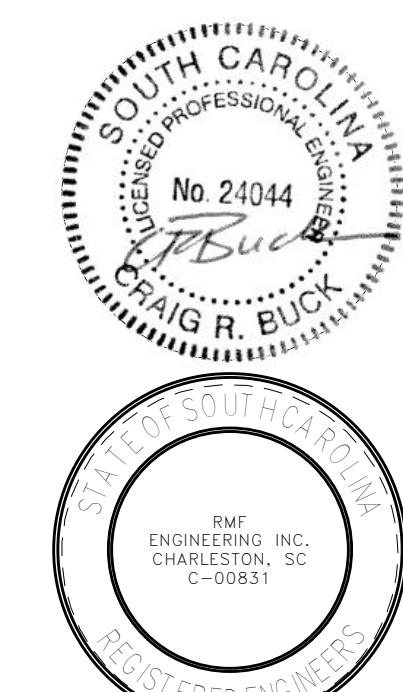
1 MECHANICAL SECTION A
SCALE: 1/4" = 1'-0"



2 MECHANICAL SECTION B
SCALE: 1/4" = 1'-0"



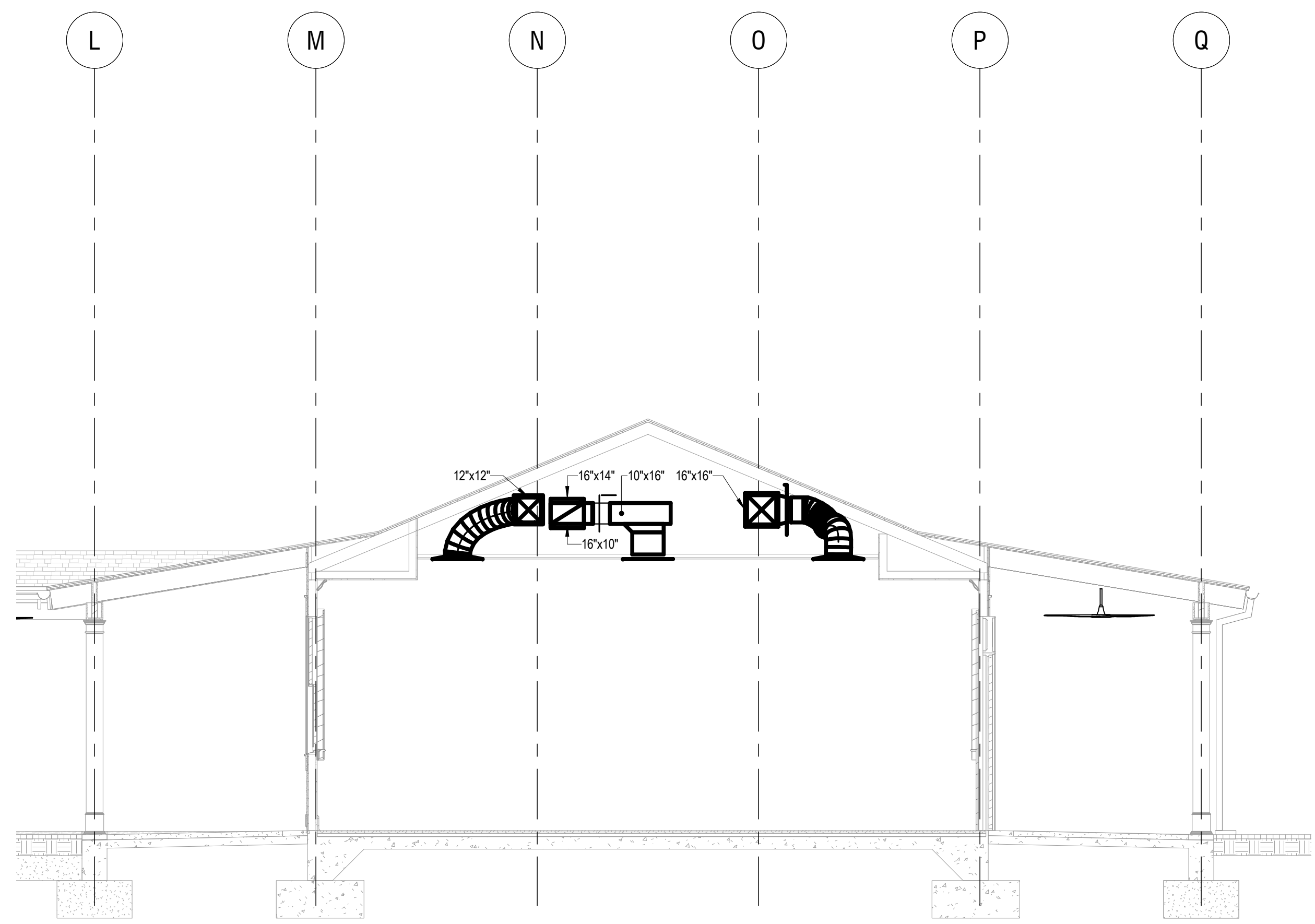
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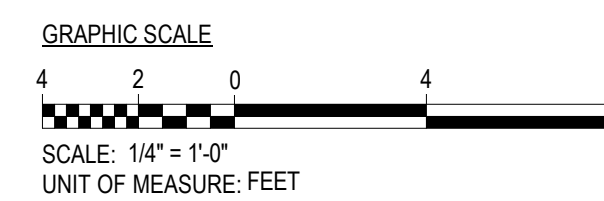
ISSUE DATE: FEBRUARY 19, 2018
PHASE: BIDDING DOCUMENTS

#	DATE	REVISION

MECHANICAL
SECTION VIEWS

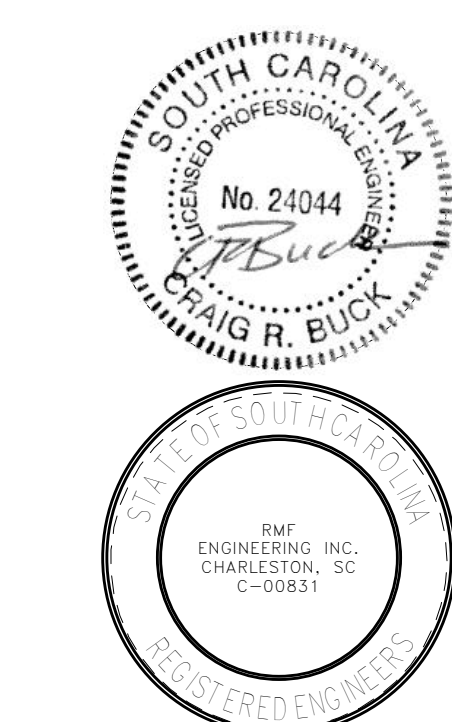


1
MECHANICAL SECTION C
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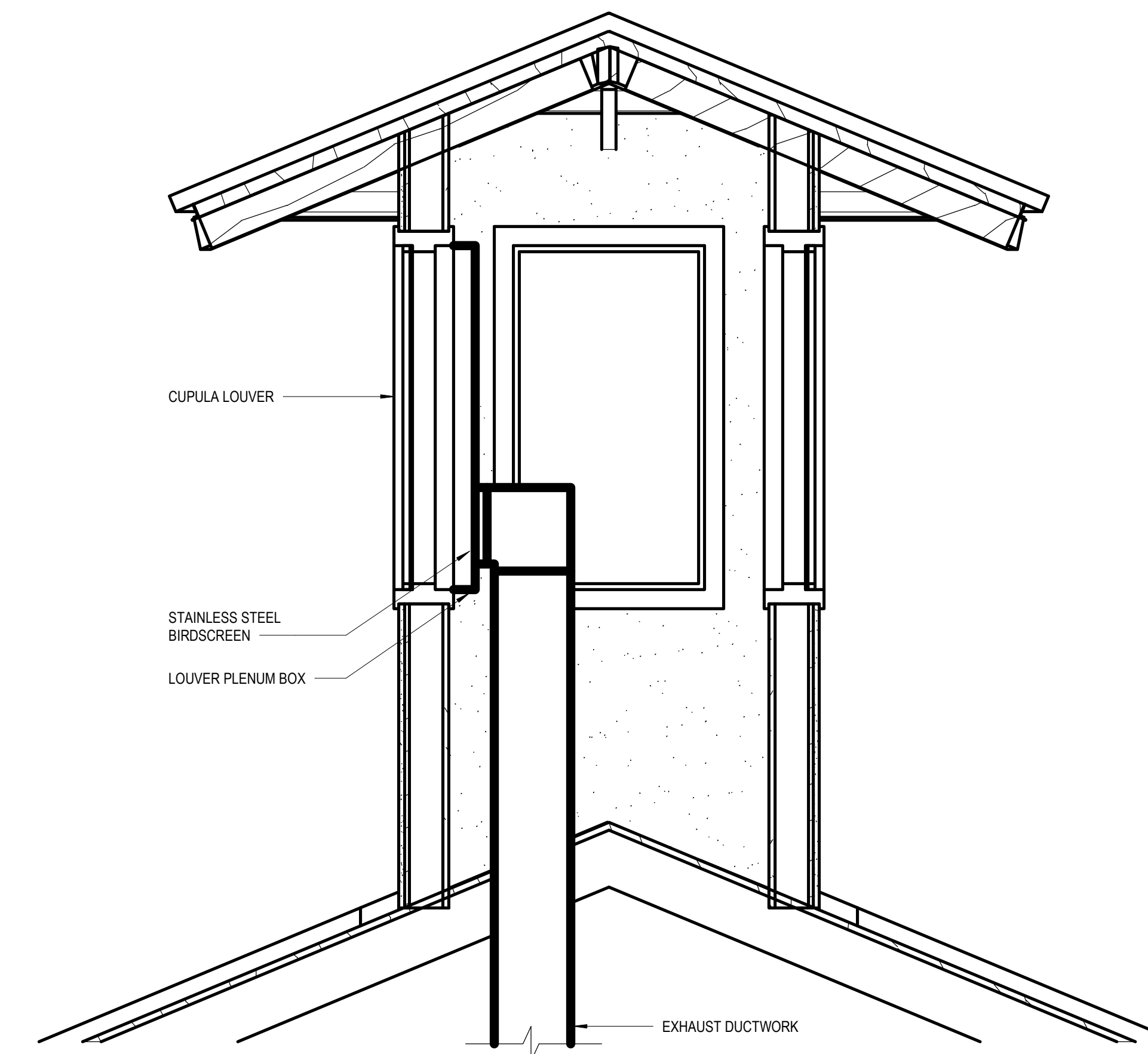
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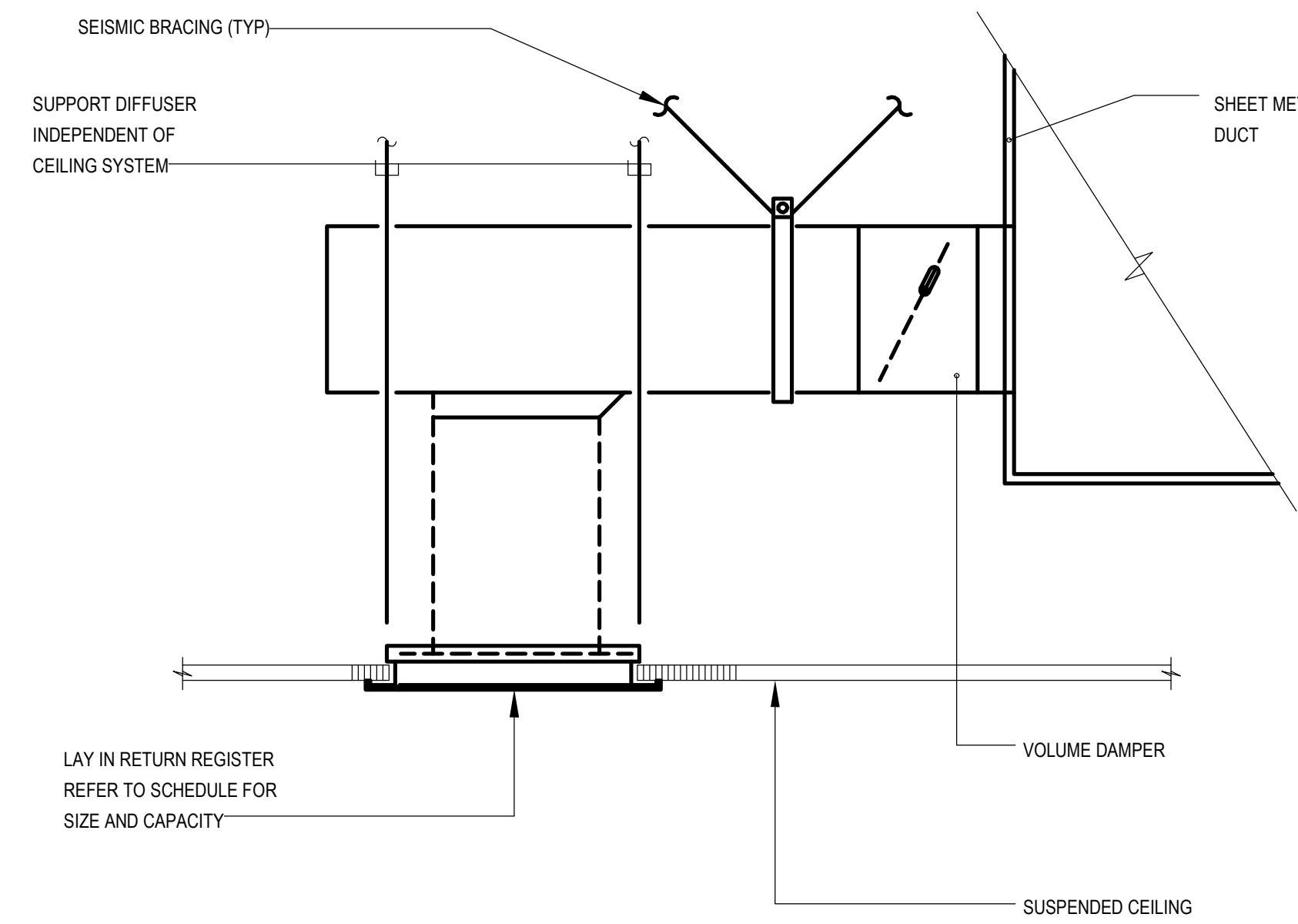
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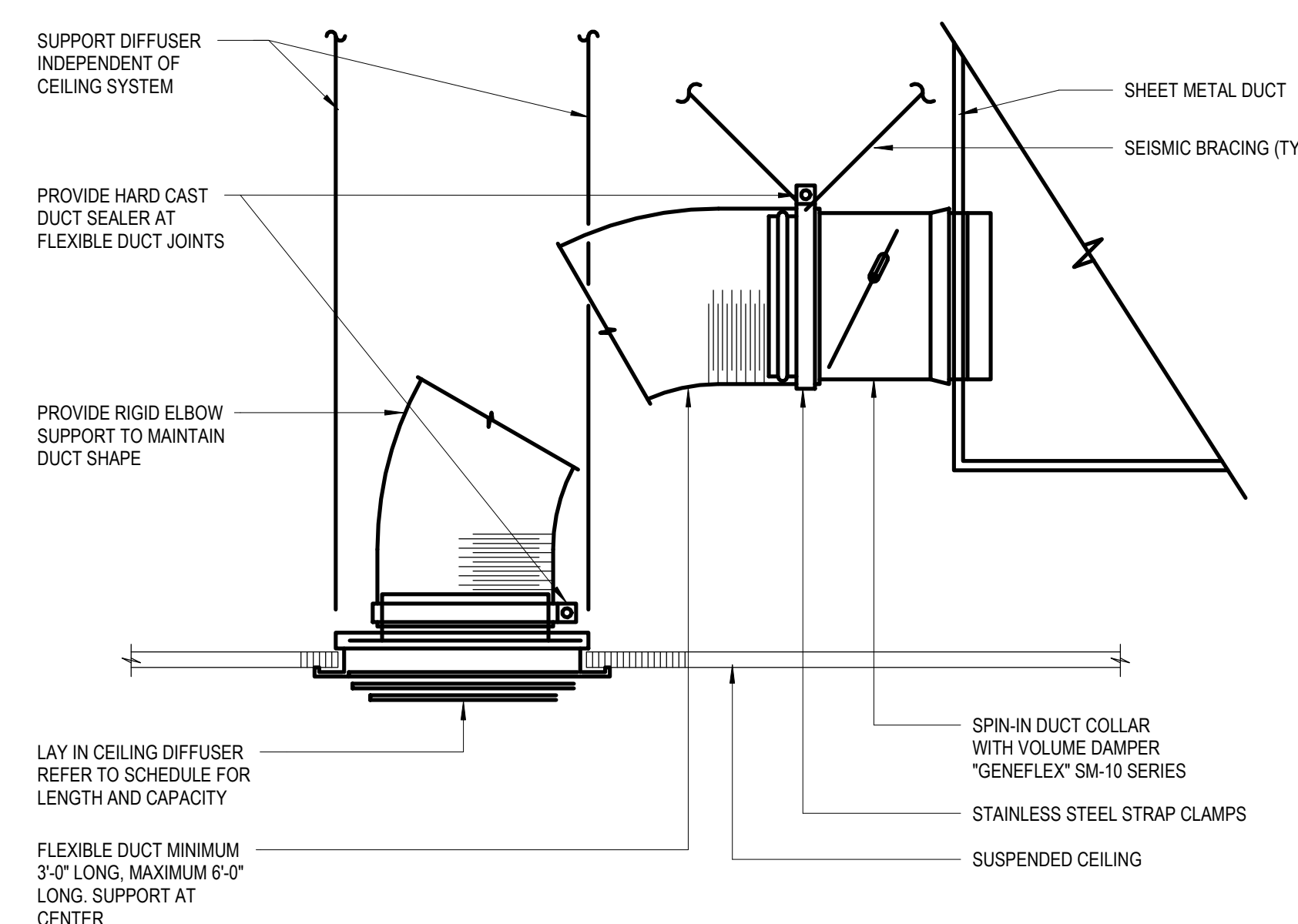
NOTE: TYPICAL FOR ALL EXHAUST TERMINATIONS AT CUPULA

5 **DETAIL - EXHAUST THROUGH CUPULA**
SCALE: N.T.S.



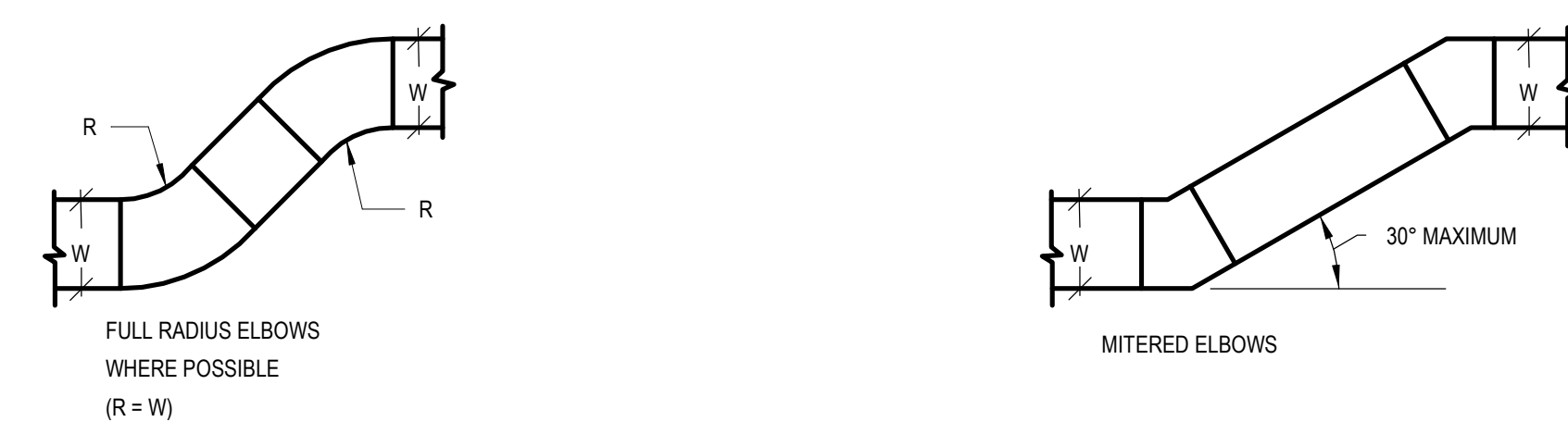
- NOTES:
1. DUCT INSULATION SHALL BE PROVIDED AS SPECIFIED.
 2. PROVIDE SEISMIC SWAY BRACING FOR ALL DUCTWORK AND HANGERS PER THE INTERNATIONAL BUILDING CODE AND INTERNATIONAL MECHANICAL CODE.
 3. CONTRACTOR SHALL VERIFY MAXIMUM LOADING ON DUCTWORK SUPPORT ASSEMBLIES.

3 **DETAIL - RETURN/EXHAUST AIR REGISTER BRANCH DUCT**
SCALE: N.T.S.

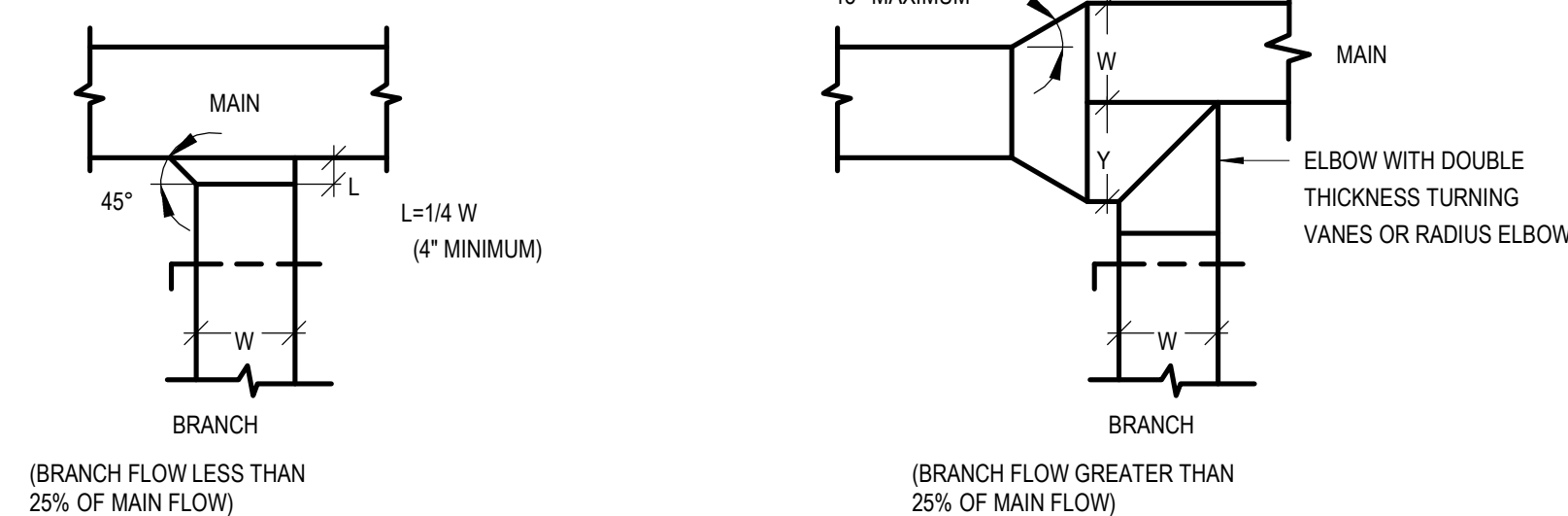


- NOTES :
1. DUCT INSULATION SHALL BE PROVIDED AS SPECIFIED.
 2. PROVIDE ADDITIONAL ROUND, RIGID SHEET METAL DUCTWORK AS REQUIRED TO LIMIT FLEXIBLE DUCT LENGTH TO 6'-0" MAXIMUM.
 3. MAXIMUM SAG 1/2" PER FOOT.
 4. PROVIDE SEISMIC SWAY BRACING FOR ALL DUCTWORK AND HANGERS PER THE INTERNATIONAL BUILDING CODE AND INTERNATIONAL MECHANICAL CODE.
 5. CONTRACTOR SHALL VERIFY MAXIMUM LOADING ON DUCTWORK SUPPORT ASSEMBLIES.

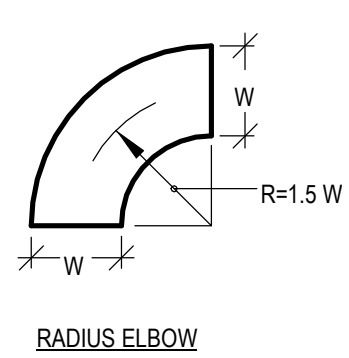
4 **DETAIL - CEILING DIFFUSER BRANCH DUCTS**
SCALE: N.T.S.



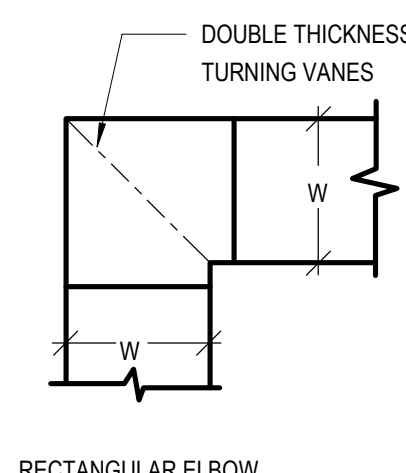
DUCT OFFSETS



BRANCH TAKE-OFFS

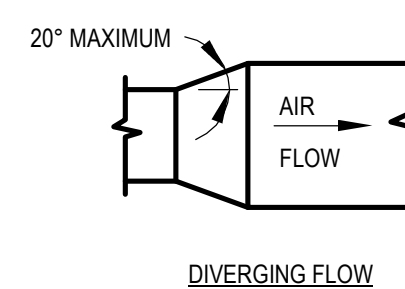


RADIUS ELBOW

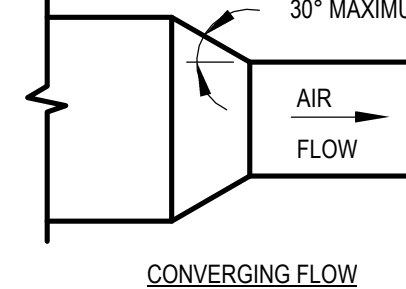


RECTANGULAR ELBOW

LOW VELOCITY ELBOWS



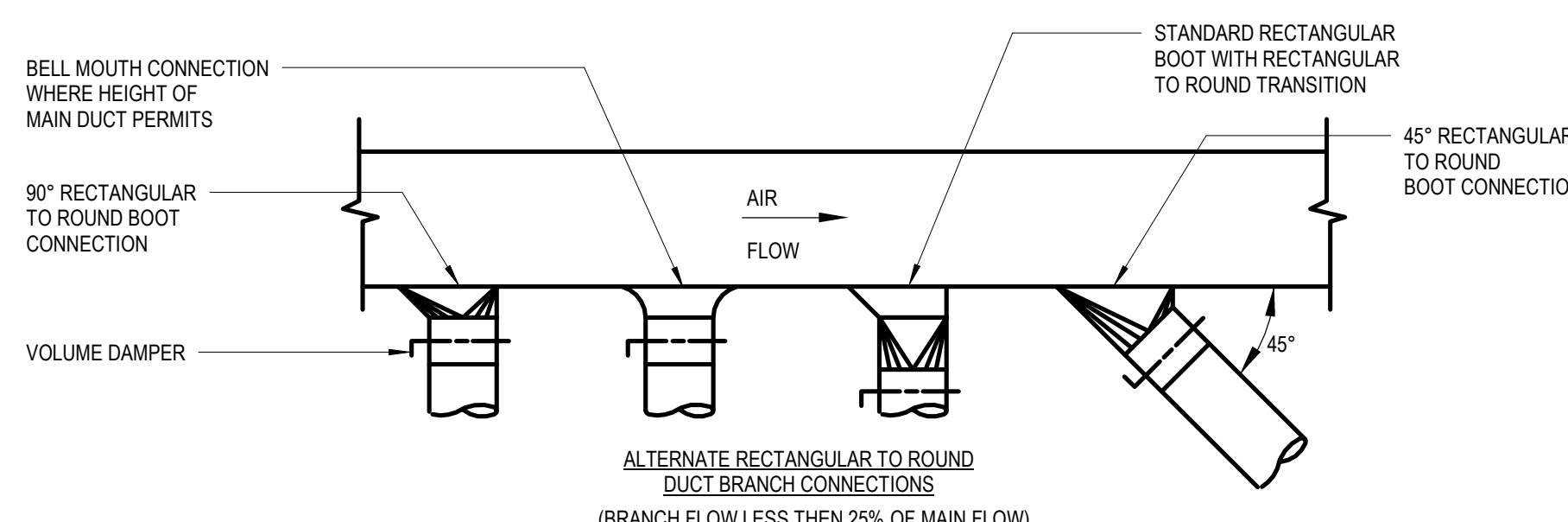
DIVERGING FLOW



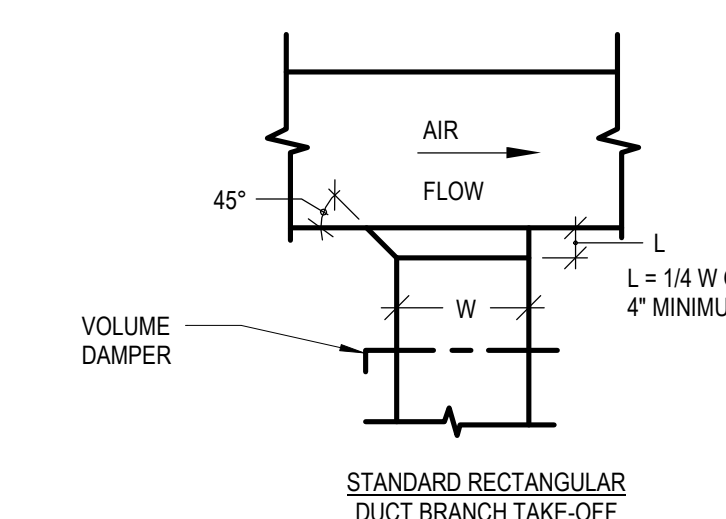
CONVERGING FLOW

RECTANGULAR TO RECTANGULAR TRANSITIONS

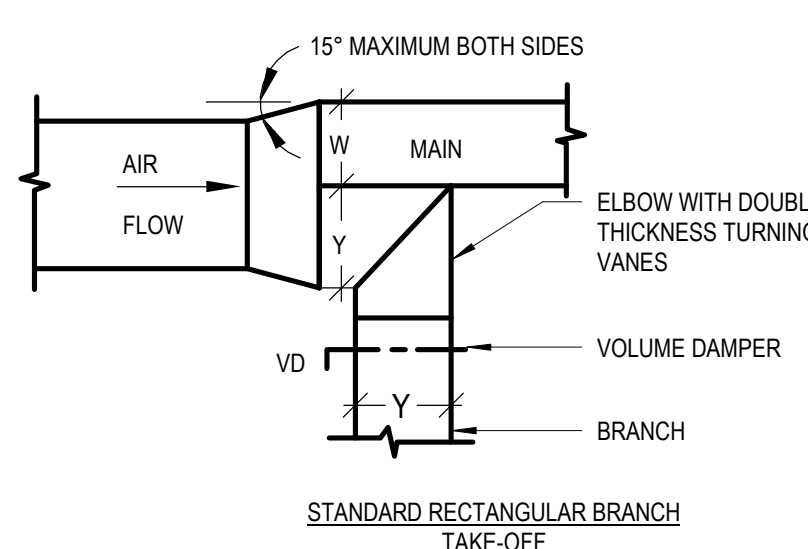
1 **DETAIL - RECTANGULAR DUCT FITTINGS**
SCALE: N.T.S.



ALTERNATE RECTANGULAR TO ROUND DUCT BRANCH CONNECTIONS
(BRANCH FLOW LESS THAN 25% OF MAIN FLOW)



STANDARD RECTANGULAR DUCT BRANCH TAKE-OFF



STANDARD RECTANGULAR BRANCH TAKE-OFF

2 **DETAIL - LOW VELOCITY BRANCH TAKE-OFF**
SCALE: N.T.S.

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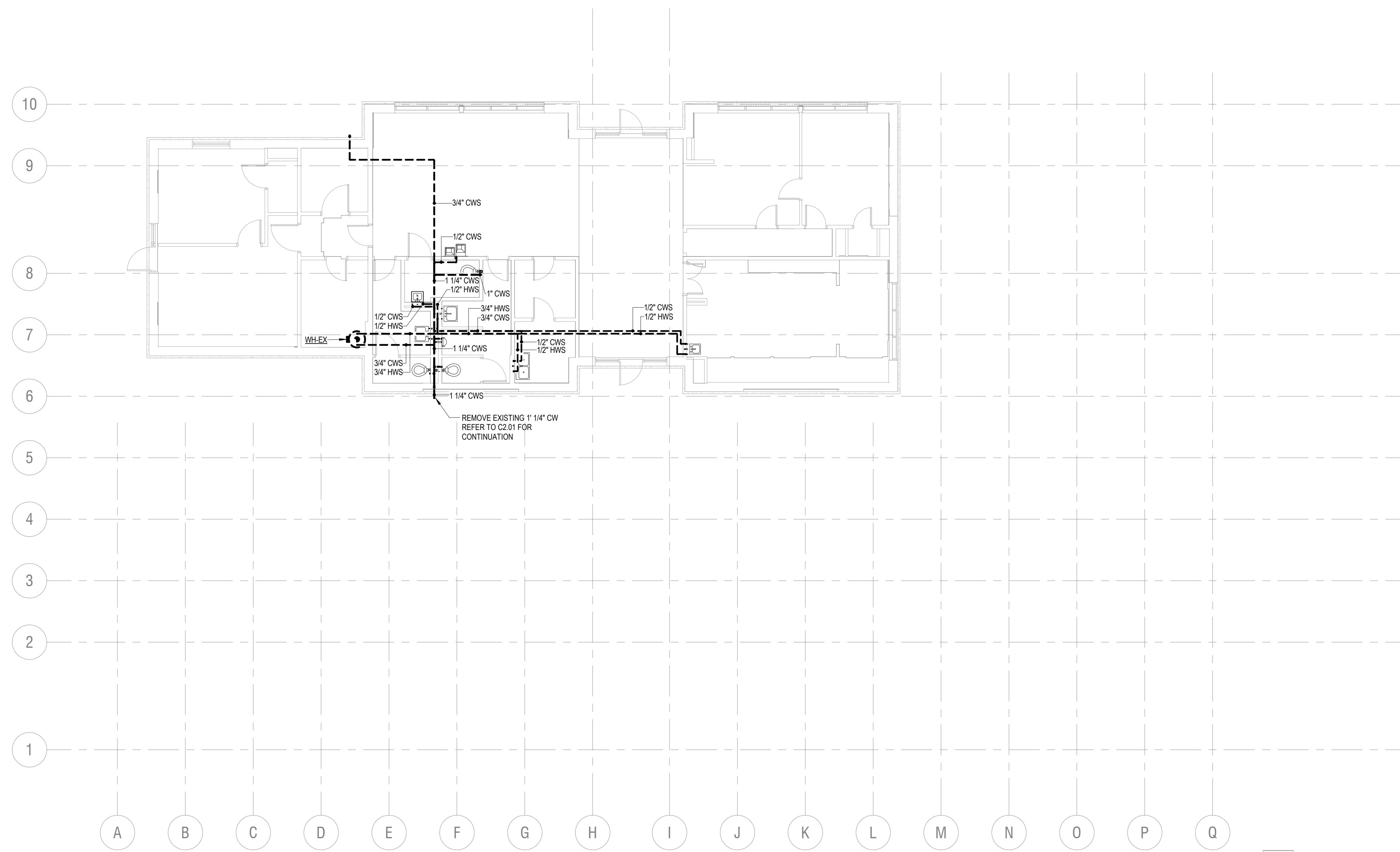
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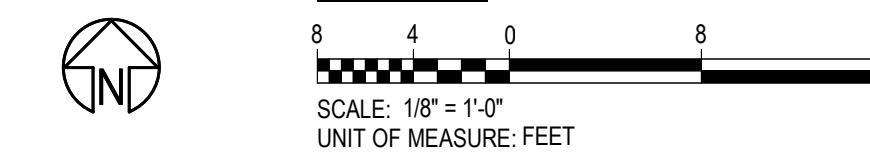
DEMO -
DOMESTIC WATER
PIPING PLAN

GENERAL NOTES

1. REMOVE ALL PIPING, HANGERS, SUPPORT, EQUIPMENT AND FIXTURES ASSOCIATED WITH THE EXISTING PLUMBING SYSTEM.
2. ANY PIPING BELOW FLOOR FINISH TO BE PROTECTED SHALL BE ABANDONED IN PLACE.

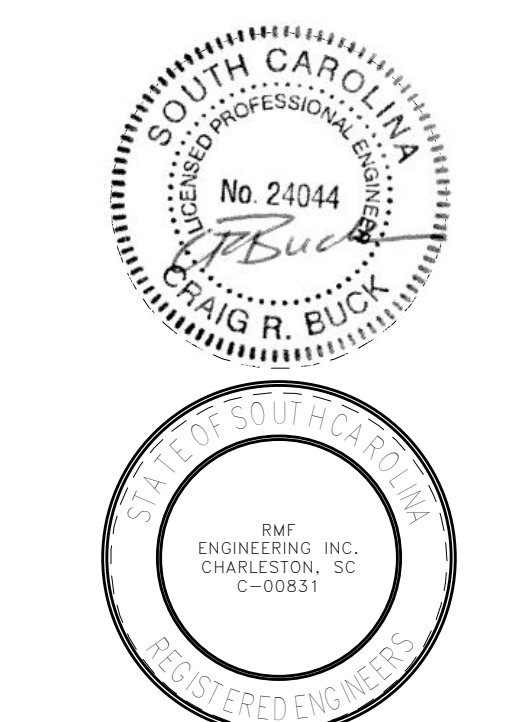


DEMO - DOMESTIC WATER PIPING PLAN - LEVEL 01
SCALE: 1/8" = 1'-0"



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ISSUE DATE: FEBRUARY 19, 2018
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DEMO - SANITARY
PIPING PLAN

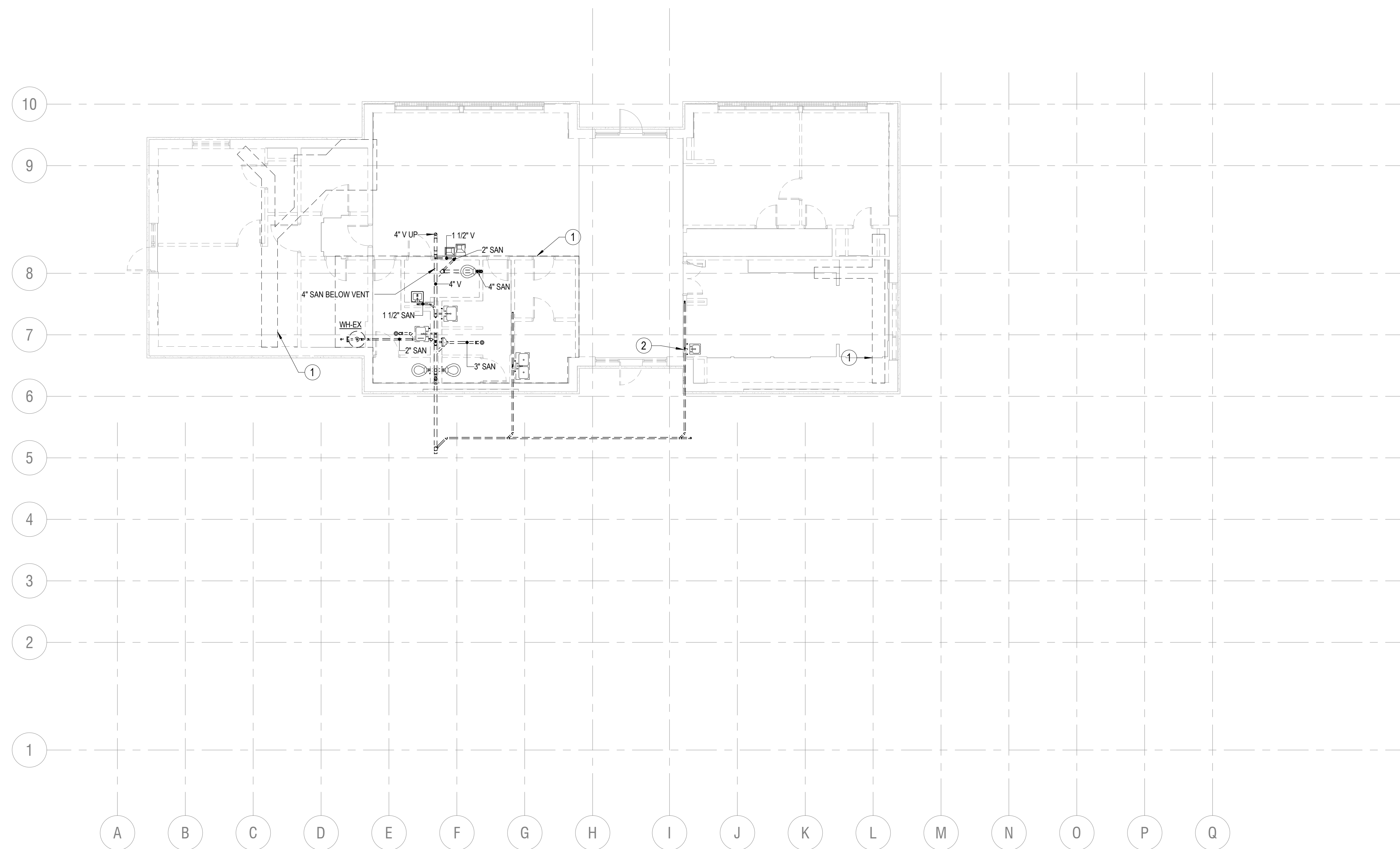
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FIRM PROJECT NO. SHEET

GENERAL NOTES

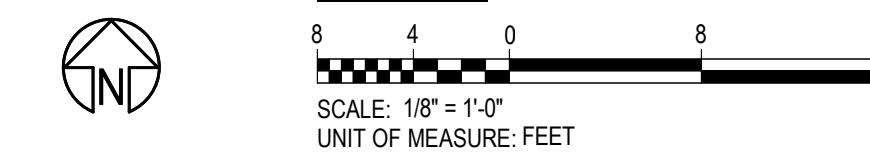
- BEFORE BEGINNING ANY FLOOR CUTTING OR UNDERGROUND WORK, LOCATE THE EXISTING SANITARY PIPE ELEVATION. PROVIDE DEPTH AND LOCATION TO THE ENGINEER.
- REMOVE ALL FIXTURES, PIPING, AND HANGERS.

DRAWING NOTES

- REMOVE SECTION OF CONCRETE SLAB AS REQUIRED FOR INSTALLATION OF NEW PIPING. PROTECT EXISTING TERRAZZO FLOOR.
- REMOVE EXISTING FIXTURE AND PIPING. CUT SANITARY PIPE AT GRADE AND FILL WITH GROUT.

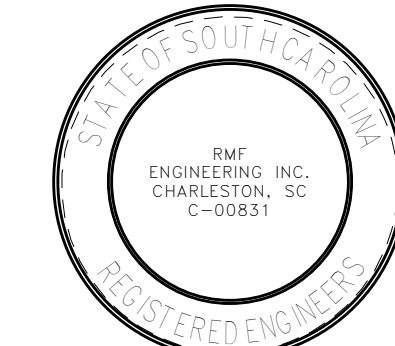


DEMO - SANITARY AND VENT PIPING PLAN - LEVEL 01
SCALE: 1/8" = 1'-0"



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ISSUE DATE: FEBRUARY 19, 2018
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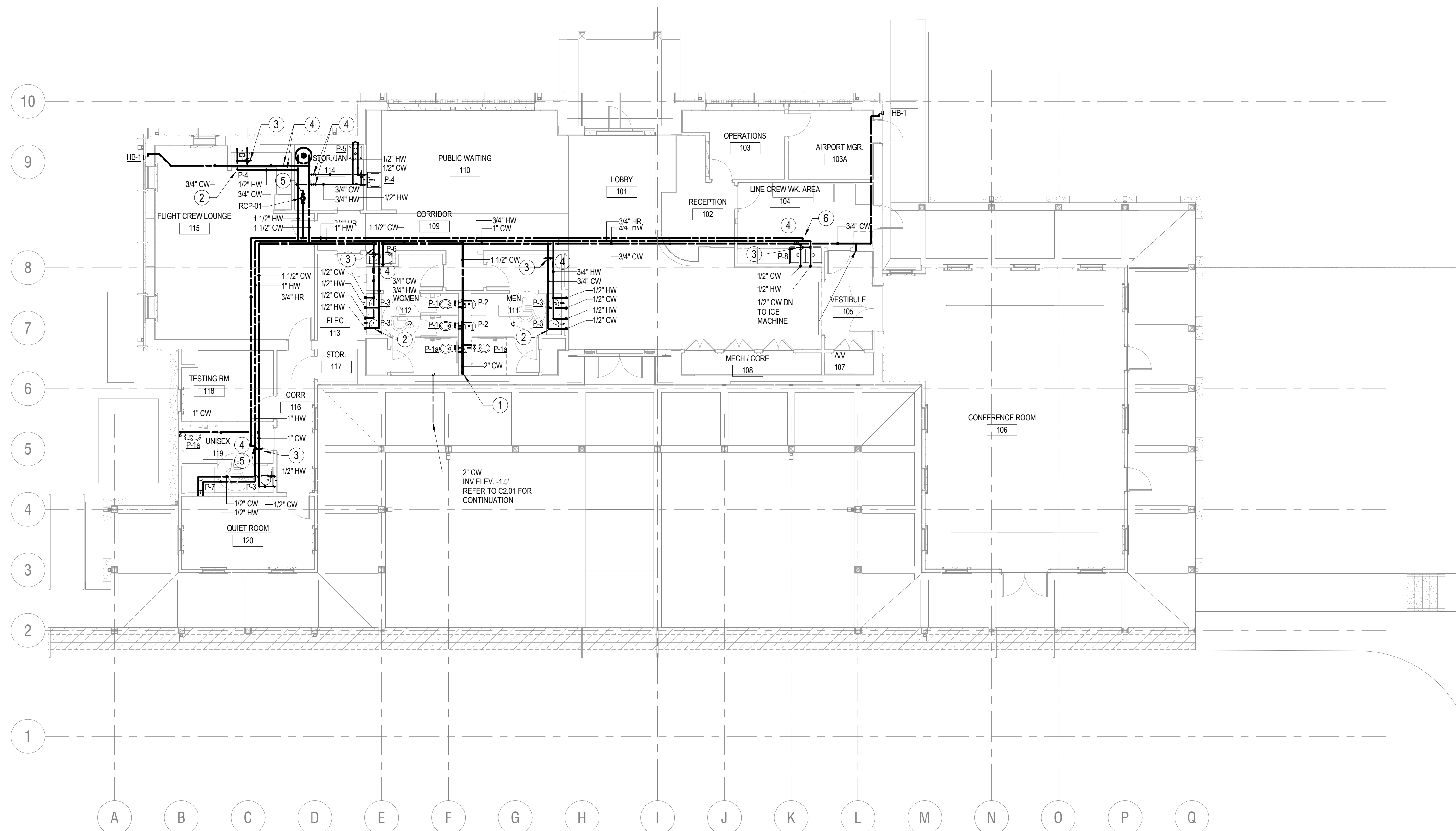
DOMESTIC WATER
PIPING PLAN -
LEVEL 01

1509
FIRM PROJECT NO. SHEET

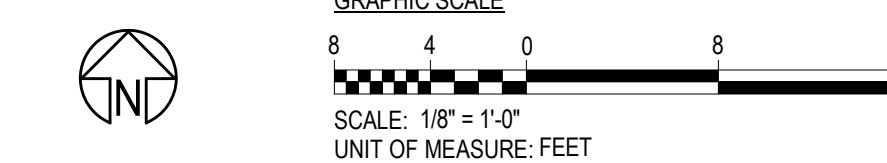
P1.01

DRAWING NOTES

- ① ROUTE NEW 2" CW UNDER SLAB TO WET WALL, THEN UP.
- ② PROVIDE MAINTENANCE HOSE BIBB WITH REMOVABLE HANDLE UNDER LAVATORIES (LB-2).
- ③ PROVIDE TEMPERING VALVE TO REDUCE HOT WATER SUPPLY TEMPERATURE TO 110°F.
- ④ PROVIDE SHUT-OFF VALVE ON HW, CW, HWR LINES IN ACCESSIBLE AREA ABOVE CEILING.
- ⑤ PROVIDE BALANCING VALVE ON HWR LINE IN ACCESSIBLE AREA ABOVE CEILING. SET BALANCING VALVE AT 1.05 GPM.
- ⑥ PROVIDE BALANCING VALVE ON HWR LINE IN ACCESSIBLE AREA ABOVE CEILING. SET BALANCING VALVE AT 1.95 GPM.



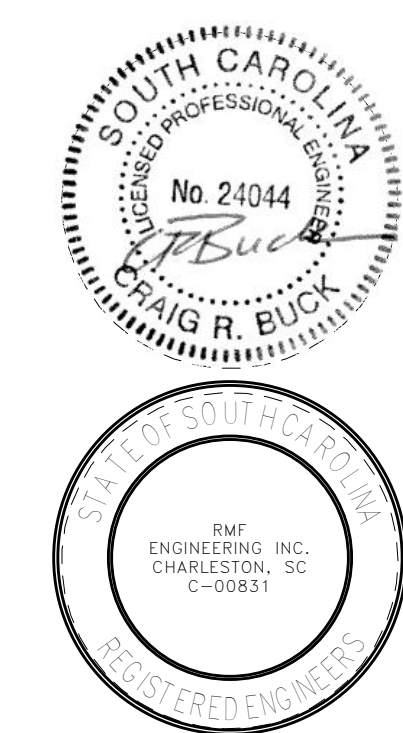
DOMESTIC WATER PIPING PLAN - LEVEL 01
SCALE: 1/8" = 1'-0"



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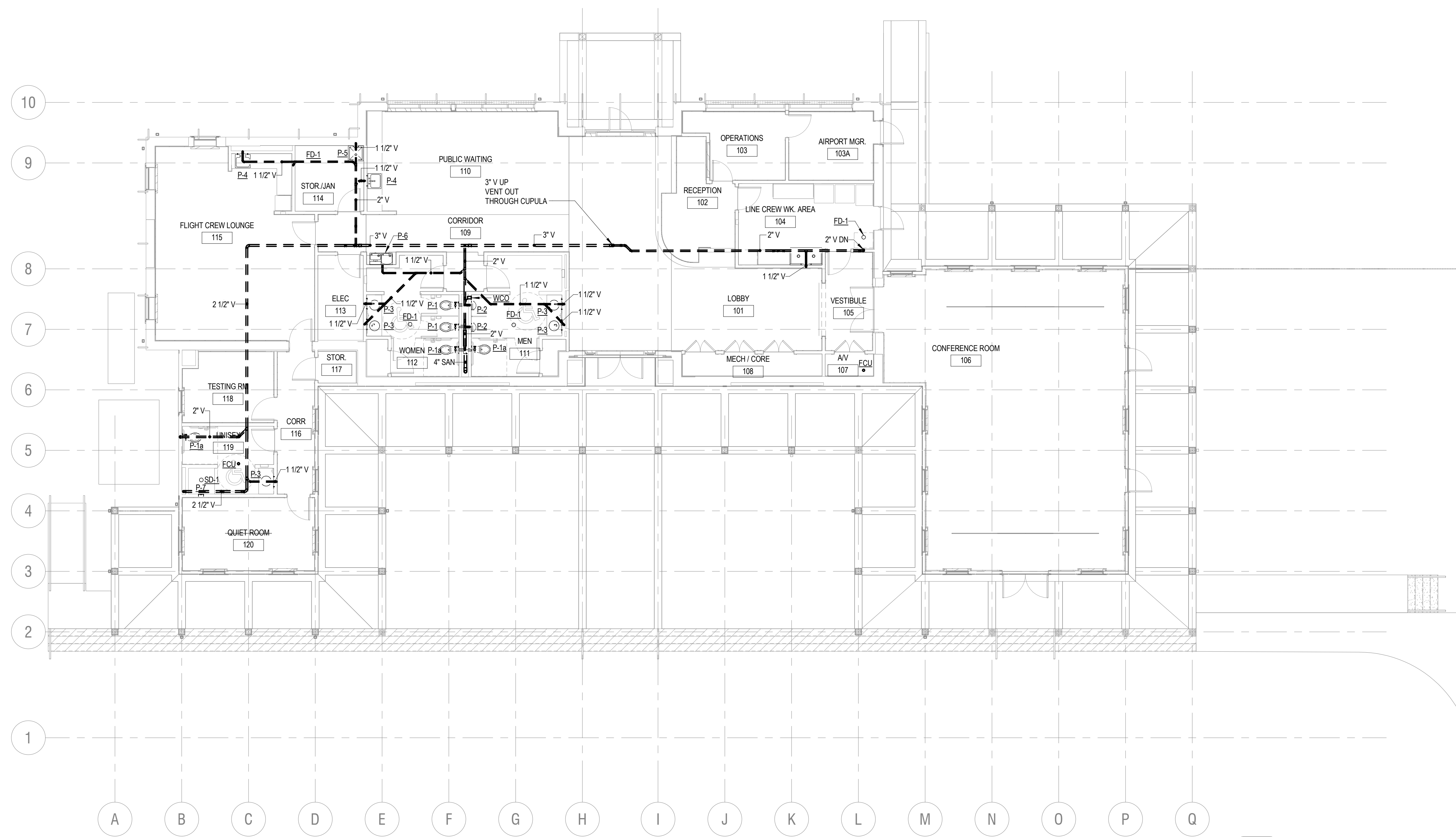
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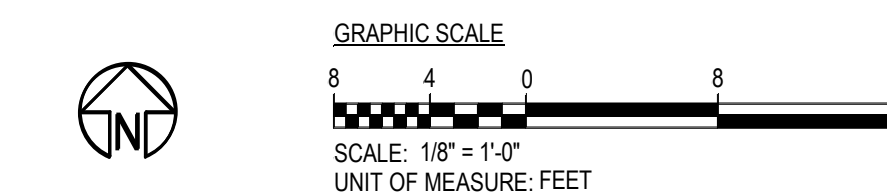
ISSUE DATE: FEBRUARY 19, 2018
PHASE: BIDDING DOCUMENTS

#	DATE	REVISION

SANITARY AND VENT PIPING PLAN
- LEVEL 01



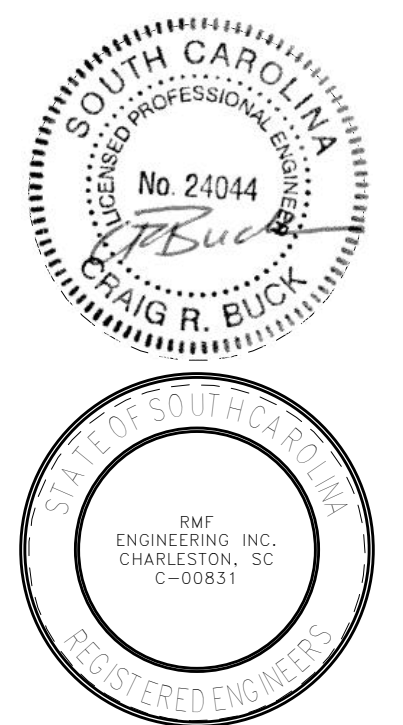
SANITARY AND VENT PIPING PLAN - LEVEL 01
SCALE: 1/8" = 1'-0"



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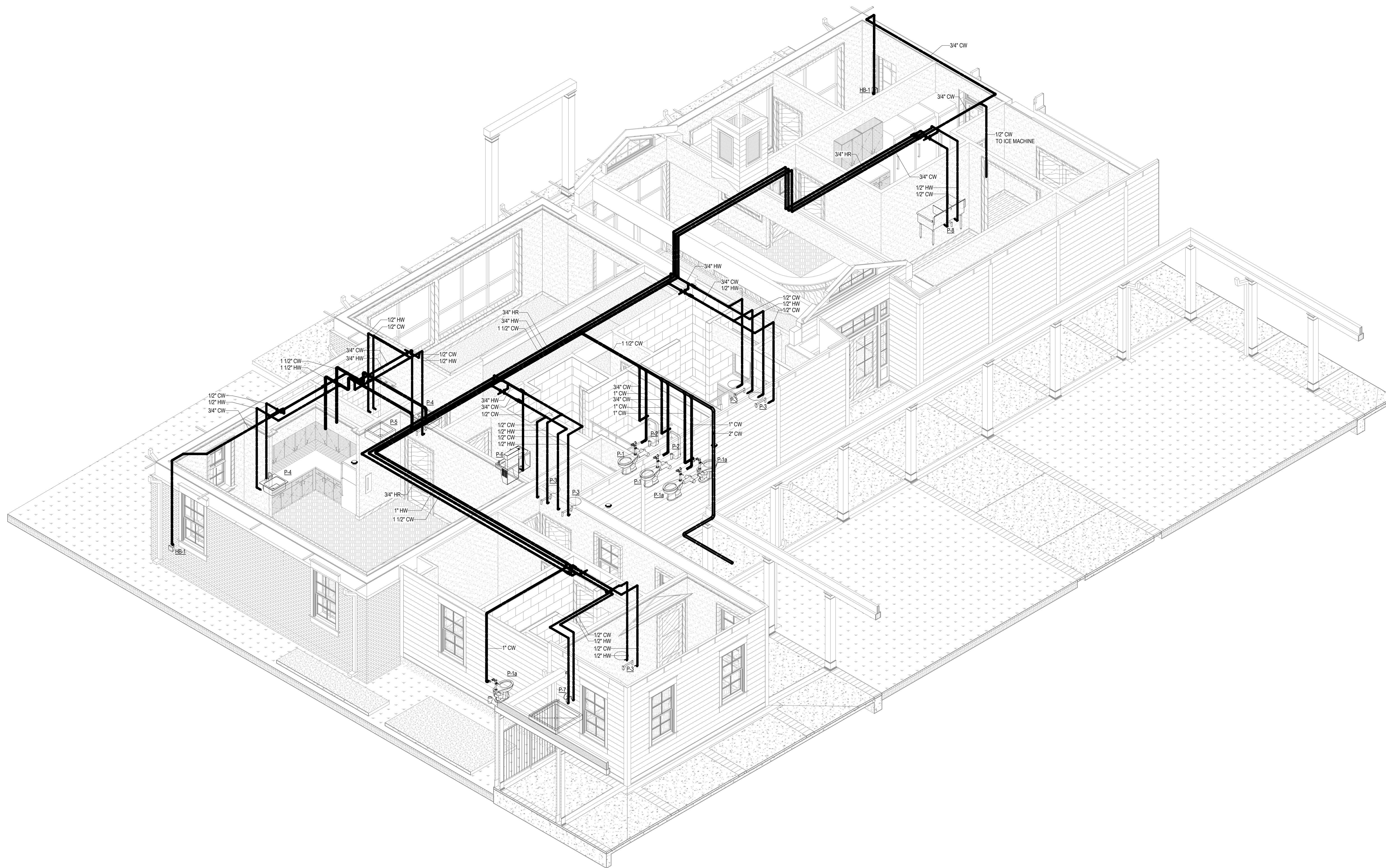
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DOMESTIC
PLUMBING RISER

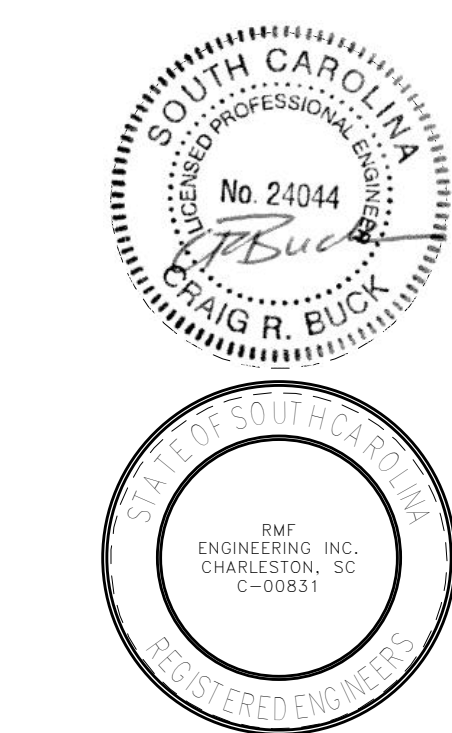


DOMESTIC PLUMBING RISER
SCALE: NONE

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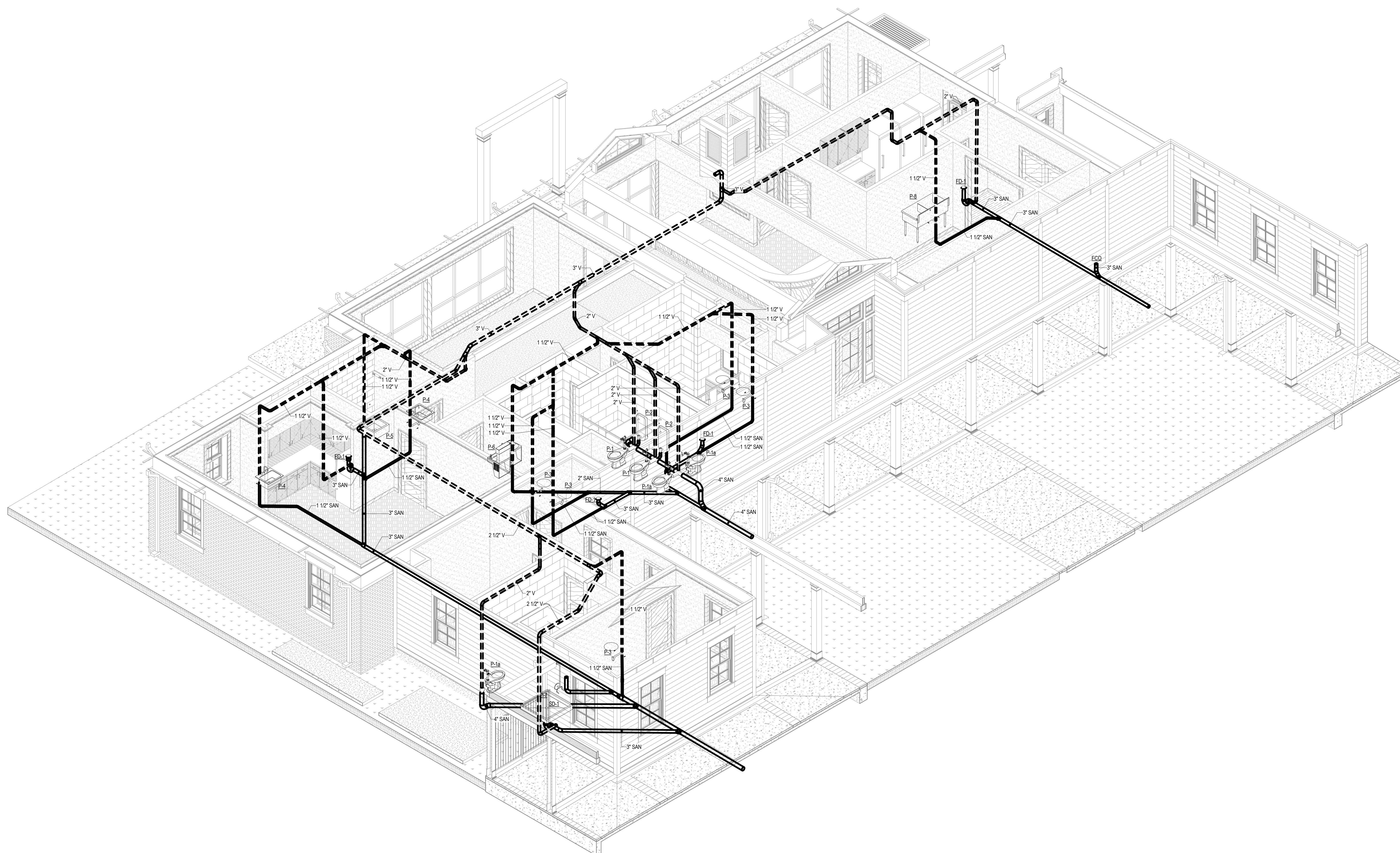
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SANITARY
PLUMBING RISER



SANITARY PLUMBING RISER
SCALE: NONE

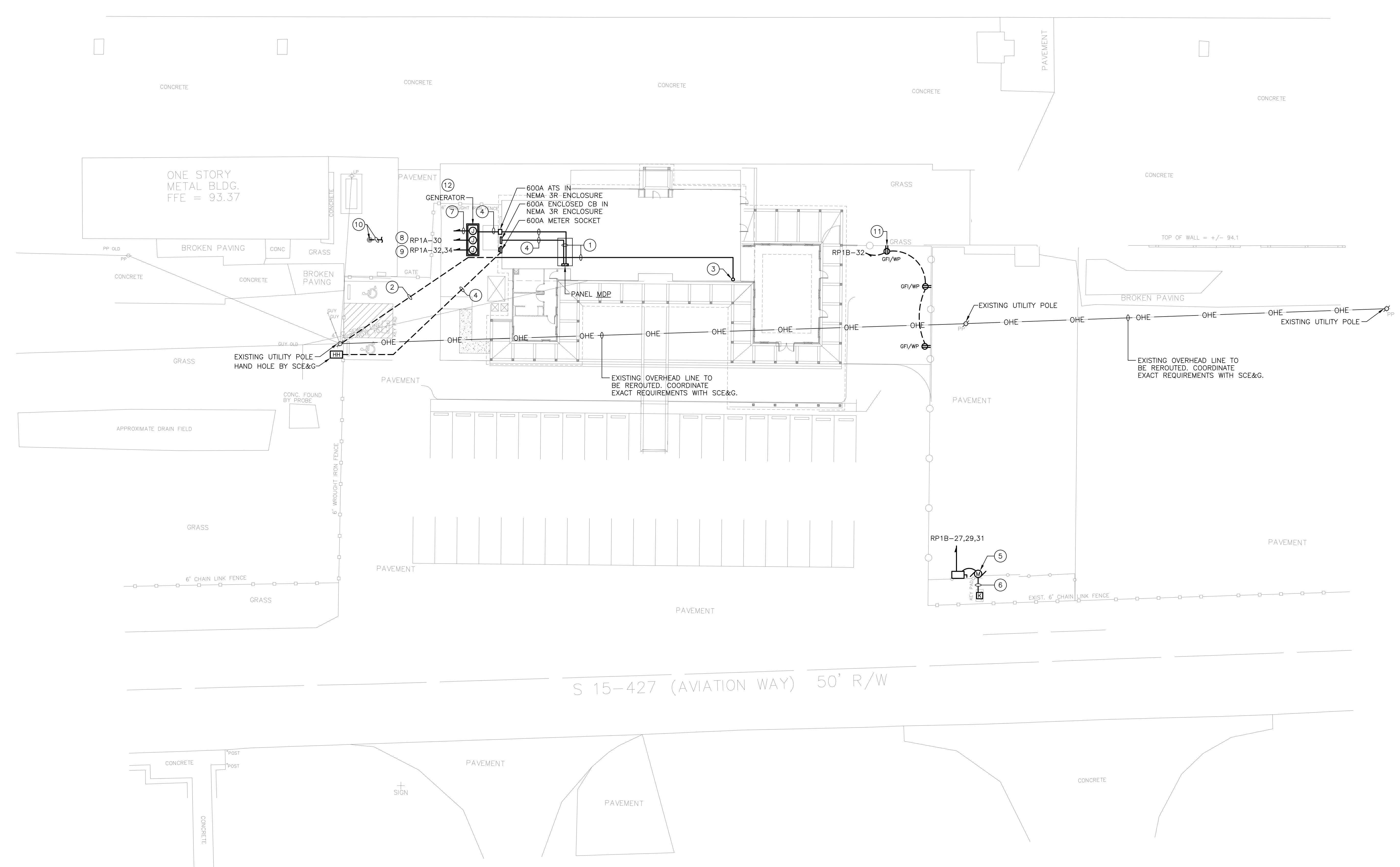
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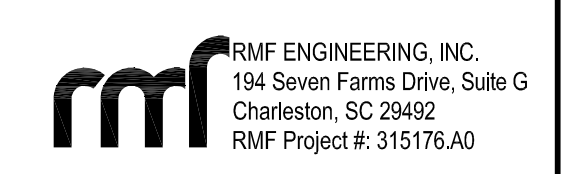
1 2 3 4 5 6

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- DRAWING NOTES:**
- ① ROUTE CONDUITS OVERHEAD IN ATTIC SPACE.
 - ② (1) 3" CONDUIT FOR BUILDING TELECOM SERVICE. CONFIRM REQUIREMENTS WITH SERVICE PROVIDER.
 - ③ TURN DOWN AT TELECOM BACKBOARD IN A/V 107.
 - ④ SEE ONE-LINE DIAGRAM.
 - ⑤ PROVIDE CONNECTION TO MOTORIZED GATE OPERATOR. COORDINATE REQUIREMENTS WITH ACTUAL EQUIPMENT FURNISHED BY OWNER.
 - ⑥ PROVIDE 1" CONDUIT FROM KEYPAD TO GATE OPERATOR.
 - ⑦ PROVIDE 4#12 IN 1" CND TO ATS FOR GENERATOR START.
 - ⑧ 20A, 120V CIRCUIT FOR BATTERY CHARGER. PROVIDE 2#12, 1#12 GND, 3/4" CND.
 - ⑨ 30A, 208V/1P CIRCUIT FOR BLOCK HEATER. PROVIDE 2#10, 1#10 GND, 3/4" CND.
 - ⑩ MOUNT EXISTING GROUND LINK ANTENNA AND ANTENNA PREVIOUSLY LOCATED ON DEMOLISHED ANTENNA TOWER ON POLE AT THIS LOCATION. PROVIDE (1) 1" CONDUIT TO A/V 107 AND (1) 1" CONDUIT TO RECEPTION DESK. SEE SHEET E3.01 FOR MORE INFORMATION. COORDINATE EXACT REQUIREMENTS WITH OWNER.
 - ⑪ STUB UP RECEPTACLE AT FENCE. TYPICAL.
 - ⑫ PROVIDE CONCRETE EQUIPMENT PAD. COORDINATE EXACT DIMENSIONS WITH EQUIPMENT PROVIDED. SEE DETAIL ON SHEET E4.01.

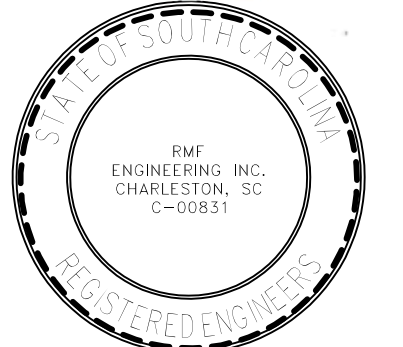
**ARCHITECTURE
INTERIORS
PLANNING**



WTS
WATSON TATE SAVORY



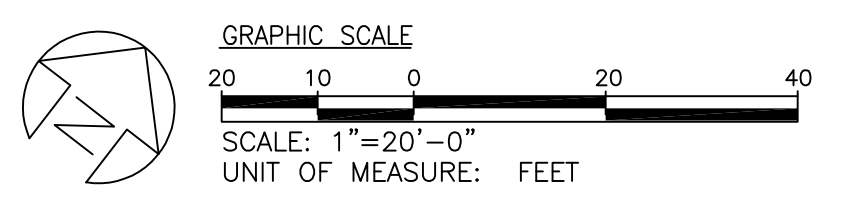
LOWCOUNTRY REGIONAL AIRPORT TERMINAL EXPANSION
COLLETON COUNTY
WALTERBORO, SC



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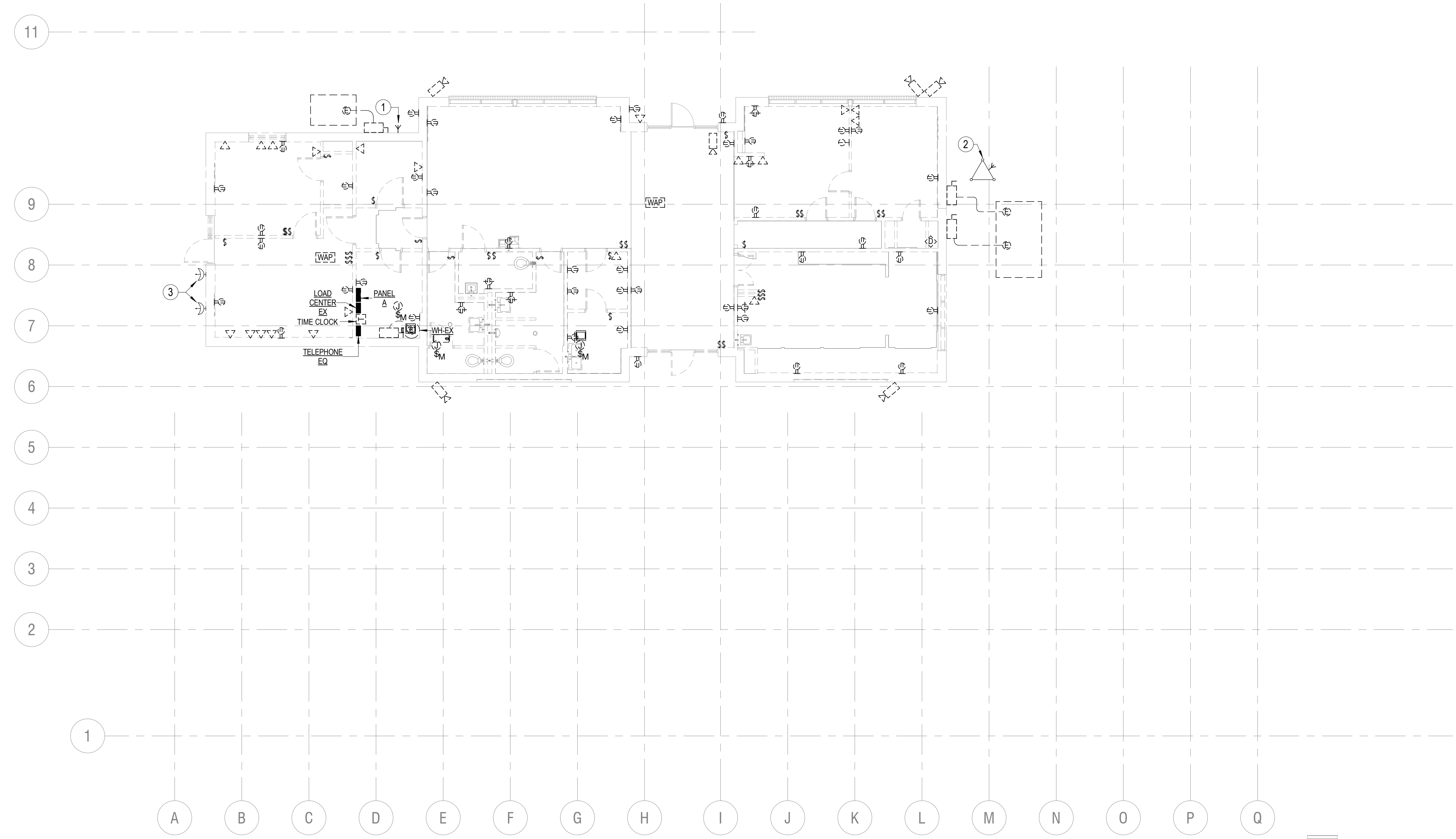
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**ELECTRICAL
SITE PLAN**



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1
ED1.01
DEMO - POWER AND SPECIAL SYSTEMS PLAN
SCALE: 1/8" = 1'-0"

DEMOLITION NOTES

1. EXISTING CONDITIONS SUCH AS LIGHTING, RECEPTACLES, ETC. WERE OBTAINED FROM AVAILABLE RECORD DRAWINGS AND FIELD SURVEYS AND ARE NOT WARRANTED TO BE COMPLETE OR CORRECT. CONTRACTOR SHALL VERIFY EXACT LOCATION OF ALL ELECTRICAL ITEMS IN THE FIELD PRIOR TO THE START OF ANY WORK.
2. SHOULD THE CONTRACTOR ENCOUNTER ANY MAJOR ELECTRICAL ITEMS, I.E. PANELS, FEEDERS, JUNCTION BOXES ETC. WHICH ARE NOT ADDRESSED ON THE DRAWINGS, HE SHALL BRING THEM TO THE ATTENTION OF THE ENGINEER. THE ENGINEER WILL REVIEW THE ITEM IN QUESTION AND GIVE THE NECESSARY DIRECTION.
3. THE OWNER SHALL BE GIVEN A FIRST RIGHT OF REFUSAL FOR ALL ELECTRICAL EQUIPMENT WHICH IS TO BE REMOVED. ALL ELECTRICAL EQUIPMENT WHICH IS DESIRED BY THE OWNER SHALL BE STORED ON THE SITE WHERE DIRECTED BY THE OWNER. THE CONTRACTOR SHALL PROMPTLY DISPOSE OF ALL ELECTRICAL ITEMS WHICH ARE REMOVED AND THE OWNER DOES NOT WANT TO KEEP.
4. IN GENERAL, ALL EXISTING ELECTRICAL DEVICES, LIGHTING FIXTURES, PANELS, CONDUITS, WIRING, JUNCTION BOXES, ETC. SHALL BE REMOVED IN THEIR ENTIRETY. THESE ITEMS ARE INDICATED WITH HEAVY DASHED LINES. ITEMS THAT ARE EXISTING TO REMAIN ARE INDICATED WITH A LIGHT CONTINUOUS LINE.
5. ALL BRANCH CIRCUIT AND TELEPHONE WIRING WHICH MUST BE IN SERVICE AND WHICH IS DISCONNECTED AS A RESULT OF THE DEMOLITION WORK SHALL BE PROPERLY RECONNECTED.
6. WHERE EXISTING DEVICES REMAIN IN WALLS WHICH RECEIVE A NEW FINISH, CONTRACTOR SHALL PROVIDE ALL NECESSARY OUTLET BOX EXTENSIONS, PLASTER RINGS, ETC. SO THAT DEVICES INSTALLED IN THE SAME MANNER AS EXISTING (I.E. FLUSH CONCEALED, ETC.).

DRAWING NOTES

- ① DISCONNECT AND IMMEDIATELY REINSTALL WALL MOUNTED ANTENNA FOR GROUND LINK SYSTEM DURING, SEE SHEET E0.02 FOR LOCATION.
- ② DEMOLISH INACTIVE ANTENNA TOWER STRUCTURE. DISCONNECT AND STORE SMALL ANTENNA MOUNTED ON STRUCTURE DURING DEMOLITION. ANTENNA TO BE REUSED, SEE E0.02 FOR LOCATION.
- ③ DEMOLISH INACTIVE SATELLITE DISH.

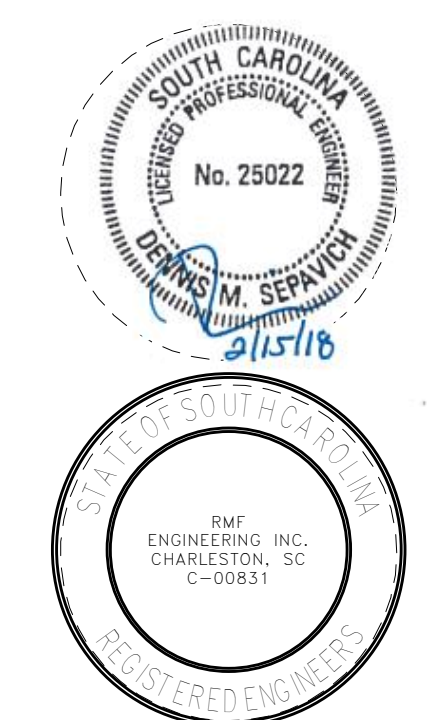
ARCHITECTURE
INTERIORS
PLANNING



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WATSON TATE SAVORY



LOWCOUNTRY REGIONAL AIRPORT TERMINAL EXPANSION
COLLETON COUNTY
WALTERBORO, SC

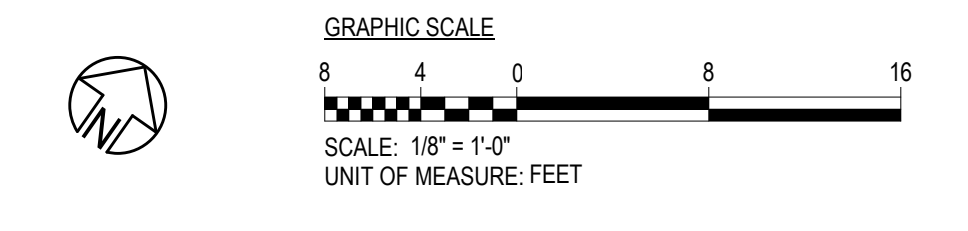


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#	DATE	REVISION

DEMO - POWER
AND SPECIAL
SYSTEMS PLAN

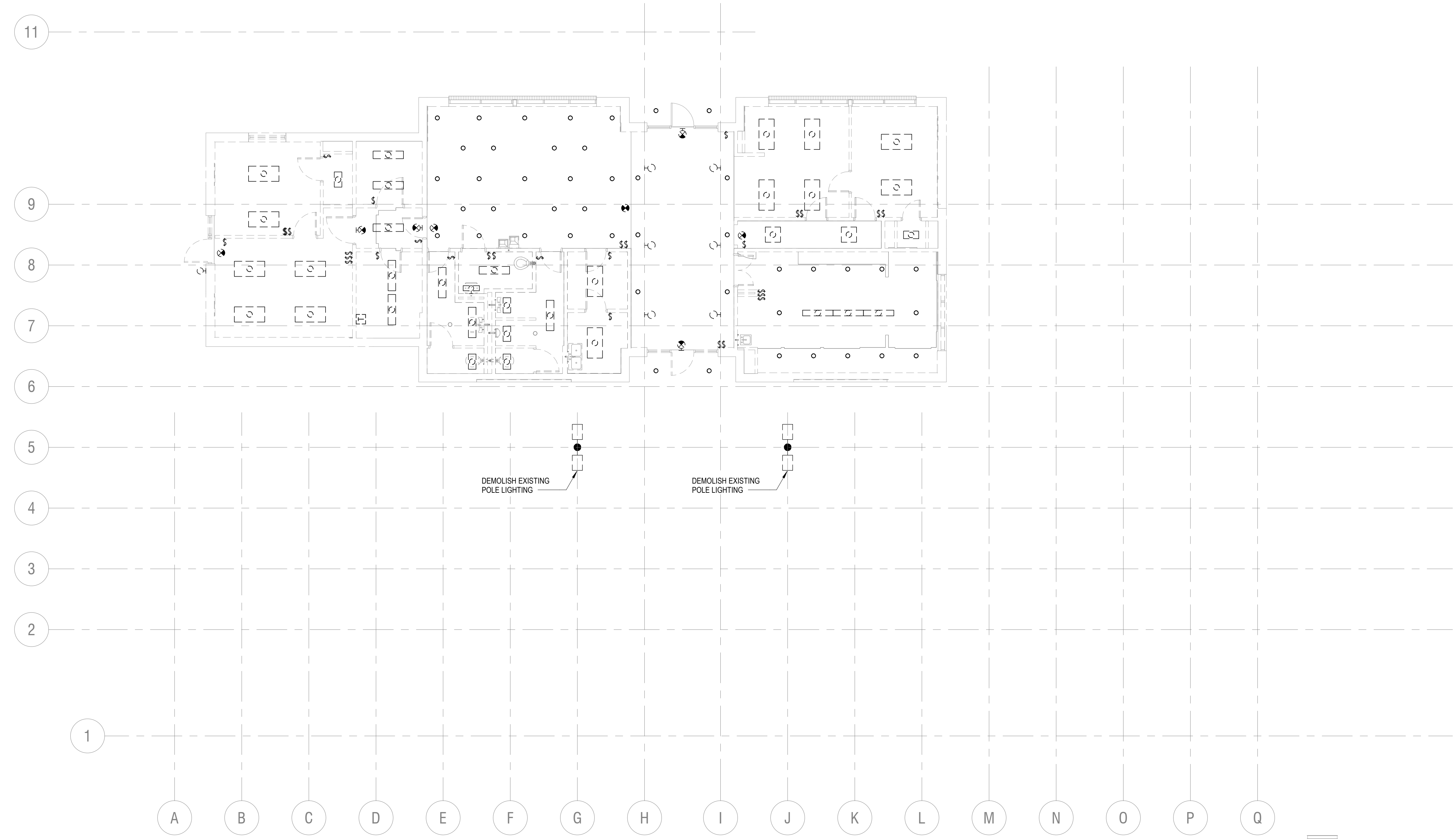
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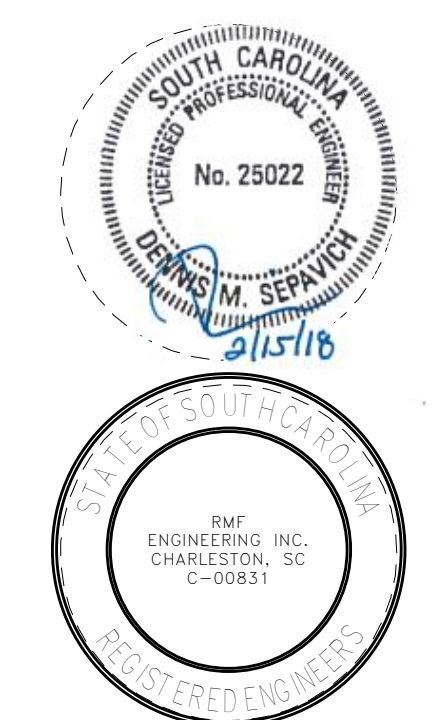
1
ED2.01
DEMO - LIGHTING PLAN
SCALE: 1/8" = 1'-0"

DEMOLITION NOTES

1. EXISTING CONDITIONS SUCH AS LIGHTING, RECEPTACLES, ETC. WERE OBTAINED FROM AVAILABLE RECORD DRAWINGS AND FIELD SURVEYS AND ARE NOT WARRANTED TO BE COMPLETE OR CORRECT. CONTRACTOR SHALL VERIFY EXACT LOCATION OF ALL ELECTRICAL ITEMS IN THE FIELD PRIOR TO THE START OF ANY WORK.
2. SHOULD THE CONTRACTOR ENCOUNTER ANY MAJOR ELECTRICAL ITEMS, I.E. PANELS, FEEDERS, JUNCTION BOXES ETC. WHICH ARE NOT ADDRESSED ON THE DRAWINGS, HE SHALL BRING THEM TO THE ATTENTION OF THE ENGINEER. THE ENGINEER WILL REVIEW THE ITEM IN QUESTION AND GIVE THE NECESSARY DIRECTION.
3. THE OWNER SHALL BE GIVEN A FIRST RIGHT OF REFUSAL FOR ALL ELECTRICAL EQUIPMENT WHICH IS TO BE REMOVED. ALL ELECTRICAL EQUIPMENT WHICH IS DESIRED BY THE OWNER SHALL BE STORED ON THE SITE WHERE DIRECTED BY THE OWNER. THE CONTRACTOR SHALL PROMPTLY DISPOSE OF ALL ELECTRICAL ITEMS WHICH ARE REMOVED AND THE OWNER DOES NOT WANT TO KEEP.
4. IN GENERAL, ALL EXISTING ELECTRICAL DEVICES, LIGHTING FIXTURES, PANELS, CONDUITS, WIRING, JUNCTION BOXES, ETC. SHALL BE REMOVED IN THEIR ENTIRETY. THESE ITEMS ARE INDICATED WITH HEAVY DASHED LINES. ITEMS THAT ARE EXISTING TO REMAIN ARE INDICATED WITH A LIGHT CONTINUOUS LINE.
5. ALL BRANCH CIRCUIT AND TELEPHONE WIRING WHICH MUST BE IN SERVICE AND WHICH IS DISCONNECTED AS A RESULT OF THE DEMOLITION WORK SHALL BE PROPERLY RECONNECTED.
6. WHERE EXISTING DEVICES REMAIN IN WALLS WHICH RECEIVE A NEW FINISH, CONTRACTOR SHALL PROVIDE ALL NECESSARY OUTLET BOX EXTENSIONS, PLASTER RINGS, ETC. SO THAT DEVICES INSTALLED IN THE SAME MANNER AS EXISTING (I.E. FLUSH CONCEALED, ETC.).



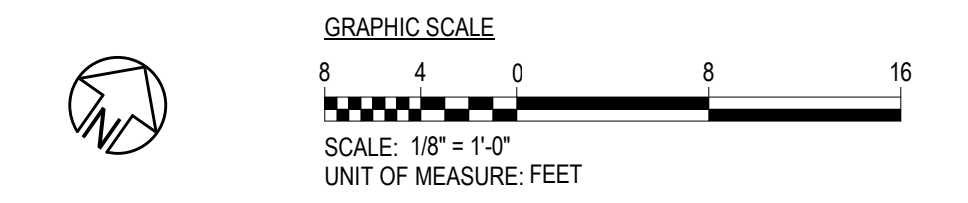
LOWCOUNTRY REGIONAL AIRPORT TERMINAL EXPANSION
COLLETON COUNTY
WALTERBORO, SC



ISSUE DATE: FEBRUARY 19, 2018
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DEMO - LIGHTING
PLAN



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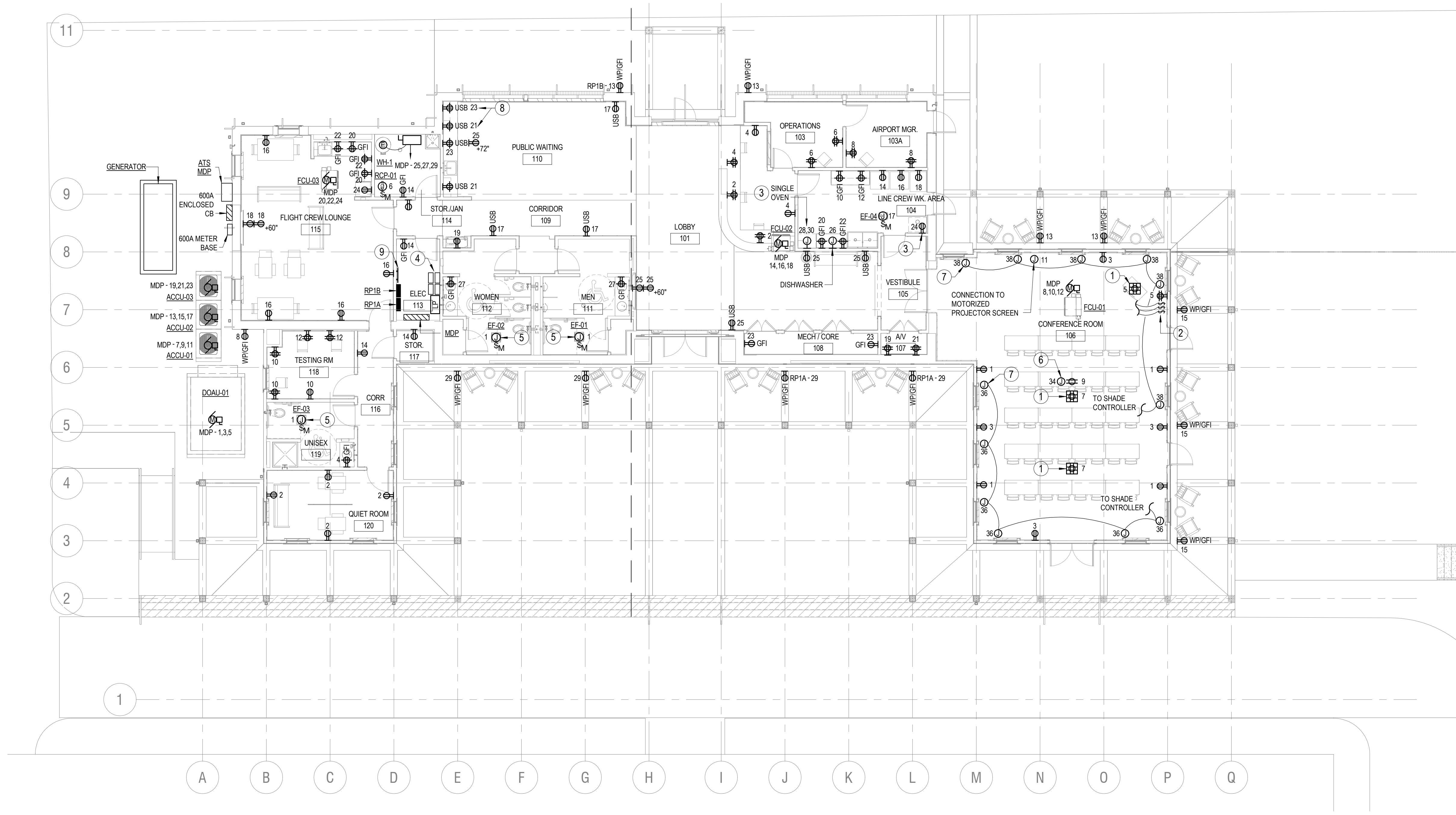
GENERAL NOTES

- REFER TO MECHANICAL EQUIPMENT SCHEDULE ON SHEET E6.02 FOR CONNECTIONS TO MECHANICAL EQUIPMENT.

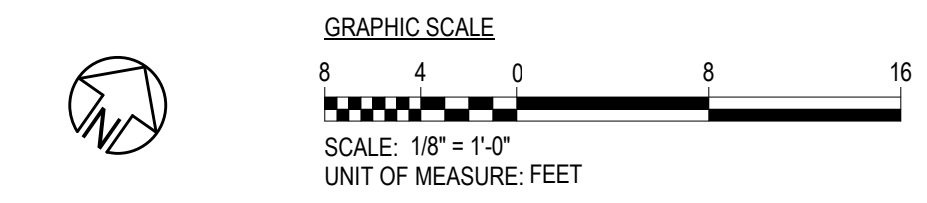
DRAWING NOTES

- (2) DUPLEX RECEPTACLES IN FLOORBOX. SEE SHEET E3.01 FOR BOX TYPE AND ADDITIONAL INFORMATION.
- SWITCHES FOR PROJECTOR SCREEN CONTROL, MOTORIZED PROJECTOR CONTROL, AND MOTORIZED SHADE CONTROL. PROVIDE SINGLE GANG BACKBOX AND 3/4" CONDUIT FOR EACH SWITCH TO EACH SYSTEM CONTROLLER. COORDINATE SIZE AND QUANTITY OF WIRES WITH EQUIPMENT PROVIDED.
- CONFIRM POWER REQUIREMENTS WITH ACTUAL EQUIPMENT FURNISHED.
- EMERGENCY LIGHTING INVERTERS. SEE SHEET E2.01 FOR MORE INFORMATION.
- EXHAUST FAN SHALL BE CONTROLLED VIA OCCUPANCY SENSOR IN ROOM.
- 120V CIRCUIT FOR MOTORIZED PROJECTOR MOUNT. COORDINATE EXACT REQUIREMENTS WITH ACTUAL EQUIPMENT FURNISHED PRIOR TO ROUGH-IN.
- CONNECTION TO MOTORIZED SHADE. COORDINATE EXACT REQUIREMENTS WITH ACTUAL EQUIPMENT FURNISHED PRIOR TO ROUGH-IN. TYPICAL.
- COUNTERTOP USB RECEPTACLE CIRCUITS SHALL BE PROTECTED BY GFCI CIRCUIT BREAKER.
- MAIN GROUND BUS BAR. SEE DETAIL ON SHEET E4.01 AND ONE-LINE DIAGRAM.

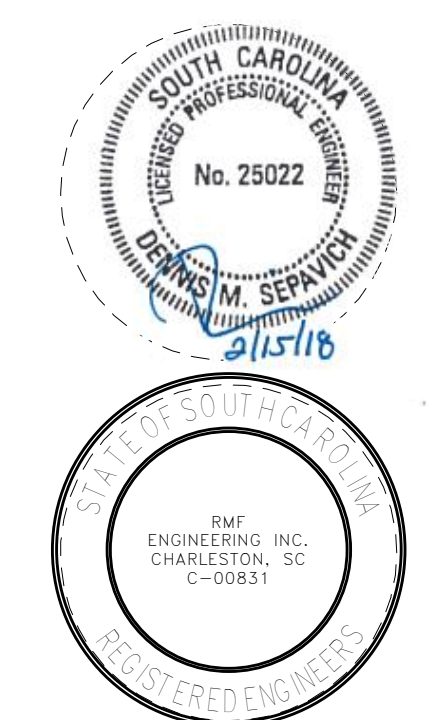
CIRCUITS INDICATED FED FROM PANEL RP1A UNLESS OTHERWISE NOTED. CIRCUITS INDICATED FED FROM PANEL RP1B UNLESS OTHERWISE NOTED.



1
E1.01
POWER PLAN - LEVEL 01
SCALE: 1/8" = 1'-0"



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POWER PLAN -
LEVEL 01

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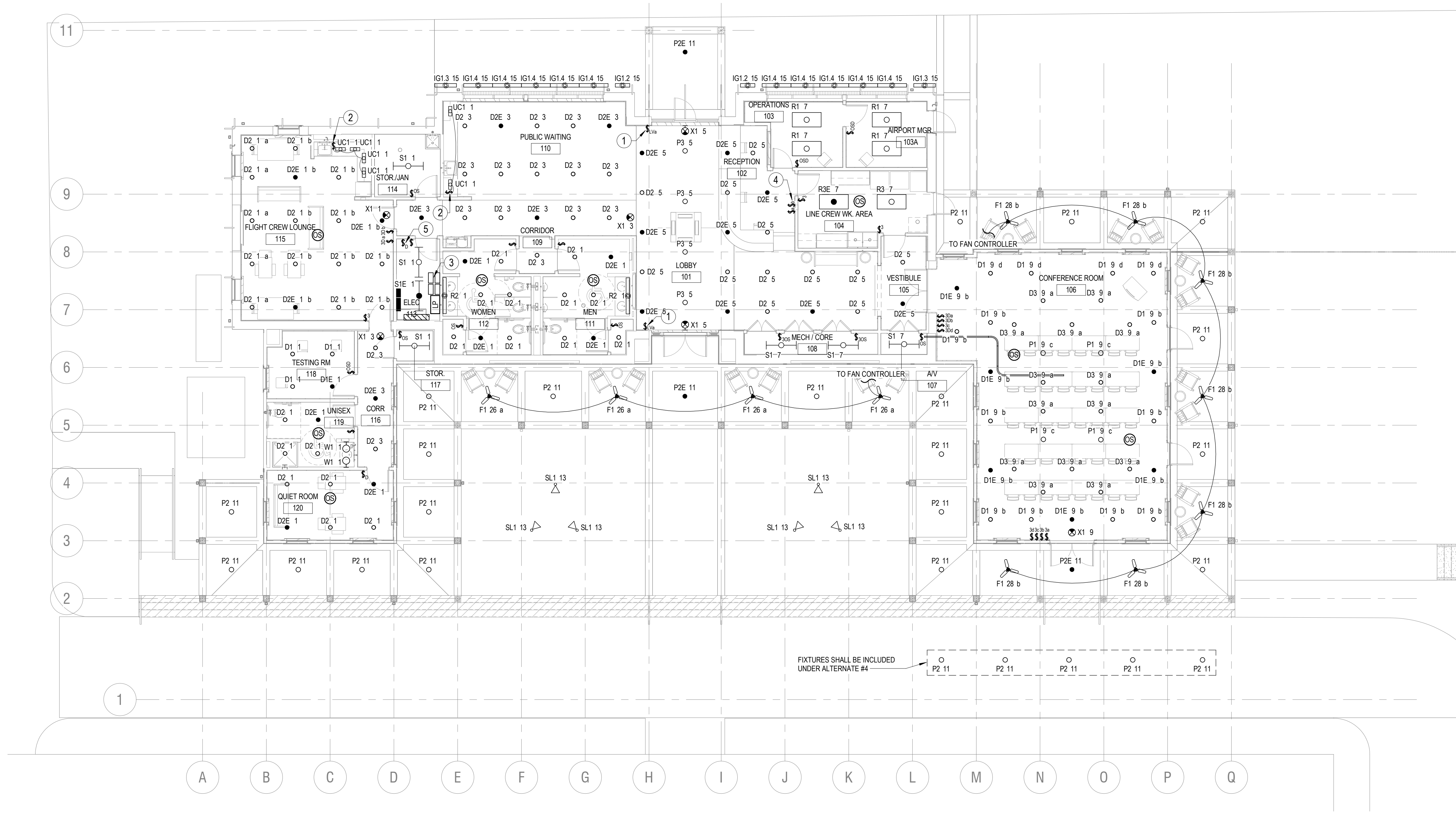
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GENERAL NOTES

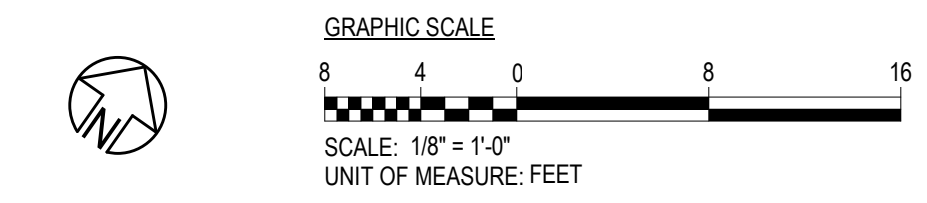
1. LIGHTING CIRCUITS INDICATED FED FROM PANEL RP1A UNLESS OTHERWISE NOTED.
2. PROVIDE AN ADDITIONAL UNSWITCHED HOT WIRE TO ALL FIXTURES WITH EMERGENCY BATTERY FOR BACKUP BATTERY OPERATION.
3. CONNECT EXIT SIGNS AHEAD OF ANY SWITCHING.
4. SEE RELAY SCHEDULE ON SHEET E6.01 FOR CIRCUITS ROUTED THROUGH BUILDING LIGHTING CONTROL PANEL.
5. CONTRACTOR SHALL PROVIDE CONDUIT RUN SHOP DRAWING TO ARCHITECT DETAILING CONDUITS TO CEILING FANS AND LIGHT FIXTURES ON EXTERIOR PORCH. NO CONDUIT SHALL BE RUN EXPOSED WITHOUT PRIOR APPROVAL FROM ARCHITECT. ANY CONDUITS RUN WITHOUT APPROVAL SHALL BE RELOCATED AS DIRECTED AT THE CONTRACTORS EXPENSE.

DRAWING NOTES

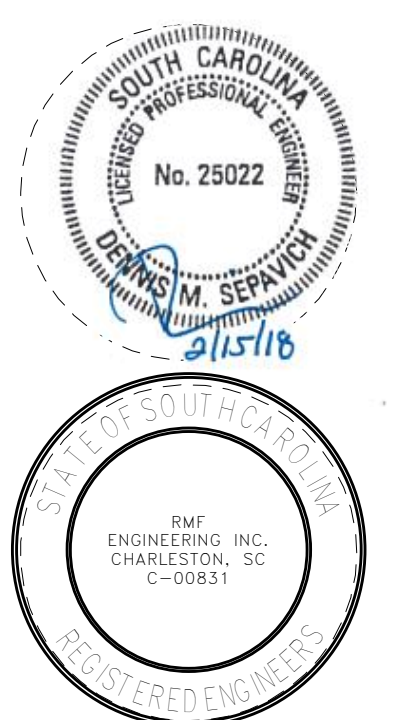
1. BUILDING LIGHTING CONTROL SYSTEM OVERRIDE SWITCH. SEE RELAY SCHEDULE ON SHEET E6.01 FOR LOADS CONTROLLED.
2. MOUNT SWITCH ABOVE COUNTERTOP TO SERVE UNDERCABINET LIGHTING.
3. PROVIDE (4) 125W INVERTERS, EMERGI-LITE #EMIL-125 OR APPROVED EQUAL. FOR FIXTURES INDICATED AS EMERGENCY ON CIRCUITS RP1A-1.3.5.9. EACH CIRCUIT SHALL BE SUPPLIED FROM A SEPARATE INVERTER. PROVIDE AN ADDITIONAL UNSWITCHED HOT WIRE TO EACH INVERTER FOR OPERATION OF UNIT UPON LOSS OF UTILITY POWER. SEE DETAIL 2 ON SHEET E4.01.
4. FAN CONTROLLERS. SEE FLOOR PLAN FOR FANS CONTROLLED.
5. PROVIDE A 0-10V DIMMER SWITCH FOR CONTROL OF TYPE IG1 LIGHT FIXTURES ON BUILDING EXTERIOR.



1
E2.01
ELECTRICAL LIGHTING PLAN - LEVEL 01
SCALE: 1/8" = 1'-0"



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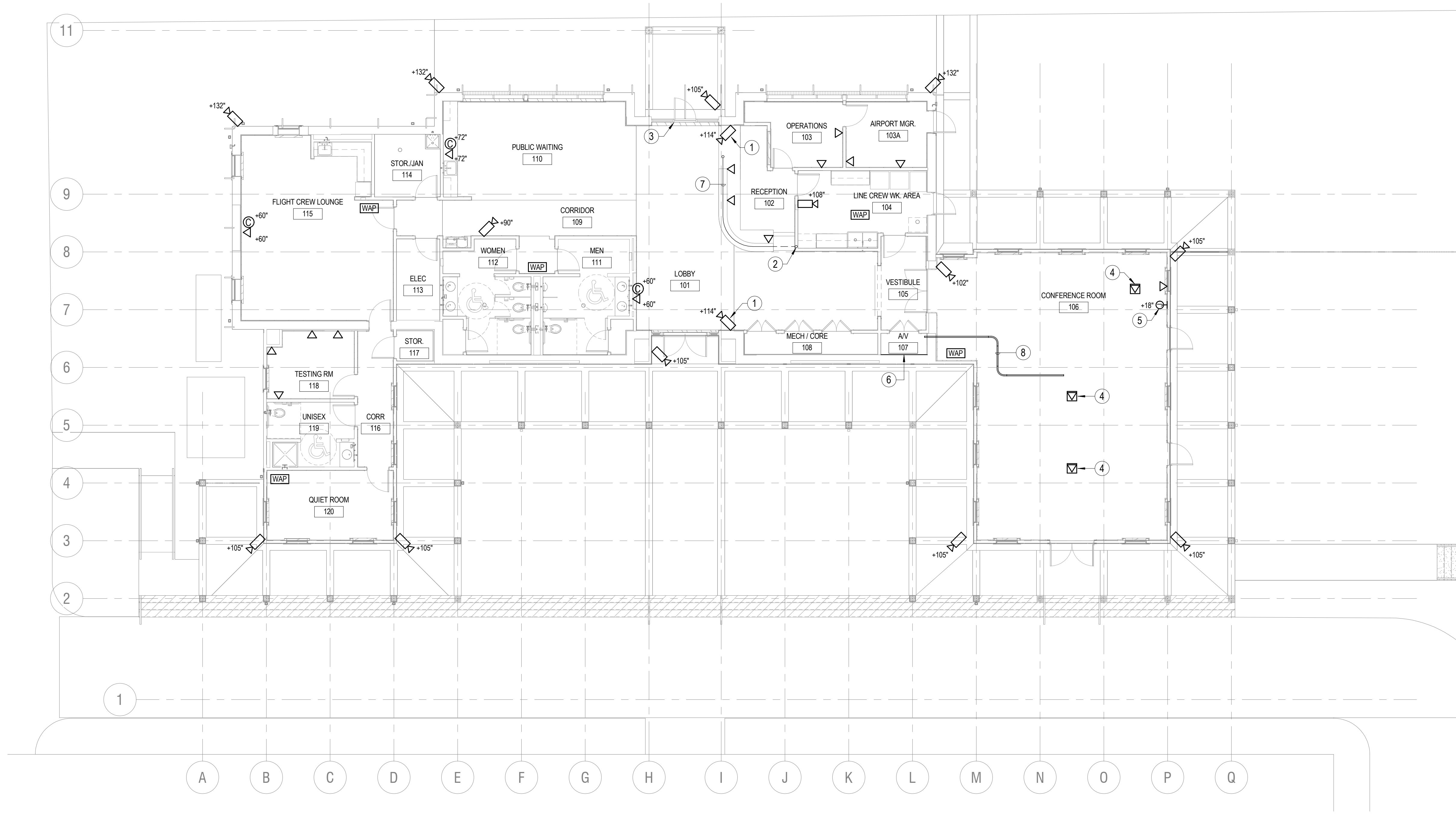
LIGHTING PLAN -
LEVEL 01

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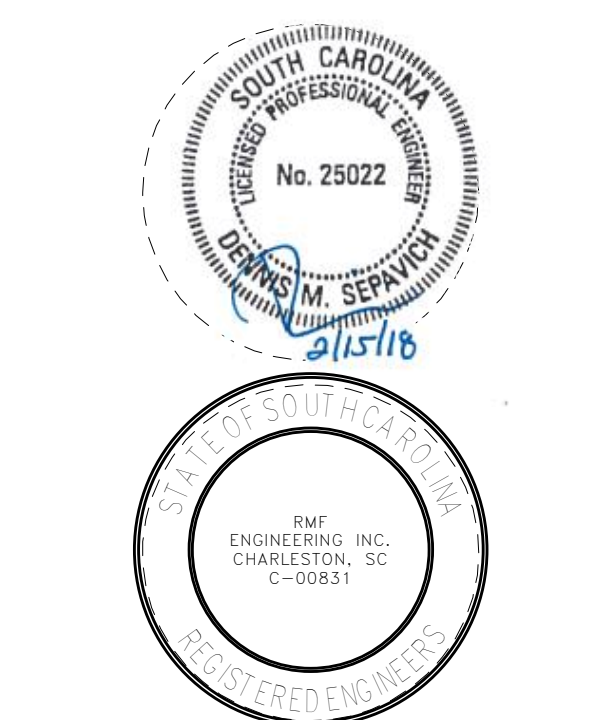
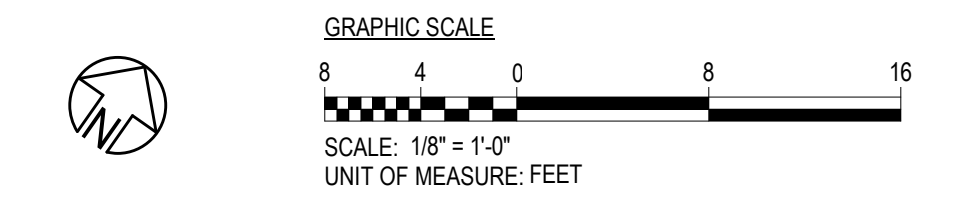
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DRAWING NOTES

- 1 VERIFY ROUGH-IN HEIGHT ON WALL WITH OWNER PRIOR TO INSTALLATION.
- 2 ROUTE CONDUIT TO ANTENNA POLE TO SERVE RELOCATED ANTENNA. SEE SHEET E03.02 FOR LOCATION.
- 3 PROVIDE A 4"x4" JUNCTION BOX AND 1" CONDUIT WITH PULL STRING BACK TO AV 107 FOR FUTURE ACCESS CONTROL SYSTEM. PROVIDE 3/4" CONDUIT FROM JUNCTION BOX INTO DOOR FRAME. LOCATE BOX ABOVE NEAREST ACCESSIBLE CEILING.
- 4 PROVIDE 4 GANG FLOORBOX, LEGRAND #EFRASS-00 WITH #EFR45B7CXXX COVER, OR APPROVED EQUAL. FLOORBOX FINISH TO BE SELECTED BY ARCHITECT. PROVIDE (2) 1 1/4" CONDUITS WITH PULL STRING TO AV 107. SEE E1.01 FOR ADDITIONAL DEVICES IN BOX.
- 5 PROVIDE DOUBLE GANG BACKBOX AND 1 1/4" CONDUIT WITH PULL STRING FOR DATA/AV TO AV 107.
- 6 PROVIDE 6.5"X4" TELECOM BACKBOARD, AC GRADE OR BETTER, FOR ENTIRE LENGTH OF BACK WALL OF AV 107. PAINT ALL SIDES WITH TWO COATS OF WHITE FIRE RETARDANT PAINT.
- 7 1" CONDUIT ROUTED CONCEALED IN CASEWORK TO RECEIVER. COORDINATE EXACT LOCATION WITH OWNER.
- 8 PROVIDE 2" CONDUIT WITH PULL STRING FROM CEILING PROJECTOR ENCLOSURE TO AV 107. COORDINATE EXACT LOCATION AND ROUTING IN THE FIELD.



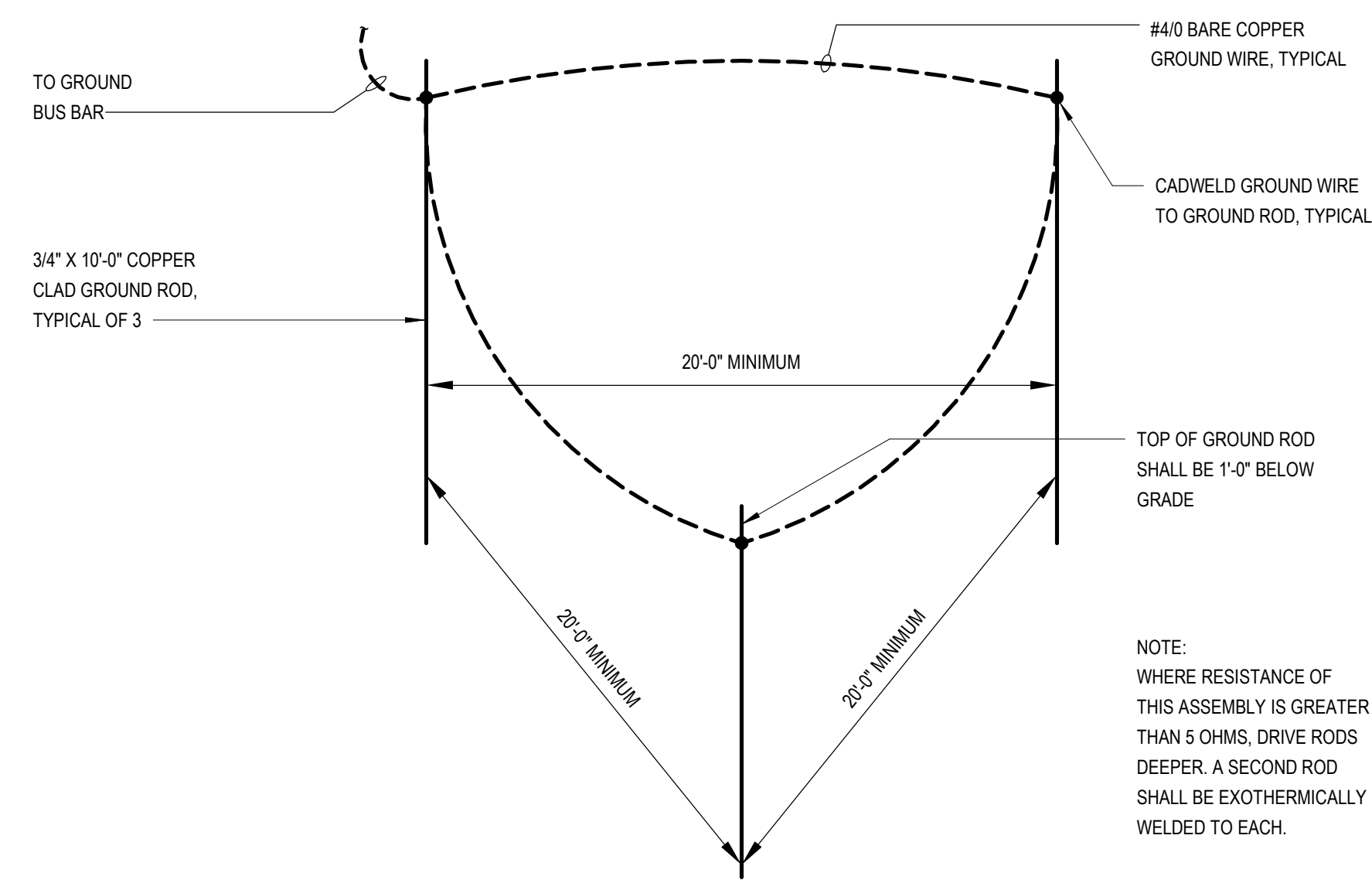
1 SPECIAL SYSTEMS PLAN - LEVEL 01
SCALE: 1/8" = 1'-0"



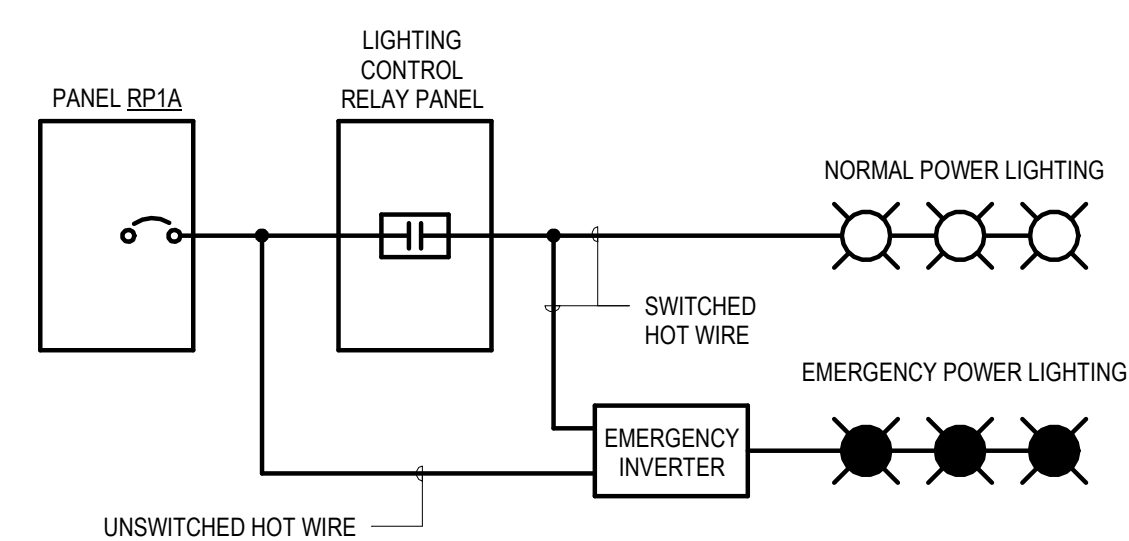
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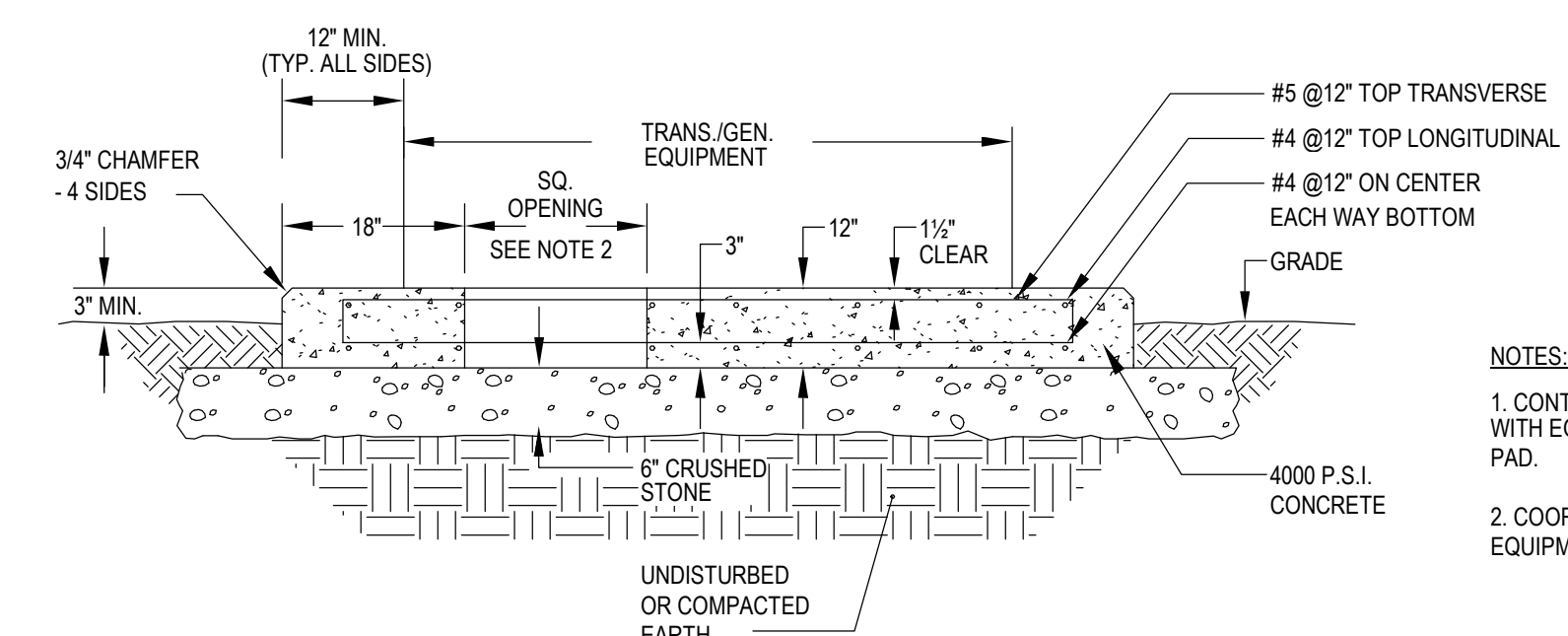
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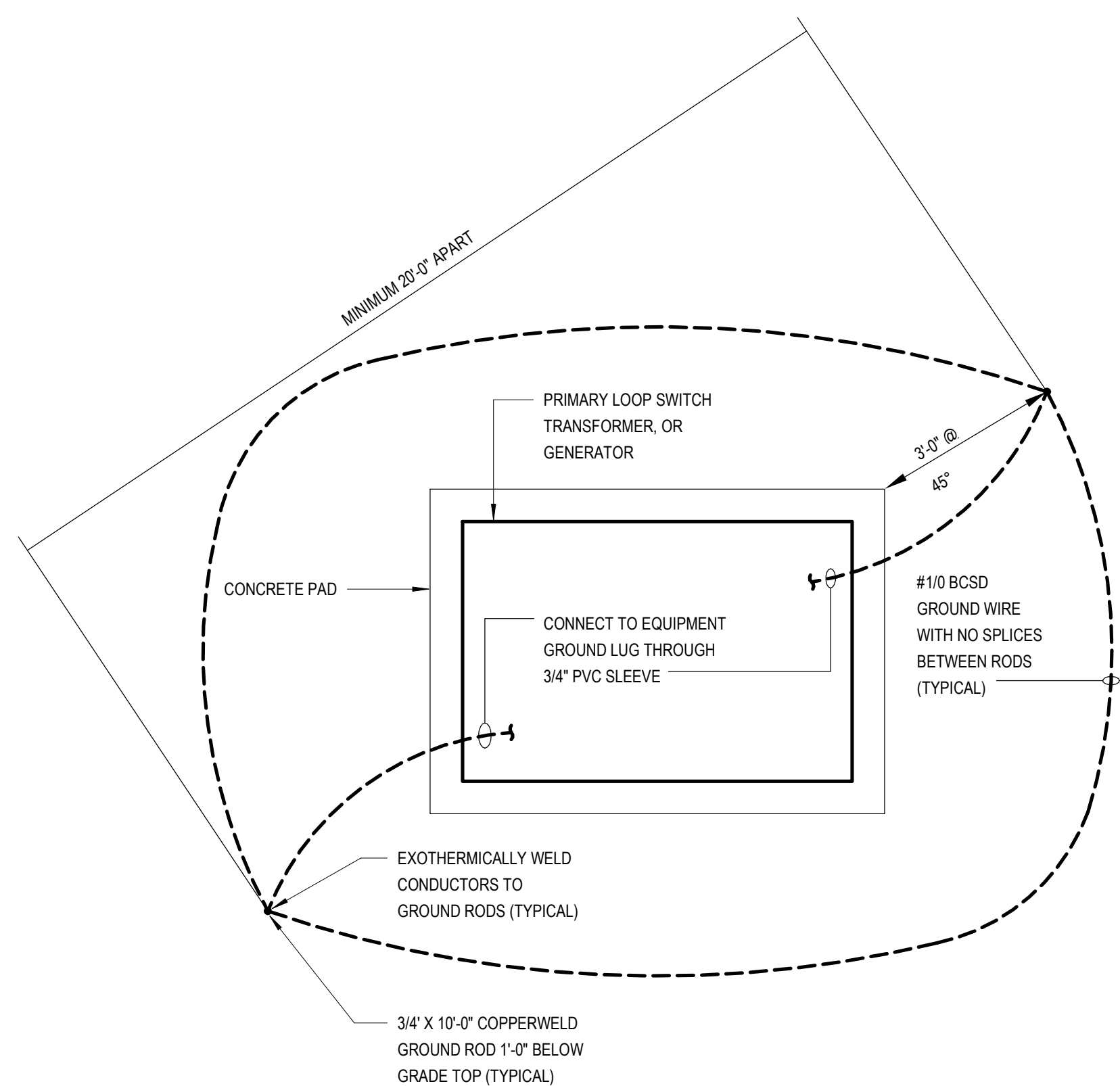
1 **DETAIL - GROUND GRID**
SCALE: N.T.S.



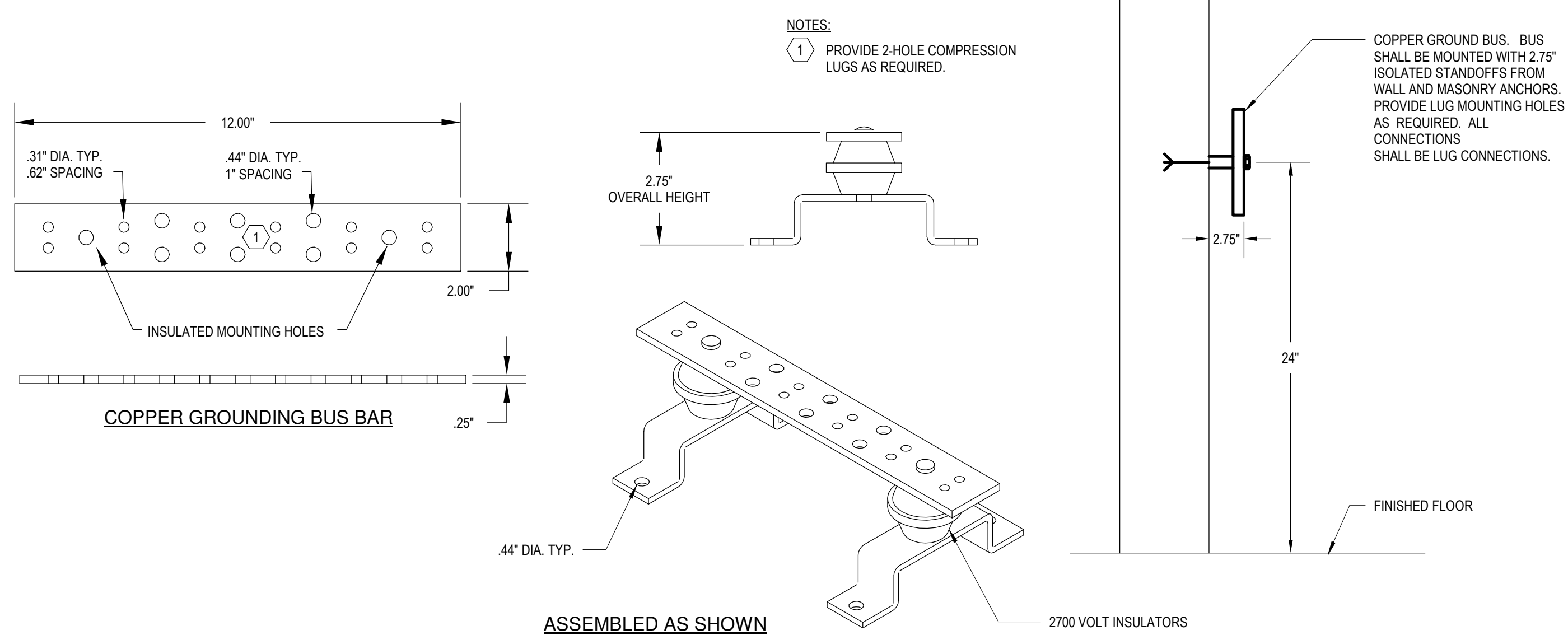
2 **DETAIL - EMERGENCY INVERTER SCHEMATIC**
SCALE: N.T.S.



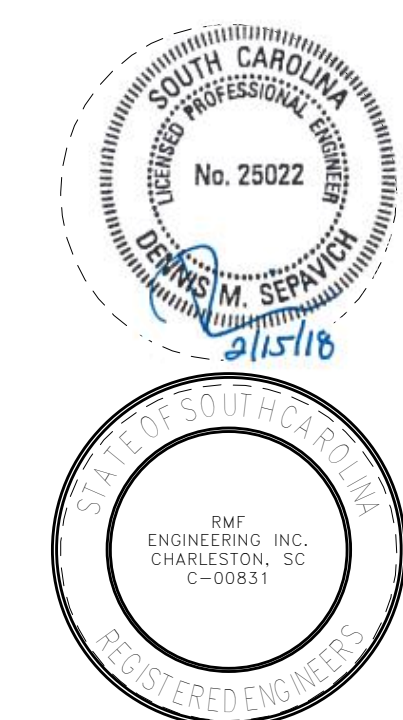
3 **DETAIL - GENERATOR PAD**
SCALE: N.T.S.



4 **DETAIL - OUTDOOR EQUIPMENT GROUNDING**
SCALE: N.T.S.



5 **DETAIL - GROUND BUS BAR**
SCALE: N.T.S.

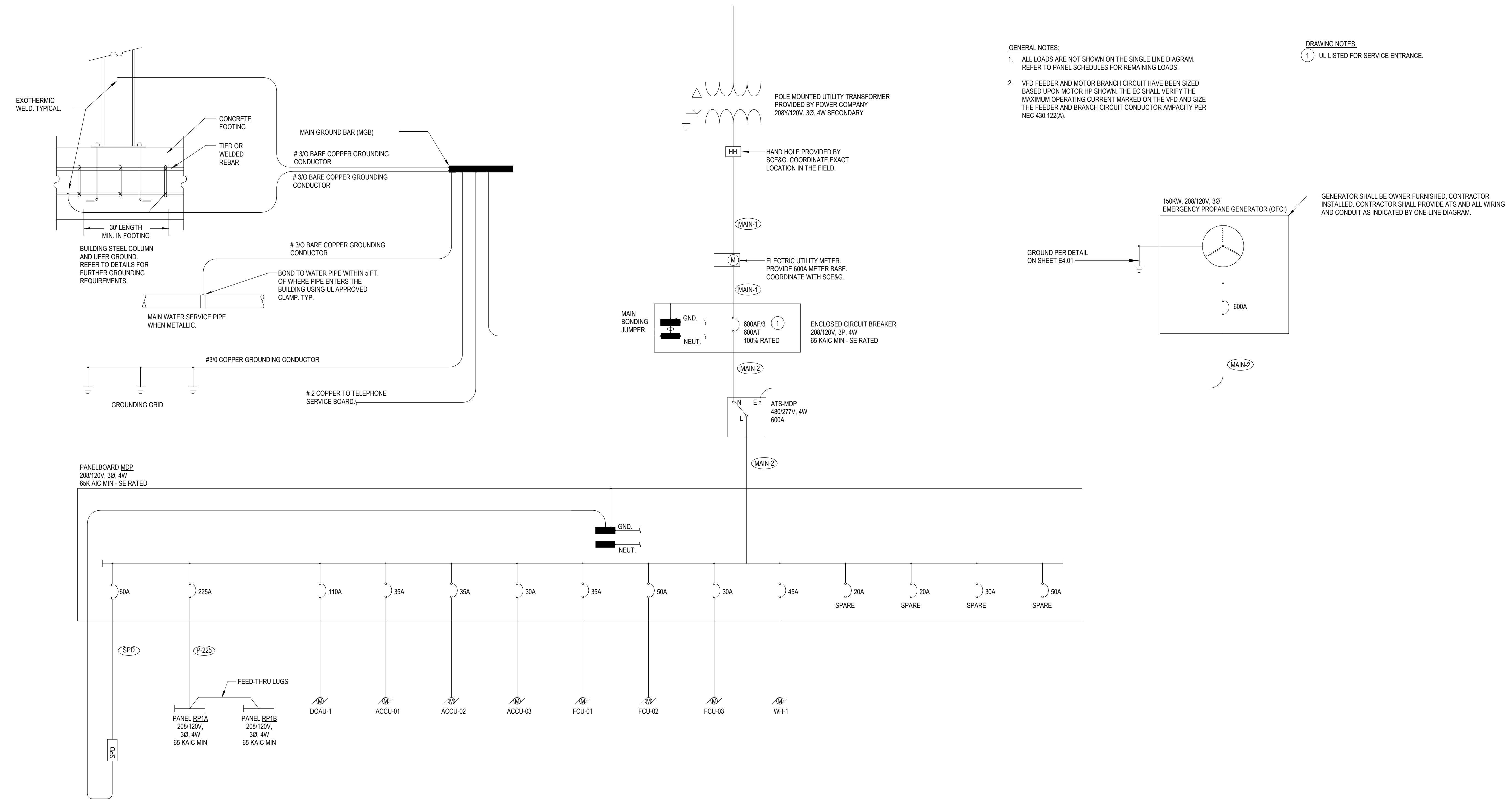


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GENERAL NOTES:
 1. ALL LOADS ARE NOT SHOWN ON THE SINGLE LINE DIAGRAM. REFER TO PANEL SCHEDULES FOR REMAINING LOADS.
 2. VFD FEEDER AND MOTOR BRANCH CIRCUIT HAVE BEEN SIZED BASED UPON MOTOR HP SHOWN. THE EC SHALL VERIFY THE MAXIMUM OPERATING CURRENT MARKED ON THE VFD AND SIZE THE FEEDER AND BRANCH CIRCUIT CONDUCTOR AMPACITY PER NEC 430.122(A).

DRAWING NOTES:
 1. UL LISTED FOR SERVICE ENTRANCE.

GENERATOR SHALL BE OWNER FURNISHED, CONTRACTOR INSTALLED. CONTRACTOR SHALL PROVIDE ATS AND ALL WIRING AND CONDUIT AS INDICATED BY ONE-LINE DIAGRAM.

FEEDER SCHEDULE (600V UNLESS OTHERWISE NOTED)

LEGEND:					EXAMPLE:				
PANEL	MOTOR	TPTS - XFMR (PRIMARY/SECONDARY)	P-100	M-30	TP-75	100A PANEL FEEDER	30HP MOTOR FEEDER	75KVA TRANSFORMER PRIMARY	
MAIN-1			P-150						
MAIN-2			P-200						
SPD			P-225						
P-20			P-250						
P-25			P-300						
P-35			P-400						
P-45			P-500						
P-60			P-800						
P-70			P-1200						
P-100			CH						
P-110			FPE						
P-125			GEN1						
			GEN2						
			PPT						

FEEDER SCHEDULE (600V UNLESS OTHERWISE NOTED)

LEGEND:					EXAMPLE:				
PANEL	MOTOR	TPTS - XFMR (PRIMARY/SECONDARY)	P-100	M-30	TP-75	100A PANEL FEEDER	30HP MOTOR FEEDER	75KVA TRANSFORMER PRIMARY	
MAIN-1			TP-75						
MAIN-2			TP-112						
SPD			TP-150						
P-20			TP-225						
P-25			TP-300						
P-35			TP-400						
P-45			TP-500						
P-60			TP-800						
P-70			TP-1200						
P-100			CH						
P-110			FPE						
P-125			GEN1						
			GEN2						
			PPT						

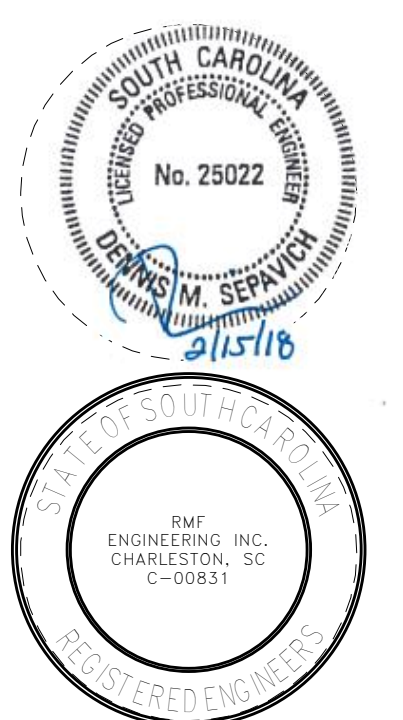
ARCHITECTURE
INTERIORS
PLANNING

rmf RMF ENGINEERING, INC.
194 Seven Farms Drive, Suite G
Charleston, SC 29402
RMF Project #: 315176 AD

WTS
WATSON TATE SAVORY

COLLETON COUNTY
SOUTH CAROLINA

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ELECTRICAL
ONE-LINE
DIAGRAM

1509
FIRM PROJECT NO. SHEET
E5.01

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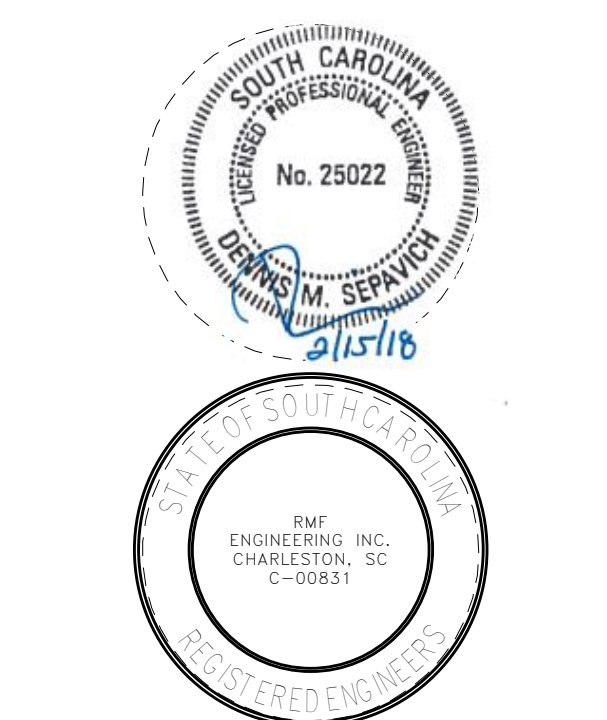
LIGHTING FIXTURE SCHEDULE														
	DESCRIPTION	LOUVER/LENS	LAMPS				BALLAST		VOLTS	WATTS	MOUNTING	MOUNTING SURFACE	REMARKS	BASIS OF DESIGN MANUFACTURER
			TYPE	WATTS	QTY.	COLOR TEMP.	TYPE	QTY.						
D1	6" OPEN LED DOWNLIGHT, 1300 NOMINAL LUMENS, IC RATED, 0-10V DIMMABLE	-	LED	15	1	2700 K	LED DRIVER	1	120	15	RECESSED	GYP SUM BOARD	COORDINATE TRIM FINISH WITH ARCHITECT	SPECTRUM #REF16LEDXT-13L-27K-XWD-DS101-RD6F-FINISH-TRIM
D1E	SAME AS TYPE D1, ROUTED THROUGH EMERGENCY INVERTER	-	LED	15	1	2700 K	LED DRIVER	1	120	15	RECESSED	GYP SUM BOARD	COORDINATE TRIM FINISH WITH ARCHITECT	SPECTRUM #REF16LEDXT-13L-27K-XWD-DS101-RD6F-FINISH-TRIM
D2	6" OPEN LED DOWNLIGHT, 1000 NOMINAL LUMENS, IC RATED, 0-10V DIMMABLE	-	LED	11	1	2700 K	LED DRIVER	1	120	11	RECESSED	GYP SUM BOARD	COORDINATE TRIM FINISH WITH ARCHITECT	SPECTRUM #REF16LEDXT-10L-27K-XWD-DS101-RD6F-FINISH-TRIM
D2E	SAME AS TYPE D2, ROUTED THROUGH EMERGENCY INVERTER	-	LED	11	1	2700 K	LED DRIVER	1	120	11	RECESSED	GYP SUM BOARD	COORDINATE TRIM FINISH WITH ARCHITECT	SPECTRUM #REF16LEDXT-10L-27K-XWD-DS101-RD6F-FINISH-TRIM
D3	6" OPEN LED DOWNLIGHT, 2000 NOMINAL LUMENS, IC RATED, 0-10V DIMMABLE	-	LED	24	1	2700 K	LED DRIVER	1	120	24	RECESSED	GYP SUM BOARD	COORDINATE TRIM FINISH WITH ARCHITECT	SPECTRUM #REF16LEDXT-20L-27K-XWD-DS101-RD6F-FINISH-TRIM
F1	CEILING FAN, WET-LOCATION RATED	-	-	-	0	-	-	-	120	71	SUSPENDED	STRUCTURE		HUNTER FAN COMPANY SEA AIR #53060
IG1.2	IN-GRADE ASYMMETRIC LINEAR WALLWASH, 5 WFT, 0-10V DIMMABLE, 2' SECTION	ACRYLIC	LED	10	1	2700 K	LED DRIVER	1	120	10	RECESSED	IN-GRADE	COLOR TEMPERATURE TO BE DETERMINED BY ARCHITECT DURING SHOP DRAWINGS.	LUMENPULSE #LOI ASHRAE-100/277-24-COLORTEMP-WW-TS2.5-DIM
IG1.3	IN-GRADE ASYMMETRIC LINEAR WALLWASH, 5 WFT, 0-10V DIMMABLE, 3' SECTION	ACRYLIC	LED	15	1	2700 K	LED DRIVER	1	120	15	RECESSED	IN-GRADE	COLOR TEMPERATURE TO BE DETERMINED BY ARCHITECT DURING SHOP DRAWINGS.	LUMENPULSE #LOI ASHRAE-100/277-36-COLORTEMP-WW-TS2.5-DIM
IG1.4	IN-GRADE ASYMMETRIC LINEAR WALLWASH, 5 WFT, 0-10V DIMMABLE, 4' SECTION	ACRYLIC	LED	20	1	2700 K	LED DRIVER	1	120	20	RECESSED	IN-GRADE	COLOR TEMPERATURE TO BE DETERMINED BY ARCHITECT DURING SHOP DRAWINGS.	LUMENPULSE #LOI ASHRAE-100/277-48-COLORTEMP-WW-TS2.5-DIM
P1	GLASS 3-BULB PENDANT	GLASS	INCANDESCENT	40	3	2700 K	-	-	120	40	SURFACE	ACOUSTIC CEILING	COORDINATE MOUNTING HEIGHT WITH ARCHITECT.	RESTORATION HARDWARE #EDISON MILK GLASS 3-BULB PENDANT
P2	EXTERIOR DECORATIVE LED PENDENT	GLASS	LED	12	1	2700 K	LED DRIVER	1	120	12	SUSPENDED	STRUCTURE	COORDINATE FINISH AND MOUNTING HEIGHT WITH ARCHITECT	MODERN FORMS #PD-W1915-27
P2E	SAME AS TYPE P2, ROUTED THROUGH EMERGENCY INVERTER	GLASS	LED	12	1	2700 K	LED DRIVER	1	120	12	SUSPENDED	STRUCTURE	COORDINATE FINISH AND MOUNTING HEIGHT WITH ARCHITECT	MODERN FORMS #PD-W1915-27
P3	DECORATIVE GLASS PENDANT	GLASS	LED	11	1	2700 K	-	-	120	11	SUSPENDED	STRUCTURE	COORDINATE MOUNTING HEIGHT WITH ARCHITECT. PROVIDE CREE 75W EQUIVALENT LED SCREW BASE A19 BULB #A19-75W-27K	VOLUME LIGHTING #V3711-44
R1	2x4 LED ARCHITECTURAL TROFFER - 4800 NOMINAL LUMENS, DRYWALL FLANGE KIT	METAL PERF BASKET	LED	40	1	3000 K	LED DRIVER	1	120	40	RECESSED	GYP SUM BOARD		COLUMBIA #LSTE24-30MLG-MPO-EU-FK24
R2	LED RECESSED PERIMETER WALL WASH	ACRYLIC	LED	35	1	2700 K	LED DRIVER	1	120	35	RECESSED	GYP SUM BOARD		PRUDENTIAL #P43-PSTD-REG3-LED27-MO-5-TMW-AWW-D1G-WTW-SC-X3B-UNV-ND COLUMBIA #LSTE24-30VLG-MPO-EU-FK24
R3	2x4 LED ARCHITECTURAL TROFFER - 7800 NOMINAL LUMENS, DRYWALL FLANGE KIT	METAL PERF BASKET	LED	65	1	3000 K	LED DRIVER	1	120	40	RECESSED	GYP SUM BOARD		COLUMBIA #LSTE24-30VLG-MPO-EU-ELL14-FK24
R3E	SAME AS TYPE R3 WITH EMERGENCY BATTERY BACKUP, 1400 LUMENS	METAL PERF BASKET	LED	65	1	3000 K	LED DRIVER	1	120	40	RECESSED	GYP SUM BOARD		COLUMBIA #LSTE24-30VLG-MPO-EU-ELL14-FK24
S1	1X4 LED WRAP AROUND	ACRYLIC	LED	48	1	3500 K	LED DRIVER	1	120	48	SURFACE	GYP SUM BOARD		COLUMBIA #LAW-4-35-ML-E-U
S1E	SAME AS TYPE S1 WITH EMERGENCY BATTERY BACKUP, 1400 LUMENS	ACRYLIC	LED	48	1	3500 K	LED DRIVER	1	120	48	SURFACE	GYP SUM BOARD		COLUMBIA #LAW-4-35-ML-E-U-ELL14
SL1	LED SITE FLOOD LIGHT	GLASS	LED	16	1	2700 K	LED DRIVER	1	120	16	SURFACE	IN-GRADE		LSI #XALV-AL-LED20-VW-WF-120V-SSUF-FINISH-SPB
UC1	LED UNDER CABINET LIGHTING, 16" LENGTH	ACRYLIC	LED	8	1	3000 K	LED DRIVER	1	120	8	SURFACE	UNDER CABINET		LITON #LULED1608A
W1	GLASS WALL SCONCE	GLASS	INCANDESCENT	40	1	2700 K	-	-	120	40	SURFACE	WALL		RESTORATION HARDWARE #EDISON MILK GLASS TALL SCONCE
X1	RED LED EDGE LIT EXIT SIGN, BATTERY BACKUP		RED LED		1				120	0	UNIVERSAL		COORDINATE QUANTITY OF FACES AND ARROWS WITH SYMBOL SHOWN ON DRAWINGS	LIGHTALARMS #SPLEDNARMDUAD

BUILDING LIGHTING CONTROL RELAY PANEL SCHEDULE							
RELAY	DESCRIPTION	VOLTAGE	PHASE	CIRCUIT NUMBER	CONTROL		LOCAL OVERRIDE SWITCH
					ZONE	TC	
1	LTG - CORRIDOR/WAITING	120	1	TRPA-3	1	YES	NO L/v
2	LTG - LOBBY/RECEPTION	120	1	TRPA-5	1	YES	NO L/v
3	SPARE	120	1				
4	LTG - EXTERIOR	120	1	TRPA-11	2	YES	NO NO
5	LTG - LANDSCAPE	120	1	TRPA-13	3	YES	NO NO
6	LTG - EXT. WALL WASH	120	1	TRPA-15	4	YES	NO NO
7	SPARE						
8	SPARE						

NOTES:
 LIGHTING CONTROL PANEL SHALL HAVE 8 FULLY PROGRAMMABLE RELAY GROUPS, DAYLIGHT SAVINGS TIME ADJUSTMENT AND ASTRONOMIC TIMECLOCK, DRY CONTACT INTERFACE WITH QUANTITY AND TYPE OF RELAYS SUITABLE FOR LOADS SERVED.
 TIME CLOCK SHALL TURN LIGHTS OFF AT THE TIME DETERMINED BY THE OWNER. SYSTEM SHALL FLASH LIGHTS FIVE MINUTES BEFORE ANY SCHEDULED OFF SEQUENCE. LOCAL OVERRIDE SWITCHES SHALL KEEP LIGHTS ON FOR AN ADDITIONAL MAXIMUM OF 4 HOURS. COORDINATE SETTINGS WITH OWNER/ARCHITECT.
 ALL BRANCH CIRCUIT WIRING INDICATED SHALL BE ROUTED THROUGH THE LIGHTING CONTROL PANEL.



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PANELBOARD: MDP															
LOCATION: ELEC 113				MAINS: MLO				AMPS: 600							
MOUNTING: Surface				VOLTS: 208/120 Wye											
ENCL NEMA: Type 1				PHASE: 3											
MIN AIC: SEE ONE-LINE DIAGRAM				WIRES: 4											
PANEL NOTES:															
PROVIDE GROUND BUS PROVIDE FULL SIZE NEUTRAL BUS UNLESS NOTED OTHERWISE															
WIRE SIZE	LOAD DESCRIPTION	P	TRIP AMPS	TYPE	CKT	A	B	C	CKT	TYPE	TRIP AMPS	P	LOAD DESCRIPTION	WIRE SIZE	
SEE MECH EQUIP. SCHEDULE	DOAU-1	3	110 A		1	13.09	15.94						225 A 3	PANEL RP1A/RP1B	SEE ONE-LINE DIAGRAM
SEE MECH EQUIP. SCHEDULE	ACCU-01	3	35 A		7	2.52	4.08						35 A 3	FCU-01	SEE MECH EQUIP. SCHEDULE
SEE MECH EQUIP. SCHEDULE	ACCU-02	3	35 A		13	3.24	5.64						50 A 3	FCU-02	SEE MECH EQUIP. SCHEDULE
SEE MECH EQUIP. SCHEDULE	ACCU-03	3	30 A		19	2.16	3.60						30 A 3	FCU-03	SEE MECH EQUIP. SCHEDULE
3#8, 1#10 GND, 3/4" CND	WH-1	3	45 A		25	4.00	0.00						60 A 3	SPD	--
--	SPARE	3	20 A		27								30 A 3	SPARE	--
--	SPARE	3	20 A		31	0.00	0.00						50 A 3	SPARE	--
TOTAL LOAD:						54.28 kVA	51.38 kVA	48.51 kVA							
BREAKER TYPE KEYS:															
LO - INDICATES C.B. EQUIPPED WITH "LOCK-ON" DEVICE GF - INDICATES C.B. IS GROUND FAULT TYPE (5mA FOR PERSONNEL) ST - INDICATES C.B. EQUIPPED WITH SHUNT TRIP DEVICE HT - INDICATES C.B. EQUIPPED WITH 30mA GROUND FAULT FOR EQUIPMENT															
Load Classification	Connected Load	Demand Factor	Estimated Demand	Panel Totals											
LTG	2.534	100.00%	2.534	Total Conn. Load: 154.17 kVA											
Other	1.100	100.00%	1.100	Total Est. Demand: 147.71 kVA											
REC	22.920	71.82%	16.460	Total Conn. Current: 427.93 A											
Equipment	23.080	100.00%	23.080	Total Est. Demand Current: 410.00 A											
HVAC	104.564	100.00%	104.564												

PANELBOARD: RP1A															
LOCATION: ELEC 113				MAINS: MLO				AMPS: 225							
MOUNTING: Surface				VOLTS: 208/120 Wye											
ENCL NEMA: Type 1				PHASE: 3											
MIN AIC: SEE ONE-LINE DIAGRAM				WIRES: 4											
PANEL NOTES:															
PROVIDE GROUND BUS PROVIDE FULL SIZE NEUTRAL BUS UNLESS NOTED OTHERWISE															
WIRE SIZE	LOAD DESCRIPTION	P	TRIP AMPS	TYPE	CKT	A	B	C	CKT	TYPE	TRIP AMPS	P	LOAD DESCRIPTION	WIRE SIZE	
2#12, 1#12 GND	LTG BATH/LOUNGE/QUIET	1	20 A		1	1.25	0.72						20 A 1	REC QUIET ROOM 120	2#12, 1#12 GND
2#12, 1#12 GND	LTG WAITING/CORRIDOR	1	20 A		3			0.22	0.18				20 A 1	REC UNISEX 119	2#12, 1#12 GND
2#12, 1#12 GND	LTG LOBBY/RECEPTION	1	20 A		5					0.23	0.21		20 A 1	RCP-01	2#12, 1#12 GND
2#12, 1#12 GND	LTG OFFICE/LINE/MECH/AV	1	20 A		7	0.43	0.18						20 A 1	REC EXTERIOR	2#12, 1#12 GND
2#12, 1#12 GND	LTG CNF ROOM	1	20 A		9			0.50	0.90				20 A 1	REC TESTING RM 118	2#12, 1#12 GND
2#12, 1#12 GND	LTG EXTERIOR	1	20 A		11					0.00	0.72		20 A 1	REC TESTING RM 118	2#12, 1#12 GND
2#12, 1#12 GND	LTG LANDSCAPE	1	20 A		13	0.10	0.72						20 A 1	REC ELEC/STOR/CORR	2#12, 1#12 GND
2#12, 1#12 GND	LTG EXTERIOR WALLWASH	1	20 A		15			0.25	0.72				20 A 1	REC FLIGHT LOUNGE 115	2#12, 1#12 GND
2#12, 1#12 GND	REC CORR/WAITING	1	20 A		17					0.72	0.36		20 A 1	REC FLIGHT LOUNGE 115	2#12, 1#12 GND
2#12, 1#12 GND	REC WATER COOLER	1	20 A	GF	19	0.18	0.36						20 A 1	REC FLIGHT LOUNGE 115	2#12, 1#12 GND
2#12, 1#12 GND	REC PUBLIC WAITING 110	1	20 A	GF	21			0.36	0.36				20 A 1	REC FLIGHT LOUNGE 115	2#12, 1#12 GND
2#12, 1#12 GND	REC PUBLIC WAITING 110	1	20 A	GF	23					0.36	0.18		20 A 1	REC FLIGHT LOUNGE 115	2#12, 1#12 GND
2#12, 1#12 GND	REC PUBLIC WAITING 110	1	20 A	GF	25	0.18	0.40						20 A 1	CEILING FANS	2#12, 1#12 GND
2#12, 1#12 GND	REC MENS/WOMENS	1	20 A		27			0.36	0.70				20 A 1	CEILING FANS	2#12, 1#12 GND
2#12, 1#12 GND	REC EXTERIOR	1	20 A		29					0.72	0.60		20 A 1	GEN BATTERY CHARGER	2#12, 1#12 GND
--	SPARE	1	20 A		31	0.00	2.25						30 A 2	GEN BLOCK HEATER	2#10, 1#10 GND, 3/4" CND
--	SPARE	1	20 A		33			0.00	2.25				20 A 1	SPARE	--
--	SPARE	1	20 A		35					0.00	0.00		36	SPARE	--
--	SPARE	1	20 A		37	0.00	0.00						38	SPARE	--
--	SPARE	1	20 A		39			0.00	0.00				40	SPARE	--
--	SPARE	1	20 A		41					0.00	0.00		42	SPARE	--
--	DO NOT USE	--	--		43	0.00	9.26						44		--
--	DO NOT USE	--	--		45			0.00	6.25				46		--
--	DO NOT USE	--	--		47					0.00	6.07		48		--
TOTAL LOAD:						15.94 kVA	13.03 kVA	10.17 kVA							
BREAKER TYPE KEYS:															
LO - INDICATES C.B. EQUIPPED WITH "LOCK-ON" DEVICE GF - INDICATES C.B. IS GROUND FAULT TYPE (5mA FOR PERSONNEL) ST - INDICATES C.B. EQUIPPED WITH SHUNT TRIP DEVICE HT - INDICATES C.B. EQUIPPED WITH 30mA GROUND FAULT FOR EQUIPMENT															
Load Classification	Connected Load	Demand Factor	Estimated Demand	Panel Totals											
LTG	2.534	100.00%	2.534	Total Conn. Load: 39.13 kVA											
Other	1.100	100.00%	1.100	Total Est. Demand: 32.67 kVA											
REC	22.920	71.82%	16.460	Total Conn. Current: 108.62 A											
Equipment	11.080	100.00%	11.080	Total Est. Demand Current: 90.69 A											
HVAC	1.528	100.00%	1.528												

PANELBOARD: RP1B															
LOCATION: ELEC 113				MAINS: MLO				AMPS: 225							
MOUNTING: Surface				VOLTS: 208/120 Wye											
ENCL NEMA: Type 1				PHASE: 3											
MIN AIC: SEE ONE-LINE DIAGRAM				WIRES: 4											
PANEL NOTES:															
PROVIDE GROUND BUS PROVIDE FULL SIZE NEUTRAL BUS UNLESS NOTED OTHERWISE															
WIRE SIZE	LOAD DESCRIPTION	P	TRIP AMPS	TYPE	CKT	A	B	C	CKT	TYPE	TRIP AMPS	P	LOAD DESCRIPTION	WIRE SIZE	
2#12, 1#12 GND	REC CNF ROOM 106	1	20 A		1	0.72	0.72						20 A 1	REC RECEPTION 102	2#12, 1#12 GND
2#12, 1#12 GND	REC CNF ROOM 106	1	20 A		3			0.72	0.72				20 A 1	REC RECEPTION 103	2#12, 1#12 GND
2#12, 1#12 GND	REC CNF ROOM 106	1	20 A		5					0.72	0.72		20 A 1	REC OPERATIONS 103	2#12, 1#12 GND
2#12, 1#12 GND	REC CNF ROOM 106	1	20 A		7	0.72	0.72						20 A 1	REC AIRPORT MGR. 103A	2#12, 1#12 GND
2#12, 1#12 GND	REC PROJECTOR	1	20 A		9			0.60	0.18				20 A 1	REC LINE CREW 104	2#12, 1#12 GND
2#12, 1#12 GND	PROJECTOR SCREEN	1	20 A		11					0.00	0.18		20 A 1	REC LINE CREW 104	2#12, 1#12 GND
2#12, 1#12 GND	REC EXTERIOR	1	20 A		13	0.72	1.20						20 A 1	REFRIGERATOR	2#12, 1#12 GND
2#12, 1#12 GND	REC EXTERIOR	1	20 A		15			0.54	1.20				20 A 1	REFRIGERATOR	2#12, 1#12 GND
2#12, 1#12 GND	EF-4	1	20 A		17					0.96	1.20		20 A 1	FREEZER	2#12, 1#12 GND
2#12, 1#12 GND	REC AV 107	1	20 A		19	0.36	0.18						20 A 1	REC LINE CREW 104	2#12, 1#12 GND
2#12, 1#12 GND	REC AV 107	1	20 A		21			0.36	0.18				20 A 1	REC LINE CREW 104	2#12, 1#12 GND
2#12, 1#12 GND	REC MECH / CORE 108	1	20 A		23					0.36	0.18		20 A 1	ICE MACHINE	2#12, 1#12 GND
2#12, 1#12 GND	REC LOBBY 101	1	20 A		25	0.90	1.20						20 A 1	DISHWASHER	2#12, 1#12 GND
2#10, 1#10 GND	MOTORIZED GATE	3	20 A		27			0.20	1.55				20 A 2	SINGLE OVEN	3#12, 1#12 GND
--	SPARE	1	20 A		29					0.20	1.55		20 A 1	REC EVENT LAWN	2#10, 1#10 GND
--	SPARE	1	20 A		31	0.20	0.54						20 A 1	MOTORIZED PROJECTOR	2#12, 1#12 GND
--	SPARE	1	20 A		33			0.00	0.00				20 A 1	MOTORIZED SHADE	2#12, 1#12 GND
--	SPARE	1	20 A		35					0.00	0.00		36	SPARE	--
--	SPARE	1	20 A		37	0.00	1.08						38	SPARE	--
--	SPARE	1	20 A		39			0.00	0.00				40	SPARE	--
--	SPARE	1	20 A		41					0.00	0.00		42	SPARE	--
TOTAL LOAD:						9.26 kVA	6.25 kVA	6.07 kVA							
BREAKER TYPE KEYS:															
LO - INDICATES C.B. EQUIPPED WITH "LOCK-ON" DEVICE GF - INDICATES C.B. IS GROUND FAULT TYPE (5mA FOR PERSONNEL) ST - INDICATES C.B. EQUIPPED WITH SHUNT TRIP DEVICE HT - INDICATES C.B. EQUIPPED WITH 30mA GROUND FAULT FOR EQUIPMENT															
Load Classification	Connected Load	Demand Factor	Estimated Demand	Panel Totals											
REC	14.640	84.15%	12.320	Total Conn. Load: 21.58 kVA											
Equipment	5.960	100.00%	5.960	Total Est. Demand: 19.26 kVA											
HVAC	0.960	100.00%	0.960	Total Conn. Current: 59.90 A											
				Total Est. Demand Current: 53.46 A											

MECHANICAL EQUIPMENT CONNECTION SCHEDULE											
DESIGNATION	DESCRIPTION	MCA	MOC	VOLTAGE	NUMBER OF POLES	DISC SW	DISC SW AMP	DISC SW POLES	CONDUIT SIZE	CONDUCTORS	REMARKS
ACCU-01	AIR COOLED CONDENSING UNIT	21	35	208	3	Yes	30	3	3/4"	3#8, 1#10 GND	
ACCU-02	AIR COOLED CONDENSING UNIT	27	35	208	3	Yes	30	3	3/4"	3#8, 1#10 GND	
ACCU-03	AIR COOLED CONDENSING UNIT	18	30	208	3	Yes	30	3	3/4"	3#10, 1#10 GND	
DOAU-1	DEDICATED OUTDOOR AIR UNIT	109	110	208	3	Yes	200	3	1 1/2"	3#2, 1#6 GND	
EF-1	EXHAUST FAN	1	20	120	1	Yes	20	1	3/4"	2#12, 1#12 GND	⊙
EF-2	EXHAUST FAN	1	20	120	1	Yes	20	1	3/4"	2#12, 1#12 GND	⊙
EF-3	EXHAUST FAN	1	20	120	1	Yes	20	1	3/4"	2#12, 1#12 GND	⊙
EF-4	EXHAUST FAN	8	20	120	1	Yes	20	1	3/4"	2#12, 1#12 GND	⊙
FCU-01	FAN COIL UNIT	34	35	208	3	Yes	30	3	3/4"	3#8, 1#10 GND	
FCU-02	FAN COIL UNIT	47	50	208	3	Yes	60	3	3/4"	3#8, 1#10 GND	
FCU-03	FAN COIL UNIT	30	30	208	3	Yes	30	3	3/4"	3#10, 1#10 GND	
RCP-01	RECIRCULATION PUMP	1	20	120	1	Yes	20	1	3/4"	2#12, 1#12 GND	⊙

MECHANICAL EQUIPMENT SCHEDULE NOTES

- CONTRACTOR SHALL VERIFY SIZES OF ALL COMPONENTS SERVING HVAC EQUIPMENT (CIRCUIT BREAKERS, CONDUCTORS, DISCONNECT SWITCHES, ETC.) WITH NAMEPLATE REQUIREMENTS OF SUCH EQUIPMENT. THE CONTRACTOR SHALL ADJUST SIZES AS NECESSARY TO MEET THE REQUIREMENTS OF PURCHASED EQUIPMENT.
- ALL DISCONNECTING MEANS FOR MECHANICAL EQUIPMENT SHALL BE PROVIDED BY DIVISION 2