

SPECIFICATION BOOKLET

GREENWICH PUBLIC SCHOOLS GREENWICH HIGH SCHOOL LOCKER ROOM RENOVATIONS PHASE II

OWNER: ADDRESS: CITY: GREENWICH PUBLIC SCHOOLS 290 GREENWICH AVENUE GREENWICH, CT 06830

BOARD OF EDUCATION BID NUMBER:

2243-19

FULLER AND D'ANGELO, PC ARCHITECTS AND PLANNERS PROJECT NO:

19339.00

FACILTY NAME:

GREENWICH HIGH SCHOOL 10 HILLSIDE ROAD GREENWICH, CT 06830

M/E/P ENGINEERS:



AKF GROUP 1 AUDUBON STREET, 5[™] FLOOR NEW HAVEN, CT 06511 TEL: 203.388.1240





FULLER AND D'ANGELO, P.C. ARCHITECTS & PLANNERS 45 KNOLLWOOD ROAD ELMSFORD, NEW YORK 10523 (914) 592-4444 www.fullerdangelo.com

DATE ISSUED FOR BID: APRIL 23, 2019

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Information to Bidders Part 1

The Architect for the project is Fuller D'Angelo P.C. Architects and Planners, 45 Knollwood Road, Elmsford, NY 10523

The contact for the Owner is: **Eugene Watts, Senior Buyer,** Greenwich Public Schools, Havemeyer Building, 290 Greenwich Avenue, Greenwich, CT.

Contractor(s) whose bid exceeds \$500,000.00 shall hold a current "DAS" Contractor Prequalification Certificate" (not a predetermination letter) from the Department of Administrative Services of the State of Connecticut according to Connecticut General Statutes Section 4a-100, 4b-101 and 4b-91 previously stated as Public Act 03-215 and as amended by Public Act 04-141. Bidders shall submit with their bids, unless noted otherwise, a "DAS Contractor Prequalification Certificate" along with a current "Update (bid) Statement". Failure to submit those items with the bid will result in disqualification of the bidder. If you have any questions regarding these requirements contact the State of CT.DAS, at telephone number 860-713-5280 or visit their web site at <u>www.das.state.ct.us</u>.

1. BACKGROUND:

The Town of Greenwich, CT is about 30 miles northeast of New York City and has a population of about 60,000 people. The Greenwich Public Schools enjoy a national reputation for excellence and have strong support from the community. Our fifteen public schools have a current enrollment of 9000 students and consist of eleven elementary schools (K-5), three middle schools (6-8), and one comprehensive high school (9-12). Our district also offers some pre-K and alternative high schools programs.

2. CONTRACT LENGTH:

This Bid is for awarding a contract to cover the period beginning **July 5**, **2019**. Once this Bid is awarded, the bidder must make arrangements to meet with Greenwich Public Schools if required.

3. OPTION TO EXTEND:

The Board of Education may, at their option and with the approval of the vendor, extend the period of this agreement for the schools. If the Board of Education intends to extend the contract period, the vendor shall be notified in writing by the Purchasing Department at least fourteen (14) calendar days prior to the expiration of the original contract.

4. BID EVALUATION CRITERIA:

A committee composed of various administrators will evaluate bids. The following criteria guidelines will be used in analyzing and evaluating this bid:

Conformance to the requirements of this Bid, i.e. conformance to Terms, Conditions and Scope of Work. Proven skills and technical competence. Background on the firm For Vendor firm, identification of personnel who will have principal responsibility. Qualifications Form 5. A NARRATIVE DESCRIBING THE FIRMS APPROACH TO UNDERTAKING THE SCOPE OF THE WORK INCLUDING:

Cost/service fee (overall cost to the Board of Education with all factors considered). Presentation to the selection committee, if requested.

6. AWARD OF CONTRACT:

The contract will be awarded by the Board of Education to the qualified firm or person at compensation determined to be fair and reasonable considering budgetary limitations, scope, complexity and the nature of goods and/or services.

7. PURPOSE:

Greenwich Public Schools is soliciting bids to provide Locker Room Renovations Phase II at the Greenwich High School for the Greenwich Public School District.

8. OVERVIEW:

Greenwich Public Schools wishes to solicit Request for Bids for Locker Room Renovations **Phase II**, including alternates. Companies must be located within a 100-mile radius of the district in order to submit a bid. It is understood that any contract is subject to available funding.

9. THE DETAILED BIDDER SHALL INCLUDE:

An outline of the procedures to be used to provide **Locker Room Renovations Phase II at the Greenwich High School,** indicated above, and how cost estimates will be calculated.

10. INTENT OF WORK

Fixed price scope of work per plans and specifications for provision of the Locker Room Renovations Phase II at the Greenwich High School.

11. SCOPE OF SERVICE:

Men's and Women's Locker Room are to have all their lockers replaced and an epoxy floor installed. Additional work (alternates) includes options to repurposing the existing Athletic Trainers Room into a small Unisex Team Room and converting an existing Team Room into a new Athletic Trainer Room with associated ancillary spaces. Refurbishing Team Rooms, refurbishing the north/south Corridors and modifying the existing Instructors Offices.

12. CONTRACTOR AGREEMENT

1. The contractor shall simultaneously with the signing of the Contract, furnish the Town the executed Performance, Maintenance, and Payment Bond of a surety company authorized to do business in the State of Connecticut, and acceptable to the Town, in the sum of the full amount of the Con tract Obligation in the form provided by the Town. A PERFORMANCE BOND will not be required where the total estimated cost of labor and materials under the contract with respect to which such general bid is submitted is less than one-hundred thousand dollars (\$100,000.00). Once a contract exceeds \$100,000.00 the bidder will be responsible for obtaining and paying for all bonds required by Greenwich Public Schools.

- 2. Each bid shall be signed and accompanied by a bid security payable to the Town of Greenwich in the amount of ten (10%) percent of the bid and shall be in the form of a Bid Bond only as issued in the bid documents. Bid Bonds must use the Greenwich Public Schools Bid Bond Form (included within the bid documents), issued by a surety Company listed on the Current U.S. Department of Treasury's Federal Register and be licensed to underwrite bonds in the State of Connecticut.
- 3. Each bid shall be accompanied by a completed copy of the Bidders Qualification Questionnaire included in the bid documents. The Greenwich Public Schools reserve the right to request further information and/or supplemental information with respect to the Qualification Questionnaire at their sole discretion
- 4. Each bidder shall utilize the specified manufacturers. Should the Contractor desire to substitute other articles, materials, apparatus, products or process, then those specified or approved as equal, the Contractor shall apply to the Architect, in writing, for approval of such substitution, per Section 01600 Product Requirements. It should be noted that the Bid shall not be based on a substituted article, material, apparatus, product or process. No substitution reviews shall take place prior to bid.
- 5. Each form of bid contains a section for alternates and/or unit prices. All alternate prices must be completed with a dollar value. Blanks, not applicable (n/a), no effect, etc. in these portions of the form of bid shall be construed to indicate that the particular alternate shall be performed without increase to the contract price as they relate to the scope of the trade package.
- 6. Unit prices which do not affect the work of your trade may be filled in "not applicable (n/a)". "Not applicable or blanks in these portions of the form of bid shall be construed to indicate that the unit price is not applicable as they relate to the scope of the trade package.
- 7. The successful bidder will produce for the Greenwich Public Schools review a current financial statement, which will remain strictly confidential.

EXCEPTIONS.

- 8. Each bid shall be accompanied by a completely filled in and properly executed Non-Collusion Affidavit.
- 9. All work shall be done in accordance with applicable State statutes; conditions of Prevailing Wages shall apply.
- 10. Note: Failure to submit a bid with four copies does not constitute a material defect.
- 11. No Bidder may withdraw their Bid within 90 days after the actual date of Bid Opening.

- 12. Qualifications to the bid are not allowed. If bids are qualified, they may be deemed non-responsive and subsequently rejected.
- 13. If there is a conflict between the Contract Agreement and the General Conditions, the Contract Agreement shall prevail.
- 14. Bid awards must be approved by the Greenwich Public Schools. All contractors shall be required to execute the Greenwich Public Schools standard form of contract and accompanying payment and performance bonds without exception.
 - i. The contract shall be awarded to the lowest responsible and qualified bidder, meaning the bidder whose bid is the lowest of those bidders possessing the skill, ability and integrity necessary to faithful performance of the work based on objective criteria considering past performance and financial responsibility. In considering past performance, the Greenwich Public Schools shall evaluate the skill, ability and integrity of bidders in terms of the bidders' fulfillment of contract obligations and of the bidders' experience or lack of experience with projects of similar size and scope. The Greenwich Public Schools reserves the right to consider as unqualified to do the work required by the bid documents any bidder that does not habitually perform with its own forces the major portion of the work involved in the bid documents. No contract will be awarded to any bidder who is at time of award not qualified under applicable regulations issued by the Secretary of Labor, United States Department of Labor or any applicable State and local laws and regulations.
 - ii. After review of all factors, terms, and conditions, including price, the Greenwich Public Schools reserves the right to reject any and all bids, or any part thereof, or waive defects in same.
- 13. FEE:

Indicate your Bid Fee for all services as described in Part 5. The District reserves the right to provide payment in accordance with completion of services based on the Project Schedule.

14. QUESTIONS:

Questions concerning this bid will be received by email only directed to: **Eugene H. Watts**, **at bid_department@greenwich.k12.ct.us**. In the "Subject" line you must put **2243-19** Title: **Locker Room Renovations Phase II at the Greenwich High School** by using the RFI form. No questions will be accepted after **noon on May 6**, **2019**. All answers will be published by written **Bid Notification Addenda no later than end of day on May 9**, **2019**. It is the responsibility of all bidders to verify that they are current with all.

Failure to comply with these conditions will result in the bidder waiving his right to dispute the bid specifications and conditions. All Addenda will be posted on our website: www.greenwichschools.org up to 72 hours before the bid opens.

15. BID DOCUMENTS:

Specifications can be viewed at the Greenwich Public Schools website: **www.greenwichschools.org**.

Project Description:

This project involves Locker Room Renovations Phase II at the Greenwich High School.

Pre-Bid Conference

There will be a pre-bid conference beginning at <u>3:30 pm on APRIL 30, 2019 at</u> <u>Greenwich High School, 10 Hillside Road, Greenwich, CT 06838</u>. Attendance at the walkthrough is mandatory. Following the conference, interested parties may walk the site at the project.

16. ACCEPTANCE:

The department will make determination of the acceptability of work. Work shall be completed in a responsive and professional manner and in accordance with the specifications.

17. GENERAL TERMS AND CONDITIONS:

Sealed bids for Locker Room Renovations Phase II at the <u>Greenwich High School, 10</u> <u>Hillside Road, Greenwich, CT 06838</u> Greenwich Public Schools, as specified on the attached bid specification sheets, will be received at the time and date previously mentioned. All bidders and other interested persons are invited to be present at the opening of these bids that will take place at the Board of Education.

The Board of Education reserves the right to waive any informality in the bid or reject any or all bids or to accept any bid, which appears to be in the best interest of the Board. Any bid may be withdrawn prior to the opening time and date. Any bid received after the time and date as specified will not be considered.

The Board of Education may consider proximity of vendor's service as a factor in determining lowest responsible bid.

If the Board of Education deems it necessary, the Board of Education may postpone the date for the opening of these bids by notifying each bidder by telephone, mail or the issuing of an addendum through our website.

The Board of Education shall have the right to take such steps as it deems necessary to determine the ability of the bidder to perform the work and the bidder shall furnish the Board of Education with information and data for this purpose as the Board of Education may request. The right is reserved to reject any bid where, on investigation, the evidence or information submitted by such bidders does not satisfy the Board of Education that the bidder is qualified to carry out properly the terms of the contract.

Consumption or use of alcohol and/or drugs is prohibited on school property. Any individual with alcohol or drugs will be removed from said property. Smoking is prohibited in all school buildings and on school grounds.

18. TAX:

No amount shall be added for the Connecticut Sales Tax or Federal Tax. The Greenwich Public School system is exempt from the payment of taxes imposed by the Federal Government and/or State of Connecticut. Taxes must not be included in the bid price.

19. Non-Connecticut Contractors.

Pursuant to Connecticut General Statutes §12-430(7), as amended by Public Act No. 11-61, Section 66 a nonresident contractor shall comply with the State of Connecticut's bonding requirements.

20. COLLUSION AMONG BIDDERS:

More than one offer from an individual, firm, partnership, corporation or association under the same or different name will be rejected. Reasonable grounds for believing that a bidder is interested in more than one bid for the work contemplated will cause rejection of all bids in which the bidder is interested. Any or all bidders will be rejected if there is any reason for believing that collusion exists among the bidders.

Participants in such collusion may not be considered in future offers for the same work. Each bidder, by submitting a bid, certifies that it is not a part to any collusive action.

21. EMPLOYMENT DISCRIMINATION BY CONTRACTOR PROHIBITED:

The successful bidder will not discriminate against any employee or applicant for employment because of race, religion, color, sex, or national origin, except where religion, sex or national origin is a bona fide occupational qualification reasonably necessary to the normal operation of the contractor. The successful bidder agrees to post in a conspicuous place, available to employees and applicants for employment, notices setting forth the provision of this nondiscrimination clause. The successful bidder in all solicitation or advertisements for employees, placed by or on behalf of the contractor, will state that such successful Bidder is an Equal Opportunity Employer.

Notices, advertisements, and solicitations placed in accordance with Federal Law, rules or regulation shall be deemed sufficient for the purpose of meeting the requirements of this section.

22. The intention of this BID/RFP is to establish a contract with one or more contractors who will, upon request, provide the time with the services, labor, and supplies described in this solicitation.

This is no guarantee as to the amount of services, labor or supplies that the Board of Education may purchase during the term of this contract.

23. Per Connecticut General Statutes CGS § 10-221d, which went into effect July 1, 2016, and 10-222c, all people who are entering into a paid agreement with a school district must submit to a mandatory background check. If you are an individual, you must send me your employment history so that I can do the background check. If you are a company having multiple employees in the schools, you will be responsible for obtaining the background checks on each of your employees.



ARCHITECTS AND PLANNERS

45 KNOLLWOOD ROAD TEL: 914.592.4444

REQUEST FOR INFORMATION NO.

Greenwich Public Schools Greenwich High School Locker Room Renovations Phase II

ELMSFORD, NEW YORK 10523

FAX: 914.592.1717

Date: April 23, 2019

A/E Project Number: 19339.00 Bid # 2243-19

To: **Greenwich Public Schools** Mr. Eugene Watts Email: bid_department@greenwich.k12.ct.us

| From: | Tele. No.: | Fax |
|---------|------------------|----------------------|
| | | |
| Subject | Discipline/Trade | Dwg./Spec. Reference |
| | | |

QUESTION:

SIGNATURE___

FULLER AND D'ANGELO, P.C. RESPONSE

SIGNATURE_____

CC: Company Name Contact Name Fax Number Copies Notes

Review and any responses to this request for information by the architect/engineer is strictly for design intent only and does not constitute acknowledgement or acceptance of any cost or schedule implications unless specifically presented by the contractor. By submission of this request for information the contractor assumes all responsibility in the absence of an approved change order or work directive

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FULLER AND D'ANGELO P.C.

DATE____

Field Condition Drawing/Spec Discrepancy **Owner Change** Clarification Other

DATE_____

GENERAL TERMS AND CONDITIONS

Sealed bids for furnishing these services to Greenwich Public Schools, as specified on the attached bid specification sheets, will be received on **MAY 15, 2019 at 1PM.** All bidders and other interested persons are invited to be present at the opening of these bids which will take place at the Board of Education. Bidders are urged to read all documents carefully and fill out all information requested. Bids which are incomplete, obscure, or conditional, and which contain irregularities of any kind, will be subject to rejection.

The Board of Education reserves the right to waive any informality in the bid or reject any or all bids or to accept any bid that appears to be in the best interest of the Board. Any bid may be withdrawn prior to the opening time and date. Any bid received after the time and date as specified will not be considered.

The Board of Education will consider proximity of vendor's service as a factor in determining lowest responsible bid. The bidder's company must be within a one hundred (100) mile radius of the Greenwich Board of Education.

If the Board of Education deems it necessary, the Board of Education may postpone the date for the opening of this bid by notifying each bidder by telephone, mail or the issuing of an addendum.

The Board of Education shall have the right to take such steps as it deems necessary to determine the ability of the bidders to perform the work and the bidders shall furnish the Board of Education with information and data for this purpose as the Board of Education may request. The right is reserved to reject any bid where, on investigation, the evidence or information submitted by such bidders does not satisfy the Board of Education that the bidders is qualified to carry out properly the terms of the contract.

Consumption or use of alcohol and/or drugs is prohibited on School Property. Any individual with alcohol or drugs will be removed from said property. Smoking is prohibited in all School Buildings and on school grounds.

INSURANCE PROCEDURE

PLEASE NOTE:

THIS PAGE MUST BE RETURNED WITH YOUR BID/RFP. FAILURE TO DO SO MAY RESULT IN YOUR BID/RFP BEING REJECTED.

Please take the insurance requirements of the Contract to your agent/broker immediately upon receipt of the bid documents to determine your existing coverage and any costs for new or additional coverage required for the work noted in this Request for BID/RFP. Any BID/RFP with deficient insurance requirements will be rejected.

STATEMENT OF VENDOR:

I have read the insurance requirements for this work and have taken the documentation to my insurance agent/broker. The BID/RFP cost reflects any additional costs relating to insurance requirements for this work.

Signature

Date

Insurance Requirement Sheet

<u>Insurance Requirements</u>: Before starting and until final completion and acceptance of the work called for in the Contract and expiration of the guarantee period provided for in the Contract, the Contractor and its subcontractors, if any, shall procure and maintain insurance of the types and amounts checked in paragraphs A through F below for all Contract operations.

- A. General Liability, with minimum coverages for combined bodily injury and property damage liability of \$2,000,000 general aggregate, \$1,000,000 per occurrence including:
 - 1. Commercial General Liability.
 - 2. Town as additional insured.
 - 3. Owners and Contractors Protective Liability (separate policy in the name of the Town).
- B. Comprehensive Automobile Liability, with minimum coverages of \$1,000,000 combined single limit for bodily injury and property damage, including, where applicable, coverage for any vehicle, all owned vehicles, scheduled vehicles, hired vehicles, non-owned vehicles and garage liability.
- C. Excess Liability, with minimum coverage of \$5,000,000 in umbrella form, or such other form as approved by Town Department Head and Risk Management Director.
- D. Workers' Compensation and Employer's Liability, with minimum coverages as provided by Connecticut State Statutes.
- E. Professional Liability (for design and other professionals for Errors and Omissions), with minimum coverage of \$1,000,000. If the policy is on a claims-made basis, coverage shall be continually renewed or extended for three (3) years after work is completed under the Contract.

F. Other (Builder's Risk, etc.):_

G. CERTIFICATE HOLDER: TOWN OF GREENWICH ATTN: BOARD OF EDUCATION. (Also fill in on ACORD Certificate of Insurance) 290 Greenwich Avenue, Greenwich, CT 06830.

The Acord certificate of insurance form must be executed by your insurance agent/broker and returned to this office. Company name and address must conform on all documents including insurance documentation. It is required that the agent/broker note the individual insurance companies providing coverage, rather than the insurance group, on the Acord form. The Contract number (provided to the awarded Contractor), project name and a brief description must be inserted in the "Description of Operations" field. It must be confirmed on the Acord Form that the Town of Greenwich is endorsed as an additional insured by having the appropriate box checked off and stating such in the "Description of Operations" field. A letter from the <u>awarded vendor's</u> agent/broker certifying that the Town of Greenwich has been endorsed onto the general liability policy as an additional insured is also mandatory. This letter <u>must follow exactly</u> the format provided by the Purchasing Department and must be signed by the same individual authorized representative who signed the Acord form. If the insurance coverage required is provided on more than one Acord certificate of insurance, then additional endorsement letters are also required. Contract development will begin upon receipt of complete, correct insurance documentation.

The Contractor shall be responsible for maintaining the above insurance coverages in force to secure all of the Contractor's obligations under the Contract with an insurance company or companies with an AM Best Rating of B+:VII or better, licensed to write such insurance in Connecticut and acceptable to the Risk Manager, Town of Greenwich. For excess liability only, non-admitted insurers are acceptable, provided they are permitted to do business through Connecticut excess line brokers per listing on the current list of Licensed Insurance Companies, Approved Reinsurers, Surplus Lines Insurers and Risk Retention Groups

Issued by the State of Connecticut Insurance Department.

| PRODUC | CER | | nt(s) | | ndorsement. A st | | | 100 |
|---------|--|-----|-------|-----------------------|---------------------------------------|-----------------|--|-------|
| | | | | | CONTACT NAME: PHONE | | FAX | |
| | | | | | (A/C, No, Ext): E-MAIL ADDRESS: | | (A/C, No): | |
| | | | | | PRODUCER CUSTOMER ID #: | | | |
| | | | | | | NSURER(S) AFFOR | RDING COVERAGE | NAIC# |
| ISUREI | D | | | | INSURER A : | | | |
| | | | | | INSURER B : | | | |
| | | | | | INSURER C : INSURER D : | | | |
| | | | | | INSURER E : | | | |
| | | | | | INSURER F : | | | |
| | ERAGES CER S IS TO CERTIFY THAT THE POLICIES | | | NUMBER: | | | REVISION NUMBER: | |
| | TIFICATE MAY BE ISSUED OR MAY F LUSIONS AND CONDITIONS OF SUCH TYPE OF INSURANCE | | | LIMITS SHOWN MAY HAVE | | Y PAID CLAIMS | | |
| G | ENERAL LIABILITY | | | | | | EACH OCCURRENCE DAMAGE TO RENTED | \$ |
| | COMMERCIAL GENERAL LIABILITY | | | | | | PREMISES (Ea occurrence) | \$ |
| - | CLAIMS-MADE OCCUR | | | | | | MED EXP (Any one person) | \$ |
| | | | | | | | PERSONAL & ADV INJURY GENERAL AGGREGATE | \$ |
| G | BEN'L AGGREGATE LIMIT APPLIES PER: | | | | | | PRODUCTS - COMP/OP AGG | \$ |
| | POLICY PRO- LOC | | | | | | | \$ |
| A | | | | | | | COMBINED SINGLE LIMIT (Ea accident) | \$ |
| - | ANY AUTO | | | | | | BODILY INJURY (Per person) | \$ |
| | ALL OWNED AUTOS SCHEDULED AUTOS | | | | | | BODILY INJURY (Per accident) | \$ |
| | HIRED AUTOS | | | | | | PROPERTY DAMAGE (Per accident) | \$ |
| | NON-OWNED AUTOS | | | | | | | \$ |
| _ | | | | | | | | \$ |
| | UMBRELLA LIAB OCCUR EXCESS LIAB CLAIMS MADE | | | | | | EACH OCCURRENCE | \$ |
| | DEDUCTIBLE | | | | | | AGGREGATE | \$ |
| | RETENTION \$ | | | | | | | \$ |
| | VORKERS COMPENSATION | | | | | | WC STATU- TORY LIMITS ER | |
| | NY PROPRIETOR/PARTNER/EXECUTIVE | N/A | | | | | E.L. EACH ACCIDENT | \$ |
| 0 | Mandatory in NH) | | | | | | E.L. DISEASE - EA EMPLOYEE | \$ |
| 0 (N | ves, describe under | | | | | - | E.L. DISEASE - POLICY LIMIT | \$ |
| 0 (N | yes, describe under ESCRIPTION OF OPERATIONS below | 1 | | | | | | |

ACORD 25 (2009/09)

The ACORD name and logo are registered marks of ACORD

REFERENCES:

Please list at least three (5) school districts in Connecticut or New York of similar size to Greenwich Public Schools where you or your company has performed these services.

1.__

NAME AND ADDRESS

TELEPHONE # FAX # EMAIL

CONTACT PERSON AND TELEPHONE NUMBER

2.___

NAME AND ADDRESS

TELEPHONE # FAX # EMAIL

CONTACT PERSON AND TELEPHONE NUMBER

3.__

NAME AND ADDRESS

TELEPHONE # FAX # EMAIL

CONTACT PERSON AND TELEPHONE NUMBER

4.___

NAME AND ADDRESS

TELEPHONE # FAX # EMAIL

CONTACT PERSON AND TELEPHONE NUMBER

5.____

NAME AND ADDRESS

TELEPHONE # FAX # EMAIL

CONTACT PERSON AND TELEPHONE NUMBER

LIST OF DRAWING SHEETS

PART 1 - GENERAL

1.1 DRAWING INDEX

A. Drawings are listed on Drawing G-1.

PART 2 - PRODUCTS (NOR USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

INSTRUCTIONS TO BIDDERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Refer to the Invitation to Bids, Information to Bidders and the Agreement for additional information. Any conflicts the Invitation to Bids, Information to Bidders and the Agreement shall supercede this Section.

1.3 DOCUMENT INCLUDES

- A. Invitation
 - 1. Bid Submission
 - 2. Intent
- B. Bid Documents and Contract Documents
 - 1. Definitions
 - 2. Contract Documents Identification
 - 3. Availability
 - 4. Examination
 - 5. Inquiries/Addenda
 - 6. Product/Assembly/System Substitutions
- C. Site Assessment
 - 1. Prebid Conference
- D. Qualifications
 - 1. Qualifications
- E. Bid Submission
 - 1. Bid Depository
 - 2. Submission Procedure
 - 3. Bid Ineligibility
- F. Bid Enclosures/Requirements
 - 1. Security Deposit
 - 2. Consent of Surety
 - 3. Performance Assurance
 - 4. Bid Form Requirements
 - 5. Bid Form Signature
 - 6. Additional Bid Information
 - 7. Selection and Award of Alternates
 - Offer Acceptance/Rejection
 - 1. Duration of Offer
 - 2. Acceptance of Offer

1.4 RELATED DOCUMENTS

G.

- A. Division 00 Procurement Requirements and Greenwich Public Schools Front End documents as listed in the Table of Contents.
- B. Division 01 General Requirements including:
 - 1. Document 01 1000 Summary of Contract.
 - 2. Document 00 4100 Bid Form.

- 3. Section 00 4400 Contractor's Qualification Statement.
- 4. Document 00 7300 Supplementary Conditions.
- 5. Section 01 2100 Allowances.
- 6. Section 01 2300 Alternates.
- 7. Section 01 6116 Volatile Organic Compound (VOC) Content Restrictions: Requirements for VOC-restricted product categories.

1.5 BID SUBMISSION

- A. Refer to Invitation to Bids for date and time.
- B. Offers submitted after the stated time shall be returned to the bidder unopened.
- C. Offers will be opened publicly immediately after the time for receipt of bids.

1.6 INTENT

A. The intent of this General Contracting Bid is to request and obtain an offer to perform work to complete the Locker Room Renovations - Phase II at Greenwich High School located within the Greenwich Public Schools for a Stipulated Sum in accordance with the Contract Document.

1.7 LUMP SUM BIDS

A. Bids will be received for one (1) prime contracts as follows:1. General Construction .

1.8 WORK IDENTIFIED IN THE CONTRACT DOCUMENTS

A. Work of this proposed Contract comprises the Locker Room Renovations - Phase IIas indicated on drawings and specification..

1.9 CONTRACT TIME

A. The Contractor shall complete its portion of the Project work within such Contract Time as will assure the substantial completion of the Project by all contracts, in accordance with the sequence of work described in Section 01 1000 - Summary of Contract and Section 01 1010 - Milestone Schedule. The attention of the bidders is specifically directed to the provisions of the Agreement and that on no account will the contactor be permitted to assert a claim for damages for delay.

1.10 BID DOCUMENTS AND CONTRACT DOCUMENTS

- A. Definitions: All definitions set forth in the Agreement and Section 01 1000 Summary of Contract are applicable to these Instructions to Bidders.
- B. Contract Documents: Defined in the Agreement including issued Addenda .
- C. Bid, Offer, or Bidding: Act of submitting an offer under seal.
- D. Bid Amount: Monetary sum identified by the Bidder in the Bid Form.

1.11 CONTRACT DOCUMENTS IDENTIFICATION

A. The Contract Documents are identified as Project Number 19339.00, as prepared by Fuller and D'Angelo, P.C. who is located at 45 Knollwood Road, Elmsford, New York 10523, and with contents as identified in the Table of Contents.

1.12 AVAILABILITY

- A. Bid Documents may be viewed at the office of Greenwich Public Schools which is located at 290 Greenwich Avenue, Greenwich CT .
- B. Specifications can be viewed and downloaded from the Greenwich Public Schools website: www.greenwichschools.org
- C. Bid Documents are made available only for the purpose of obtaining offers for this project. Their use does not grant a license for other purposes. Download Documents for Bidding.

1.13 EXAMINATION

- A. Bid Documents are on display at the offices of the following:
 - 1. Bid Documents can be viewed and downloaded from the Greenwich Public Schools website: www.greenwichschools.org.
- B. Upon receipt of Bid Documents verify that documents are complete. Notify Eugene Watts Greenwich Public Schools Purchasing Dept. should the documents be incomplete, see e.mail address below.
- C. Immediately notify Eugene Watts Greenwich Public Schools Purchasing Dept. upon finding discrepancies or omissions in the Bid Documents.

1.14 INQUIRIES/ADDENDA

- A. Addenda are written or graphic instruments issued prior to the Bid Date which modify or interpret the bidding documents, including Drawings and Specifications, by additions, deletions, clarifications or corrections. Addenda will become part of the Contract Documents when the Construction Contract is executed
- B. Verbal answers are not binding on any party.
- Clarifications requested by bidders must be in writing not later than Noon on May 6, 2019. The reply will be in the form of an Addendum, if required, a copy of which will be posted on the Website by May 9, 2019 end of day, other addendum may be posted to within 24 hours of bid time.
- D. Questions: Any and all questions about the interpretation or clarification of the Bid Documents, or about any other matter affecting the Work or pertaining to the bid must be directed in writing to:

Bid_Department@greenwich.k12.ct.us - In the subject line put Bid Number 2243-19 Attn: Mr. Eugene Watts

E. Answers: The Owner will issue addenda, if necessary, to answer such questions. Bidders shall rely on answers contained in such addenda and shall not rely upon any oral answers given by any employee or agent of the Owner's Representative, Architect, and Architect's Consultants

1.15 PRODUCT/ASSEMBLY/SYSTEM SUBSTITUTIONS

- A. Where the Bid Documents stipulate a particular product bidders shall comply with the specifications, performance and quality of the specification item. The Architect will not review any substitutions during the bidding period. The bidder assumes all responsibility to meet the requirements and the Architect shall be final authority as to a product is equal to the specification.
- B. Wherever in the Contract Documents an article, material, apparatus, product or process is identified by "Basis of Design", trade name or catalog reference, or by the name of the patentee, manufacturer or dealer, it is understood that it constitutes the standard requirement to meet the contract specifications. All other products shall be considered as "substitutions" and shall be submitted in accordance to Section 01 2500 - Substitution Procedures.
- C. Where two or more articles, materials, apparatus, products or processes are listed as acceptable by reference to trade name or otherwise, the choice of these will be optional to the bidder. All other products these shall be considered as "substitutions" and shall be submitted in accordance to Section 01 2500 Substitution Procedures.
- D. Where articles, materials, apparatus, products or processes are listed by reference to a named specified item as "or Equal", these shall be considered as "substitutions" and shall be submitted in accordance to Section 01 2500 Substitution Procedures.
- E. Bidders may base their bid on a product they may consider equal to the specified product. These shall be considered as "substitutions" and shall be submitted in accordance to Section 01 2500 Substitution Procedures.
- F. The bidder is made aware that the Owner's Representative and Architect will make the final determination as to what constitutes an equal.

- G. If the Architect shall reject the proposed equal as not being the equal of that specifically named in the contract, the successful Contractor shall immediately proceed to furnish the designated article, material, apparatus, product or process specified or an approved equal without additional cost or time delay to the Owner.
- H. See Section 01 6000 Product Requirements for additional requirements.
- I. Where the Bid documents stipulate a particular product bidders shall comply with the specifications, and performance and quality of the specification item. The architect will not review any substitutions during the bidding period. The bidder assumes the responsibility to meet the requirements and the architect shall be the final authority as to a product is an equal to the specification.

1.16 PREBID CONFERENCE

- A. A mandatory bidders conference has been scheduled for 3:30 PM a.m. on the 30 day of April, 2019 at the location of Greenwich High School Main Lobby.
- B. Attendance is Mandatory.
- C. Representatives of Fuller and D'Angelo, P.C. will be in attendance.
- D. If applicable, information relevant to the Bid Documents will be recorded in an Addendum, issued to Bid Document recipients.

1.17 EVIDENCE OF QUALIFICATIONS

- A. Contractors whose bid exceeds \$500,000.00 shall hold a current "DAS Contractor Prequalification Certificate" (not a pre-determination letter) from the Department of Administrative Services of the State of Connecticut according to Public Act 03-215 and as amended by Public Act 04-141. These Bidders shall submit with their bids a "DAS Contractor Prequalification Certificate" along with a current "Update (bid) Statement." Failure to submit these items with the bid will result in disqualification of the bidder per the Public Act. If you have any questions regarding these requirements, contact the State of CT DAS at telephone number (860) 713-5280 or visit their web site at www.das.state.ct.us
- B. **Bidder shall submit with their bid proposal** a properly executed Contractor's Qualification Statement in Section 00 4400.
- C. To be considered qualified, in addition to the qualifications listed in the Contractor's Qualification Statement Section 00 4400, bidder must demonstrate to the Owner's satisfaction:
 - 1. The Corporation, partnership, sole proprietorship or principals of the entity in whose name the bid is submitted has no less than the previous five (5) years performing or coordinating the Work which they are bidding on.
 - 2. The Bidder has to have performed five (3) similar projects.
 - 3. The principal(s) of the bidder have satisfactorily completed no less than five (5) projects of comparable size and type to this project, and not less than a cost of \$500,000.
 - 4. The bidder is not currently involved in bankruptcy proceedings.
 - 5. The bidder is capable of and intends and intends to perform the work with a minimum of 35% with its own forces.
 - 6. The bidder will perform the work with sufficient personnel as required to comply with the schedule.
 - 7. The bidder or principals of the bidder and each subcontractor must have a minimum of five (5) years experience in the work and/or applicable trade.
 - 8. The Field Superintendent must have at least five (5) years as a working field superintendent and must speak English.
 - 9. All bidders will be required to submit a listing of projects, including addresses, Owner's name, Architect, date work was performed and any other information which would serve to document its ability to perform the work of the character desired and in time required.

1.18 SUBCONTRACTORS/SUPPLIERS/OTHERS

- A. Greenwich Public Schools reserves the right to reject a proposed subcontractor for reasonable cause.
- B. Refer to Agreement
- C. All proposed sub-contractors must be submitted to Owner's Representative, Architect, and Construction Manager for approval.

1.19 BID SUBMISSION PROCEDURE

- A. Bidders shall be solely responsible for the delivery of their bids in the manner and time prescribed. Refer to Invitation to Bid and Information to Bidder.
- B. Submit one (1) original and four (4) copies of the executed offer on the Bid Forms provided in the project manual, signed and sealed with the required security in a closed opaque envelope, clearly identified with bidder's name and:

Greenwich Public Schools Bid No. 2243-19. Greenwich High School Locker Room Renovations - Phase II

- C. Improperly completed information, irregularities in security deposit, may be cause not to open the Bid Form envelope and declare the bid invalid or informal.
- D. To submit a bid for a bid package, the bidder should photo copy or remove the proposal form for that bid package from the Project Manual. Then the bidder should complete, sign and submit the form as required herein. If a bidder is bidding on more than one bid package, there must be on fully completed and signed form for each package being bid. The bidder should not submit the entire Project Manual with the bid proposal.
- E. All bid prices shall be filled in, both in words and figures. Signatures shall be in ink and in longhand. Proposals which are incomplete, conditional or obscure may be rejected as informal.
 - 1. In case of a discrepancy between the words and figures, the written ward, not the figures, will govern.
- F. Bidder's shall not rely on oral statements made by any employee or agent of the Owner, Architect, Architect's consultants or Owner's Representative. Before submitting a proposal, bidders shall fully inform themselves as to all existing conditions and limitations and shall include in the Proposal a sum to cover the cost of all items included in the Contract
- G. No oral or telephonic proposals or modifications of proposals will be considered.

1.20 BID INELIGIBILITY

- A. Bids that are unsigned, improperly signed or sealed, conditional, illegible, obscure, contain arithmetical errors, erasures, alterations, or irregularities of any kind, may at the discretion of the Greenwich Public Schools, be declared unacceptable.
- B. Bid Forms, Appendices, and enclosures that are improperly prepared may, at the discretion of Greenwich Public Schools, be declared unacceptable.
- C. Failure to provide security deposit, bonding or insurance requirements may, at the discretion of Greenwich Public Schools, invalidate the bid.

1.21 SECURITY DEPOSIT

- A. Bids shall be accompanied by a security deposit as follows:
 - 1. Bid Bond or Certified Check of a sum no less than 10 percent of the Bid Amount , including allowances, unit costs, and alternates.
- B. Endorse the Bid Bond or Certified Check in the name of the Greenwich Public Schools as obligee, signed and sealed by the principal (Contractor) and surety.

- C. The security deposit(s) will be returned after delivery to the Greenwich Public Schools of the required Performance and Payment Bond(s) by the accepted bidder.
- D. Include the cost of bid security in the Bid Amount.
- E. If no contract is awarded, all security deposits will be returned.

1.22 CONSENT OF SURETY

A. Submit with the Bid: The attorney in fact who executes the required bonds on behalf of the surety to affix thereto a certified and current copy of his power of attorney indicating the monetary limit of such power.

1.23 PERFORMANCE ASSURANCE

- A. Accepted Bidder: Shall provide a Performance and Payment bond, as described in Intro Letter and Information to Bidders Part 1, Article 12 prior to the execution of the Contract, the bidder to furnish bonds covering the faithful performance of the Contract and the payment of all obligations arising thereunder in such form and amount as the Owner may prescribe and with such sureties secured through the bidder's usual sources as may be agreeable to the parties.
- B. Include the cost of performance assurance bonds in the Bid Amount.
- C. The bidder shall require the attorney in fact who executes the required bonds on behalf of the surety to affix thereto a certified and current copy of his power of attorney indicating the monetary limit of such power

1.24 INSURANCE

- A. There are special insurance requirements on this project. Refer to Greenwich Front End Documents for a summary description of the required coverages. The Owner reserves the right to refuse the award of a Contract to any apparent low bidder who fails to provide the specified insurance certificates at the required time.
 - 1. The Owner, Architect and Construction Manager shall be listed as "Additionally Insured" on all applicable Insurance policies.

1.25 BID FORM REQUIREMENTS

A. Complete all requested information in the Bid Form, Supplements to Bid and Appendices.

1.26 SALES AND USE TAXES

A. The Owner is a tax exempt entity, so there shall be no charge for sales or use taxes. The Owner will document this status as requested.

1.27 FEES FOR CHANGES IN THE WORK

A. Refer to the Agreement.

1.28 BID FORM SIGNATURE

- A. The Bid Form shall be signed by the bidder, as follows:
 - 1. Sole Proprietorship: Signature of sole proprietor in the presence of a witness who will also sign. Insert the words "Sole Proprietor" under the signature. Affix seal.
 - 2. Partnership: Signature of all partners in the presence of a witness who will also sign. Insert the word "Partner" under each signature. Affix seal to each signature.
 - 3. Corporation: Signature of a duly authorized signing officer(s) in their normal signatures. Insert the officer's capacity in which the signing officer acts, under each signature. Affix the corporate seal. If the bid is signed by officials other than the president and secretary of the company, or the president/secretary/treasurer of the company, a copy of the by-law resolution of their board of directors authorizing them to do so, must also be submitted with the Bid Form in the bid envelope.
 - 4. Joint Venture: Each party of the joint venture shall execute the Bid Form under their respective seals in a manner appropriate to such party as described above, similar to the requirements of a Partnership.

1.29 NONDISCRIMINATION

A. All Contractors and Subcontractors of all tiers and all vendors shall comply with all pertinent provisions of the State, Local and Federal law against discrimination in employment practices. Refer to Agreement.

1.30 PREVAILING WAGES

A. Connecticut State law requires the payment of prevailing wages on the project, as listed in the Project Manual.

1.31 ADDITIONAL BID INFORMATION

- A. Submit the following Supplements concurrent with bid submission:
 - 1. Refer to Greenwich Front End Documents for additional requirements.
 - 2. Document 01 2300- Alternates
 - 3. Section 00 4400 Contractor's Qualification Statement
 - 4. Section 01 2100 Allowances
- B. The bidder by making his bid represents that he has read and understands the bidding documents.
- C. The bidder by making his bid represents that he has visited the site and familiarized himself with the local conditions under which the work is to be performed. Visits to the site shall be arranged through the Architect

1.32 DURATION OF OFFER

A. Bids shall remain open to acceptance and shall be irrevocable for a period of 90 days after the bid closing date.

1.33 ACCEPTANCE OF OFFER

- A. Greenwich Public Schools reserves the right to accept or reject any or all offers.
- B. The bidder acknowledges the right of the Owner to reject any or all bids and to waive any informality or irregularity in any bid received. In addition, the bidder recognizes the right of the Owner, at its discretion to reject a bid if the bidder fails to furnish any required bid security, or to submit the information required by the bidding documents, including Section 00 4400 Contractor's Qualification Statement or if the bid is incomplete or irregular.

1.34 POST-BID PROCEDURE

- A. The bid proposal, alternates, unit costs, with the proposed subcontractor(s), the Contractor's Qualification Statement, Information received from owners of other projects all will be considered to determine whether the contractor is the "lowest responsible bidder" in making the award by Greenwich. The Owner and Architect may make such investigation as the Owner deems necessary to determine the responsibility of any bidder or to determine the ability of any bidder to perform the Work. Such investigation shall begin with a review of the Contractor's Qualification Statement (Section 00 4400) and shall include such additional information as shall be required herein, or requested afterward.
- B. The successful bidder will produce for the Greenwich Public Schools review a current financial statement, which will remain strictly confidential, NO EXCEPTIONS. Refer to Information to Bidders. **END OF SECTION**

GREENWICH PUBLIC SCHOOLS GREENWICH HIGH SCHOOL LOCKER ROOM RENOVATIONS PHASE II BID FORM

BID FORM

THE PROJECT AND THE PARTIES

TO:

Greenwich Public Schools

Purchasing Department, Havermeyer Building

290 Greewnich Avenue

Greenwich CT 06830

Attention Eugene H. Watts, Sr. Buyer

Voice: 203.625.7411

FOR:

Locker Room Renovations - Phase II

Greenwich High School

Greenwich Public Schools Bid #2243-19

BID OPENING DATE: MAY 15, 2019 AT 1:00 PM.

SUBMITTED BY:

| Bidder's Full Name | | |
|--------------------|---------------|--|
| Address | | |
| City, State, Zip | | |
| Phone # : | Contact Name: | |

1.1 OFFER

- A. Having examined the Place of The Work and all matters referred to in the Bidding Requirements and the Contract Documents prepared by Fuller and D'Angelo, P.C. for the above mentioned project, we, the undersigned, hereby offer to enter into a Contract to perform Locker Room Renovations Phase II for the Sums of:
 - 1. BASE BID
 - a. The Base Bid of this Proposal for all work required by the Contract Documents for the Locker Room Renovations Phase II is as follows:

2. CASH ALLOWANCES

a. The total Cash Allowance as indicated in Section 01 2100 - Allowances is as follows: Forty Thousand _______(\$40,000.00) DOLLARS

3. CONTINGENCY ALLOWANCES (UNIT COSTS)

a. The total for all Contingency Allowance as indicated in Section 01 2100 - Allowances is as follows:

(\$

_____(\$) DOLLARS

4. COMMISSIONING ALLOWANCES

Ten Thousand

a. The Total Commissioning Allowance as indicated in Section 01 2100 - Allowances Allowances is as follows:

_____(\$ 10,000.00) DOLLARS

(\$) DOLLARS

_____) DOLLARS

FULLER AND D'ANGELO, PC ARCHITECTS AND PLANNERS

B. TOTAL BASE BID

1.2

1.3

1. The Total Base Bid of this Proposal for all work required by the Contract Documents for Locker Room Renovations - Phase II and Related Work is as follows:

| | | | (\$ |) DOLLARS |
|------------|---|--|--|--|
| | (The T | otal Base Bid is sum of 1.1.A.1.a | a, 1.1.A.2.a, 1.1.A.3.a, and 1.1.A.4.a) | |
| C. | materia require accorda comper | I, machinery, plant, implements, d, and to do and perform all the v ance with the drawings and specifi | d agrees that he is to furnish and provi tools, labor, services, skill and other it vork necessary under the Contract, to fications and any addenda thereto, and he Total Bid stated, modified by such a e Owner. | tems of whatever nature complete the work in I to accept in full |
| D. | We hav | ve included the required security | Bid Bond as required. | |
| E. | | ve included the cost for the requir Instructions to Bidders. | ed performance assurance bonds in th | e Bid Amount as required |
| F. | All app | licable federal taxes are included | and State of Connecticut taxes are inc | cluded in the Bid Sum. |
| 2 A | ALTERN | ATES | | |
| A. | The Al | ternates for this Proposal required | d by the Contract Documents are listed | d in Section 01 2300. |
| B. | 1. | The Contractor for the above wo Bid to provide, furnish and instal | with Existing Training Room Conversion rk shall state the combined amount to l all labor, equipment and material record ance with Contract documents. | be ADDED TO the Base |
| | | | (\$ |) DOLLARS |
| C. | 1. | The Contractor for the above wo | | be ADDED TO the Base quired to remove existing |
| | | | (\$ |) DOLLARS |
| D. | 1. | provide, furnish and install all lal | n: rk shall state the amount to be ADDEI oor, equipment and material required t rdance with the Contract Documents (\$ | |
| E. | Alterna | te No. 4 - Renovate/Expand Mal | e and Female Pysical Education Instru | |
| Ŀ. | 1. | The Contractor for the above wo provide, furnish and install all lal | rk shall state the amount to be ADDEI oor, equipment and material required t Offices Room 704B and Room 705D in | D TO the Base Bid to to renovate and expand n accordance with |
| | | | (\$ |) DOLLARS |

- A. This offer shall be open to acceptance and is irrevocable for ninety (90) days from the bid closing date.
- B. If this bid is accepted by Greenwich Public Schools within the time period stated above, we will:
 - 1. Execute the Agreement within seven days of receipt of Notice of Award.
 - 2. Furnish the required bonds within seven days of receipt of Notice of Award.
 - 3. Failure to do so will constitute a breach of contract and Greenwich will have the right to terminate the contract agreement, and bid as this is a time sensitive and of time is of the essence project.

GREENWICH PUBLIC SCHOOLS GREENWICH HIGH SCHOOL LOCKER ROOM RENOVATIONS PHASE II BID FORM

C. If this bid is accepted within the time stated, and we fail to commence the Work or we fail to provide the required Bond(s), the security deposit shall be forfeited as damages to Greenwich Public Schools by reason of our failure, limited in amount to the lesser of the face value of the security deposit or the difference between this bid and the bid upon which a Contract is signed.

1.4 REJECTION OF BIDS

A. The undersigned agrees that the Owner shall have the right to accept or reject any or all bids

1.5 CONTRACT TIME

A. If this Bid is accepted, we will:

Complete all the work covered by this Proposal with a commencement date of NO EARLIER THAN Letter of Award by Owner. Work shall be as indicated in Section 01100 Summary of Contracts Failure to complete each phase of work by dates indicated will result in liquidated damages as stated in the Agreement.

1.6 ADDENDA

A. The following Addenda have been received. The modifications to the Bid Documents noted below have been considered and all costs are included in the Bid Sum.

| 1. | Addendum # | Dated | · |
|----|------------|-------|---|
| 2. | Addendum # | Dated | · |
| 3. | Addendum # | Dated | · |
| 4. | Addendum # | Dated | · |
| 5. | Addendum # | Dated | |

1.7 BID FORM SUPPLEMENTS

- A. The following Supplements are attached to this Bid Form and are considered an integral part of this Bid Form:
 - 1. Refer to Greenwich Front End Documents for additional requirements.
 - 2. Section 00 4400 Contractor's Qualification Statement.
 - 3. Section 01 2100 Allowances.

1.8 BIDDER'S FURTHER AFFIRMATION AND DECLARATION

- A. The above name bidder and should this bid be a joint bid each party thereto, further affirm and declares:
 - 1. That said bidder is of lawful age and the only one interested in this bid; and that no other person, firm or corporation, except those herein above named, has any interest in this bid or in the contract proposed to be entered into.
 - 2. That this bid is made without any understanding, agreement or connection with any other person, firm, or corporation making a bid for the same work, and is in all respects fair and without collusion or fraud.
 - 3. That said bidder is not in arrears to the Greenwich Public Schools upon debt or contract, and is not a defaulter, as surety or otherwise upon any obligation to the said Greenwich Public Schools
 - 4. That no member of the Greenwich Public Schools or any officer or employee of the Greenwich Public Schools or person whose salary is payable in whole or in part from the said school district treasury, or the spouse of any foregoing is or shall be or become interested, directly or indirectly, as a contracting party, partner, stockholder, surety or otherwise, in this bid, or in the performance of the Contract, or in the supplies, materials or equipment and work or labor to which it relates, or in any portion of the profits thereof.
 - 5. That he/she has carefully examined the site of the work and that, from his/her own investigations, he/she has satisfied him/herself as to the nature and location of the work, and character, quality and quantity of materials, and all difficulties likely to be encountered, the kind and extent of equipment and other facilities needed for the performance of the work, the general and local conditions, and all other items which may, in any way, affect the work or its performance.

6. That if a corporation, this bid or proposal containing the Non-Collusive Binding Certification and the foregoing Affirmation and Declaration has been authorized by the Board of Directors of such Corporation, which authorization includes the signing and submission of this bid or proposal and the inclusion therein of the said Certificate of Non-Collusion and Affirmation and Declaration as the Act and Deed of the Corporation.

1.9 BID FORM SIGNATURE(S)

Signature Corporate Seal

The Corporate Seal of

Company Name:

was hereunto affixed in the presence of:

(Authorized signing officer, Title)

(Seal)

(Authorized signing officer, Title)

If the Bid is a joint venture or partnership, add additional forms of execution for each member of the joint venture in the appropriate form or forms as above.

Subscribed and sworn before me this day of ____ 20__.

Notary Public:

My Commission Expire:

END OF BID FORM

QUALIFICATION OF BIDDERS

1.1 REQUIREMENTS

- A. The Undersigned certifies under oath that the information provided herein is true and sufficiently complete so as not to be misleading.
- B. Refer to Greenwich Public Schools front end sections for additional information.
- C. Contractor(s) whose bid exceeds \$500,000.00 shall hold a current "DAS" Contractor Prequalification Certificate" (not a predetermination letter) from the Department of Administrative Services of the State of Connecticut according to Connecticut General Statutes Section 4a-100, 4b-101 and 4b-91 previously stated as Public Act 03-215 and as amended by Public Act 04-141. Bidders shall submit with their bids, unless noted otherwise, a "DAS Contractor Prequalification Certificate" along with a current "Update (bid) Statement". Failure to submit those items with the bid will result in disqualification of the bidder. If you have any questions regarding these requirements contact the State of CT.DAS, at telephone number 860-713-5280 or visit their web site at www.das.state.ct.us.
- D. With the submittal of the Bid Proposal Form, **the bidder shall attach this Qualification of Bidders** and shall answer all the questions and provide all information requested herein. Failure to answer these questions or provide information requested in full may be cause for rejection of the bidder's proposal. If more space is needed, attach additional sheets with reference to subject paragraph.
- E. The Owner reserves the right to consider, but not limited to, the financial responsibility, experience and reputation in the construction industry, as well as the specific qualifications listed below and elsewhere in this document in considering bids and awarding the contract. The Board of Education reserves the right to waive any informalities if, at its discretion the interest of the Greenwich Public Schools will be better served.
- F. To demonstrate qualification for performing the Work of this Contract, bidders may be requested to submit written evidence of financial position and current commitments.
- G. Each Company (Bidder) shall have been in existence under the same name for no less than five (5) years.
- H. Each Company (Bidder) shall have a sucessfuly completed two (2) School projects within the last five (5) years substantially **similar in scope, size, complexity and dollar value** to the work of this project.
- I. The contractor shall furnish, on the attached form, the two (2) projects of that it has performed during the most recent five (5) years including, but not limited to, the name and address of the project, the name of the awarding entity/owner, the name of the awarding entity's/owner's representative, construction manager and architect, current telephone numbers where each can be reached, the description of the project, general scope of the contractor's work, contract price, dates of performance, whether the contract was terminated for cause or convenience, whether the contract was completed on time and whether liquidated damages were assessed against the contractor, and if so,to any items above provide a written explanation.
 - 1. The Owner reserves the right to require additional information it deems appropriate concerning the history of the contractor's performance of each such contract.
- J. The final determination of whether the contractor possesses the requisite experience rests in the sole discretion of the Owner.
- K. To be considered qualified, in addition to the items listed in the Qualification of Bidders, bidder must demonstrate to the Owner's satisfaction:
 - 1. The Corporation, partnership, sole proprietorship of the entity in whose name the bid is submitted has no less than the previous five (5) years performing or coordinating the Work which they are bidding on.
 - 2. The bidder will perform the work with sufficient personnel as required to comply with the schedule.

- 3. Each subcontractor must have a minimum of five (5) years experience in the work and/or applicable trade.
- 4. Field Superintendent must have at least five (5) years experience as a working field superintendent and must speak English or have a translator available at all times at no cost to the Owner.

1.2 QUESTIONAIRE:

1.3

| | Submi | itted to: | Greenwich Public Schools | | | | | | |
|----|----------|--|--|---------------------------------------|--|--|--|--|--|
| | Addre | SS: | 290 Greewnich Avenue | | | | | | |
| | City/T | own: | Greenwich CT 06830 | | | | | | |
| | Submi | tted By: | | | | | | | |
| | Corpo | ration | Partnership | Individual | | | | | |
| | | | | | | | | | |
| | | | ee: | | | | | | |
| | | | | | | | | | |
| | | of Proje | | II | | | | | |
| | | 5 | Greenwich High School | | | | | | |
| | Type (| of Work [.] | (file separate for each Classification of Work |) | | | | | |
| | - jp• (| | | VAC, and Electrical and Related Work. | | | | | |
| (| ORGANI | ZATIO | - | | | | | | |
| ۱. | How r | nanv vea | ars has your organization been in business as a | Contractor? | | | | | |
| | 1. | | any years has your organization been in busing | | | | | | |
| | 2. | | Under what other or former names has your organization operated? | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| 3. | What | | m's bonding range? | | | | | | |
| | | | | | | | | | |
| | 10 | | ate | | | | | | |
| | | If your organization is a corporation, answer the following: 1. Date of Incorporation: | | | | | | | |
| | 1. | a. | State of Incorporation: | | | | | | |
| | | | | | | | | | |
| | | с. | President's Name: Vice-president's name(s): | | | | | | |
| | | с. d. | Secretary's name: | | | | | | |
| | | e. | Treasurer's name: | | | | | | |
|). | If you | If your organization is a partnership, answer the following: | | | | | | | |
| | 1. | | | | | | | | |
| | | a. | Type of partnership (if applicable): | | | | | | |
| | | b. | Name(s) of general partner(s): | | | | | | |
| Ξ. | If you | | ration is individually owned, answer the follow | | | | | | |
| | 1. | Date of | organization: | | | | | | |
| | 2. | Name of | of owner: | | | | | | |
| 7. | If the t | | your organization is other than those listed abo | | | | | | |

1.4 OWNERSHIP, MANAGEMENT, AFFILIATION

A. Identify each person who is or has been, within the past five years, an owner of 5.0% or more of the firm's shares, one of the five largest shareholders, a director, an officer, a partner or the proprietor, or a managerial employee.

| First Name: | MILast Name | DOB |
|----------------|--------------------------------|-----------------|
| % Owned: Direc | tor: YesNoOfficer: YesNo Title | Partner: Yes No |
| First Name: | MILast Name | DOB |
| % Owned: Direc | tor: YesNoOfficer: YesNo Title | Partner: YesNo |
| First Name: | MILast Name | DOB |

% Owned: __Director: Yes__No__Officer: Yes__No__ Title _____Partner: Yes__No___

B. Joint Ventures: Provide information for all firms involved. Fill in name, % owned, office held; indicate by Y or N whether director, officer, partner and title

| First Name: _ | MI | Last Nam | ne | | DOB | | |
|---------------|-----------------|----------------|------|-----------|-----|-------------------|---|
| % Owned: | _Director: YesN | NoOfficer: Ye | sNo_ | _ Title _ | | Partner: YesN | 0 |
| First Name: _ | MI | Last Nam | ne | | DOB | | |
| % Owned: | _Director: YesN | No Officer: Ye | sNo_ | _ Title _ | | Partner: YesN | 0 |
| First Name: _ | M | ILast Nam | ne | | DOB | | |
| % Owned: | _Director: YesN | No Officer: Ye | sNo_ | | | _ Partner: Yes No | |

- C. Has the firm or any firm listed in response to questions above defaulted or been terminated and its surety called upon to complete, any contract awarded within the past five years Yes ____ No ___ If yes, give date(s), agency (ies)/owner(s), project(s), contract numbers, and describe including the result:
- D. List below any projects performed by the bidder in the past five (5) years on which any of the following events occurred:
 - 1. Were any extension of time were requested by the contractor, Yes__ No __and were such requests granted? Yes__ No __
 - 2. Was litigation and/or arbitration commenced by either the Owner or the bidder as a result of the work of the project performed by the bidder? Yes No____
 - Were any liens filed on the project by subcontractors or material suppliers of the bidder?
 Yes No
 - 4. Did the bidder make any claims for extra work on the project, and did said claim result in a change order? Yes_ No ____
 - 5. If Yes:
 - Project Name/Address_____

Type of Event____

Name & Phone # of Owner:

Contact Person at Owner:

E. For all contracts within the past five years: (a) List all liens or claims over \$25,000 filed against the firm and remaining undischarged or unsatisfied for more than 90 days; and (b) list and describe all liquidated damages assessed:

1.5 FINANCIAL INFORMATION

A. Submit firm's most recent annual financial statement and Dun and Bradstreet Report.

1.6 OTHER INFORMATION

- A. Within the past five years has the firm, any affiliate, any predecessor company or entity or any person identified in questions number 1.1 through 1.2 above been the subject of any of the following: (Respond to each question and describe in detail the circumstances of each affirmative answer: (Attach additional pages if necessary).
 - 1. A judgment of conviction for any business-related conduct constituting a crime under state or federal law No_ Yes_
 - 2. A criminal investigation or indictment for any business-related conduct constituting a crime under state or federal law? No_Yes_
 - 3. A grant of immunity for any business-related conduct constituting a crime under state and federal law? No_Yes_
 - 4. A federal or state suspension or debarment? No_Yes_
 - 5. A rejection of any bid for lack of qualifications, responsibility or because of the submission of an informal, non-responsive or incomplete bid? No_Yes_
 - 6. A denial or revocation of prequalification? No_Yes_
 - 7. A voluntary exclusion from bidding/contracting agreement? No_Yes_
 - 8. Any administrative proceeding or civil action seeking specific performance or restitution in connection with any public works contract except any disputed work proceeding? No_Yes_
 - 9. An OSHA Citation and Notification of Penalty containing a violation classified as serious? No____Yes___
 - 10. An OSHA Citation or Notification of Penalty containing a violation classified as willful? No__Yes__
 - 11. A prevailing wage or supplement payment violation? No Yes
 - 12. A State Labor Law violation deemed willful? No_Yes_
 - 13. Any other federal or state Citations, Notices, violation orders, pending administrative hearings or proceedings or determinations of a violation of any labor law or regulation? No_Yes_
 - 14. Any criminal investigation, felony indictment or conviction concerning formation of or any business association with, an allegedly false or fraudulent women's, minority or disadvantaged business enterprise? No_ Yes_
 - 15. Any denial, desertification, revocation or forfeiture of Women's Business Enterprise, Minority Business Enterprise or Disadvantaged Business Enterprise status? No_Yes_
 - 16. Rejection of a low bid on a State contract for failure to meet statutory affirmative action M/WBE requirements? No_Yes_
 - 17. A consent order with the NYS Department of Environmental Conservation or a federal, state or local government enforcement determination involving a violation of federal or state environmental laws? No Yes
 - 18. Any bankruptcy proceeding? No Yes
 - 19. Any suspension or revocation of any business or professional license? No_Yes_
 - 20. Any citations, notices, violation orders, pending administrative hearings or proceedings or determinations for violation of hearings or proceedings or determinations for violation of:
 - a. Federal, state or local health laws, rules or regulations? No_Yes_
 - b. Federal, state or local environmental laws, rules and regulations? No_Yes_
 - c. Unemployment insurance or workers compensation coverage or claim requirements. No_ Yes_
 - d. ERISA (Employee Retirement Income Security Act) No_Yes_
 - e. Federal, state or local human rights laws. No_Yes_
 - f. Federal, state or local labor laws. No_Yes_

- g. Federal or state security laws. No_Yes_
- h. Withdrawal or an agreement to withdraw a bid submitted to a public owner or a request by a public owner to withdraw a bid? No_Yes_
- B. During the five year period preceding the submissions of this bid, has the bidder been named as a party in any lawsuit in an action involving a claim for personal injury or wrongful death arising from performance of work related to any project in which it has been engaged? If the answer to this question is yes, list all such lawsuits, the index number associated with said suit and the status of the lawsuit at the time of the submission of this bid. No_ Yes_
- C. During the five year period preceding the submission of this bid, has the bidder been the subject of proceedings before the Department of Labor for alleged violations of the Labor Law as it relates to the payment of prevailing wages and/or supplemental payment requirements? If the answer to this question is yes, please list each such instance of the commencement of a Department of Labor proceeding, for which project such proceeding was commenced, and the status of the proceeding at the time of the submission of this bid. No_ Yes_
- D. During the five year period preceding the bidder's submission of this bid, has the bidder been the subject of proceedings involving allegations that it violated the Worker's Compensation Law including but not limited to the failure to provide proof of worker's compensation or disability coverage and/or any lapses thereof. If the answer to this question is yes, list such instance of violation and the status of the claimed violation at the time of disposition of this bid. No_Yes_
- E. Has the bidder, its officers, directors, owner and/or managerial employees been convicted of a crime or been the subject of a criminal indictment during the five years preceding the submission of this bid? If the answer to this question is yes, list the name of the individual convicted or indicted the charge against the individual and the date of submission of the charge. No_Yes_
- F. During the five year period preceding the bidder's submission of this bid, has the bidder been charged with and/or found guilty of any violations of federal, state, or municipal environmental and/or health laws, codes, rules and/or regulations. If the answer to this question is yes, list the nature of the charge against the bidder, the date of the charge, and the status of the charge at the time of the submission of this bid. No_ Yes_
- G. Has the bidder ever defaulted or had its surety called upon to complete any contract awarded within the past five years. If the answer to this question is yes, list the projects, the dates and the nature of the termination (convenience, suspension, for cause). No_ Yes_
- H. Has any officer or partner of the bidder's organization ever defaulted or had its surety called upon to complete any contract awarded within the past five years or been an officer or partner of some other organization that has been terminated from a project by an owner? If yes, state: No_ Yes_
- I. Name of Individual(s) _____ Name of Organization(s) Reason(s)

1.7 LICENSING

- A. List jurisdictions and trade categories in which your organization is legally qualified to do business, and indicate registration of license numbers, if applicable.
- B. List jurisdictions in which your organization's partnership or trade name is filed:
- C. Has any director, officer, owner or managerial employee had any professional license suspended or revoked? If the answer is yes, list the name of the individual, the professional license he/she formally had, whether the license was revoked or suspended and the date of the revocation or suspension. No_ Yes_

1.8 EXPERIENCE

- A. List the categories of work that your organization will perform with its own forces:
- B. Claims and Suits. (If the answer of any of the questions below is yes, please attach details.)
 - 1. Have you or has any director, officer, owner or managerial employee ever failed to complete any work awarded to them? If yes, list the project(s) the date(s) and the reason(s) for the failure to complete. No_ Yes_
 - 2. Are there any judgments, claims, arbitration proceedings or suits pending or outstanding against your organization or its officers? No_ Yes_
 - 3. Has your organization filed any law suits or requested arbitration with regard to construction contracts within the last five years? No_ Yes_
 - 4. Within the last five years, has any officer or principal of your organization ever been an officer or principal of another organization when it failed to complete a construction contract? (If the answer is yes, please attach details.) No_Yes_
- C. On a separate sheet, list all construction projects presently your organization has in progress or completed, giving the name of project, owner, architect, contract amount, percent complete and scheduled completion date.
- D. State total worth of work in progress and under contract:
- E. On a separate sheet, list all projects, not listed above, that your organization has completed or in progress in the past five years, giving the name of the project, owner, architect, contract amount, date of completion and percentage of the cost of the work performed with your own forces.
- F. State average annual amount of construction work performed during the past five years:
- G. On a separate sheet, list the construction experience and present commitment of the key individuals of your organization.

1.9 APPRENTICE PROGRAM

A. Has the Firm have in place apprenticeship agreements appropriate for the type and scope of work to be performed, that have been registered with, and approved by, the Commissioner of the New York State Department of Labor pursuant to the requirements found in Article 23 of the Labor Law. No Yes

1.10 REFERENCES

- A. Trade reference:
- B. Bank references:
- C. Surety:
 - 1. Name of present bonding company:
 - 2. Name and address of agent: _____
 - 3. Name or previous bonding company: _____

1.11 CERTIFICATION

A. The undersigned recognizes that this questionnaire is submitted for the purpose of the Greenwich Public Schools awarding a contract or approving a subcontract; acknowledges that the Owner may in its discretion, by means which it may choose, determine the truth and accuracy of all statements made herein; acknowledge that intentional submission of false or misleading information may constitute a felony under Penal Law §210.40 or a misdemeanor under Penal Law §210.35 or §210.45, and may also be punishable by a fine of up to \$10,000 or imprisonment of up to five years under 18 U.S.C. §1001; and states that the information submitted in this questionnaire any attached pages is true, accurate and complete.

Dated at this day of _____

Name of Organization:

GREENWICH PUBLIC SCHOOLS GREENWICH HIGH SCHOOL LOCKER ROOM RENOVATIONS PHASE II QUALIFICATION OF BIDDERS

| By: | _Title |
|---|--|
| being duly sworn deposes and says that the information provided | d herein is true and sufficiently complete |

1.12 See Project Information Form attached.

GREENWICH PUBLIC SCHOOLS GREENWICH HIGH SCHOOL LOCKER ROOM RENOVATIONS PHASE II QUALIFICATION OF BIDDERS

| Project Name: | |
|---------------------------------------|--------------|
| Company work was performed under: _ | |
| Who was Co. Principal in charge: | |
| Location: | |
| Cost of Contract: Final Cost of Work: | |
| Description of work: | |
| | |
| Owners Name: | |
| | phone e.mail |
| CM Name(if applicable): | |
| | phonee.mail |
| Architect Firm: | |
| | phonee.mail |

GREENWICH PUBLIC SCHOOLS GREENWICH HIGH SCHOOL LOCKER ROOM RENOVATIONS PHASE II QUALIFICATION OF BIDDERS

| Project Name: | | | |
|-----------------------------------|---------------------|--|--|
| Company work was performed under: | | | |
| Who was Co. Principal in charge: | | | |
| Location: | | | |
| | Final Cost of Work: | | |
| Description of work: | | | |
| | | | |
| Owners Name: | | | |
| Owner Contact: Name | | | |
| CM Name(if applicable): | | | |
| CM Contact: Name | | | |
| Architect Firm: | | | |
| Architect Contact: | | | |

END OF SECTION

NON-COLLUSION AFFIDAVIT

GREENWICH PUBLIC SCHOOLS 290 GREENWICH AVE GREENWICH, CONNECTICUT

State of :

County of ______ :s.s.

I state that I am the______(TITLE)_____

_____ Of _____ (NAME OF MY FIRM) and that I am authorized to make this affidavit on behalf of my firm, and its owners, directors, and officers. I am the person responsible in my firm for the price(s) and the amount of this bid. I state that:

- (1) The price(s) and amount of this bid have been arrived at independently and without consultation communication or agreement with any other contractor, bidder/proposer or potential bidder/proposer.
- (2) Neither the price(s) nor the amount of this bid/rfp, and neither the approximate price(s) nor approximate amount of this bid/rfp, have been disclosed to any other firm or person who is a bidder/proposer or potential bidder/proposer, and they will not be disclosed before bid/rfp opening.
- (3) No attempt has been made or will be made to induce any firm or person to refrain from bidding/proposing on this contract, or to submit a bid/proposal higher than this bid/rfp, or to submit any intentionally high or noncompetitive bid/rfp or other form of complementary bid/rfp.
- (4) I fully understand that more than one offer from an individual, firm partnership, corporation or association under the same or different name will be rejected. Reasonable grounds for believing that a bidder/proposer is interested in more than one bid/rfp for the work contemplated may cause rejection of all bids/rfps in which the bidder/proposer is interested. Any or all bidders/proposers will be rejected if there is any reason for believing that collusion exists among the bidders/proposers. Participants in such collusion may not be considered in the future offers for the same work. Each bidder/proposer by submitting a bid/proposal certifies that it is not a part to any collusive action.
- (5) The bid/rfp of my firm is made in good faith and not pursuant to any agreement or discussion with, or inducement from, any firm or person to submit a complementary or other noncompetitive bid/proposal.

(6) ______its affiliates, subsidiaries, officers, (NAME OF MY FIRM) directors and employees are not currently under investigation by any governmental agency and have not in the last four years been convicted or found liable for any act prohibited by State or Federal law in any jurisdiction, involving conspiracy or collusion with respect to bidding/proposing on any public contract, except as follows: _____ understands and acknowledges that I state that (NAME OF MY FIRM)

the above representations are material and important, and will be relied on by Greenwich Public Schools in awarding the bid/proposal for which this is submitted. I understand and my firm understands that any misstatement in this affidavit is and shall be treated as fraudulent concealment from Greenwich Public Schools of the true facts relating to the submission of bids/proposals for this contract.

(7) I agree to furnish and deliver all services on the date and time agreed on by ______ and the Greenwich Board of Education at (NAME OF MY FIRM)

The time the purchase order is placed. Furthermore, there will not be any cancellations to the Board of Education. If a bidder/proposer submits a bid/proposer on any item he/she will be responsible for delivering that item at the bid/proposal cost, in accordance with the attached above specifications, which were submitted with this bid/proposal and upon which the bid/proposal was made.

- (8) In submitting this bid/proposal, the undersigned declares that this is made without any connection with any persons making another bid/proposal on the same contract; that the bid/proposal is in all respects fair and without collusion, fraud or mental reservation; and that no official of the Town, or any person in the employ of the Town, is directly or indirectly interested in said bid/proposal or in the supplies or work to which it relates, or in any portion of the profits thereof.
- (9) In submitting this bid, the undersigned further declares that it has not, and will not, induce or attempt to induce any Town of Greenwich employee or officer to violate the Greenwich Code of Ethics in connection with its offer to provide goods or services under, or otherwise in the performance of such contract.
- (10) The undersigned further understands that the above declarations are material representations to the Town of Greenwich made as a condition to the acceptance of the bid/proposal. If found to be false, the Town of Greenwich retains the right to reject said bid/proposal and rescind any resultant contract and/or purchase order and notify the undersigned accordingly, thereby declaring as void said bid/proposal and contract or purchase order.
- (11) The Greenwich Code of Ethics can be found at <u>www.greenwichct.org</u>. Code of Ethics stated as follows:
 - <u>DEFINITION</u>. (1)Indirect interest, without limiting its generality, shall mean and include the interest of any subcontractor in any prime contract with the Town and the interest of any person or his immediate family in any corporation, firm or partnership which as a direct or indirect interest in any transaction with the Town.
 (2) Substantial financial interest shall mean any financial interest, direct or indirect, which is more than nominal and which is not common to the interest of other citizens of the Town. (3) Town Officer shall mean and include any official, commission, committee, legislative body or other agency of the Town. (4) Transaction shall mean and include the offer, sale or furnishing of any real or personal property, material, supplies otherwise, for the use and benefit of the Town for a valuable consideration, excepting the services of any person as a Town Officer.
 - 2. <u>GIFTS AND FAVORS</u>. No Town Officer or his immediate family shall accept any valuable gift, things, favor, loan or promise which might tend to influence the performance or nonperformance of his official duties.
 - 3. <u>IMPROPER INFLUENCE</u>. No Town Officer having a substantial financial interest in any transaction with the Town or in any action to be taken by the Town shall use is office to exert his influence or to vote on such transaction or action.

VENDOR INFORMATION. (Please print the following)

| VENDOR NAME | |
|---|---|
| ADDRESS | |
| TELEPHONE | FAX # |
| E-MAIL | WEB SITE |
| AUTHORIZED SIGNATURE | TITLE |
| | r/proposer understands and agrees to t |
| attached terms, conditions, and spe Bidders/Proposers Employment Discrimin | ecifications, including Collusion amo nation by the Contractor Prohibited. |
| ttached terms, conditions, and spe Bidders/Proposers Employment Discrimin GNATURE | ecifications, including Collusion amo nation by the Contractor Prohibited. ME, A NOTARY PUBLIC, IN AND FOR TI |

DAY OF _____, 2019

NOTARY PUBLIC

MY COMMISSION EXPIRES_____

COMPANY INFORMATION

NAME OF FIRM STREET CITY, STATE, ZIP

SALES REPRESENTATIVE NAME TELEPHONE #

| Minimum Rates and Classifie for Building Construction ID# : B 25932 | cations Connecticut Department of Labor Wage and Workplace Standards Division | | |
|--|---|--|--|
| By virtue of the authority vested in the Labor Commissioner under provisions of Section 31-53 of the General Statutes of Connecticut, as amended, the following are declared to be the prevailing rates and welfare payments and will apply only where the contract is advertised for bid within 20 days of the date on which the rates are established. Any contractor or subcontractor not obligated by agreement to pay to the welfare and pension fund shall pay this amount to each employee as part of his/her hourly wages. | | | |
| Project Number: | Project Town: Greenwich | | |

State#:

FAP#:

Project: Greenwich High School Locker Room Renovations Phase II

| CLASSIFICATION | Hourly Rate | Benefits |
|--|-------------|----------|
| 1a) Asbestos Worker/Insulator (Includes application of insulating materials, protective coverings, coatings, & finishes to all types of mechanical systems; application of firestopping material for wall openings & penetrations in walls, floors, ceilings | 38.25 | 27.96 |
| 1b) Asbestos/Toxic Waste Removal Laborers: Asbestos removal and encapsulation (except its removal from mechanical systems which are not to be scrapped), toxic waste removers, blasters.**See Laborers Group 7** | | |
| 1c) Asbestos Worker/Heat and Frost Insulator | 40.21 | 29.30 |

| Project: Greenwich High School Locker Room Renovations Phase II |
|---|
|---|

| 2) Boilermaker | 38.34 | 26.01 |
|---|-------|-----------|
| | | |
| | | |
| 3a) Bricklayer, Cement Mason, Concrete Finisher (including caulking), Stone Masons | 34.72 | 33.58 + a |
| | | |
| 3b) Tile Setter | 34.90 | 25.87 |
| | | |
| 3c) Terrazzo Mechanics and Marble Setters | 31.69 | 22.35 |
| | | |
| 3d) Tile, Marble & Terrazzo Finishers | 26.70 | 21.75 |
| | | |
| 3e) Plasterer | 33.48 | 32.06 |
| | | |

-----LABORERS------

| 4) Group 1: Laborers (common or general), acetylene burners, concrete specialists, wrecking laborers, fire watchers. | 30.05 | 20.10 |
|--|-------|-------|
| 4a) Group 2: Mortar mixers, plaster tender, power buggy operators, powdermen, fireproofer/mixer/nozzleman (Person running mixer and spraying fireproof only). | 30.30 | 20.10 |
| 4b) Group 3: Jackhammer operators/pavement breaker, mason tender (brick), mason tender (cement/concrete), forklift operators and forklift operators (masonry). | 30.55 | 20.10 |
| 4c) **Group 4: Pipelayers (Installation of water, storm drainage or sewage ines outside of the building line with P6, P7 license) (the pipelayer rate shall apply only to one or two employees of the total crew who primary eask is to actually perform the mating of pipe sections) P6 and P7 rate is \$26.80. | 30.55 | 20.10 |
| 4d) Group 5: Air track operator, sand blaster and hydraulic drills. | 30.55 | 20.10 |

| 4e) Group 6: Blasters, nuclear and toxic waste removal. | 31.80 | 20.10 |
|--|-------|-------|
| | | |
| 4f) Group 7: Asbestos/lead removal and encapsulation (except it's removal from mechanical systems which are not to be scrapped). | 31.05 | 20.10 |
| | | |
| 4g) Group 8: Bottom men on open air caisson, cylindrical work and boring crew. | 28.38 | 20.10 |
| | | |
| 4h) Group 9: Top men on open air caisson, cylindrical work and boring crew. | 27.86 | 20.10 |
| | | |
| 4i) Group 10: Traffic Control Signalman | 16.00 | 20.10 |
| | | |
| 5) Carpenter, Acoustical Ceiling Installation, Soft Floor/Carpet Laying, Metal Stud Installation, Form Work and Scaffold Building, Drywall Hanging, Modular-Furniture Systems Installers, Lathers, Piledrivers, Resilient Floor Layers. | 32.60 | 25.34 |

| 5a) Millwrights | 33.14 | 25.74 |
|--|-------|--------------|
| | | |
| | | |
| 6) Electrical Worker (including low voltage wiring) (Trade License required: E1,2 L-5,6 C-5,6 T-1,2 L-1,2 V-1,2,7,8,9) | 34.50 | 29.64 |
| | | |
| 7a) Elevator Mechanic (Trade License required: R-1,2,5,6) | 53.37 | 33.705+a+b |
| | | |
| | | |
| LINE CONSTRUCTION | | |
| | | |
| Groundman | 26.50 | 6.5% + 9.00 |
| | | |
| | | |
| Linemen/Cable Splicer | 48.19 | 6.5% + 22.00 |
| | | |
| Linemen/Cable Splicer | 48.19 | 6.5% + 22.00 |

| 8) Glazier (Trade License required: FG-1,2) | 37.18 | 21.05 + a |
|--|-------|-----------|
| | | |
| | | |
| 9) Ironworker, Ornamental, Reinforcing, Structural, and Precast Concrete Erection | 35.47 | 35.14 + a |
| OPERATORS | | |
| | | |
| Group 1: Crane handling or erecting structural steel or stone, hoisting engineer 2 drums or over, front end loader (7 cubic yards or over), work boat 26 ft. and over and Tunnel Boring Machines. (Trade License Required) | 39.55 | 24.30 + a |
| Group 2: Cranes (100 ton rate capacity and over); Excavator over 2 cubic yards; Piledriver (\$3.00 premium when operator controls hammer); Bauer Drill/Caisson. (Trade License Required) | 39.23 | 24.30 + a |
| Group 3: Excavator; Backhoe/Excavator under 2 cubic yards; Cranes (under 100 ton rated capacity), Grader/Blade; Master Mechanic; Hoisting Engineer (all types of equipment where a drum and cable are used to hoist or drag material regardless of motive power of operation), Rubber Tire Excavator (Drott-1085 or similar);Grader Operator; Bulldozer Fine Grade. (slopes, shaping, laser or GPS, etc.). (Trade License Required) | 38.49 | 24.30 + a |

| Group 4: Trenching Machines; Lighter Derrick; Concrete Finishing Machine; CMI Machine or Similar; Koehring Loader (Skooper). | 38.10 | 24.30 + a |
|---|-------|-----------|
| Group 5: Specialty Railroad Equipment; Asphalt Paver; Asphalt Reclaiming Machine; Line Grinder; Concrete Pumps; Drills with Self Contained Power Units; Boring Machine; Post Hole Digger; Auger; Pounder; Well Digger; Milling Machine (over 24" Mandrell) | 37.51 | 24.30 + a |
| Group 5 continued: Side Boom; Combination Hoe and Loader; Directional Driller; Pile Testing Machine. | 37.51 | 24.30 + a |
| Group 6: Front End Loader (3 up to 7 cubic yards); Bulldozer (rough grade dozer). | 37.20 | 24.30 + a |
| Group 7: Asphalt roller, concrete saws and cutters (ride on types), vermeer concrete cutter, Stump Grinder; Scraper; Snooper; Skidder; Milling Machine (24" and under Mandrell). | 36.86 | 24.30 + a |
| Group 8: Mechanic, grease truck operator, hydroblaster; barrier mover; power stone spreader; welding; work boat under 26 ft.; transfer machine. | 36.46 | 24.30 + a |

| Group 9: Front end loader (under 3 cubic yards), skid steer loader regardless of attachments, (Bobcat or Similar): forklift, power chipper; landscape equipment (including Hydroseeder). | 36.03 | 24.30 + a |
|--|-------|-----------|
| Group 10: Vibratory hammer; ice machine; diesel and air, hammer, etc. | 33.99 | 24.30 + a |
| Group 11: Conveyor, earth roller, power pavement breaker (whiphammer), robot demolition equipment. | 33.99 | 24.30 + a |
| Group 12: Wellpoint operator. | 33.93 | 24.30 + a |
| Group 13: Compressor battery operator. | 33.35 | 24.30 + a |
| Group 14: Elevator operator; tow motor operator (solid tire no rough terrain). | 32.21 | 24.30 + a |

| Group 15: Generator Operator; Compressor Operator; Pump Operator; Welding Machine Operator; Heater Operator. | 31.80 | 24.30 + a |
|---|-------|-----------|
| | | |
| Group 16: Maintenance Engineer/Oiler. | 31.15 | 24.30 + a |
| | | |
| Group 17: Portable asphalt plant operator; portable crusher plant operator; portable concrete plant operator. | 35.46 | 24.30 + a |
| | | |
| Group 18: Power safety boat; vacuum truck; zim mixer; sweeper; (Minimum for any job requiring a CDL license). | 33.04 | 24.30 + a |
| | | |
| PAINTERS (Including Drywall Finishing) | | |
| | | |
| 10a) Brush and Roller | 33.62 | 21.05 |
| | | |

| 10b) Taping Only/Drywall Finishing | 34.37 | 21.05 |
|---|-------|-----------|
| | | |
| | | |
| 10c) Paperhanger and Red Label | 34.12 | 21.05 |
| | | |
| | | |
| 10e) Blast and Spray | 36.62 | 21.05 |
| | | |
| | | |
| 11) Plumber (excluding HVAC pipe installation) (Trade License required: P-1,2,6,7,8,9 J-1,2,3,4 SP-1,2) | 42.62 | 31.21 |
| | | |
| | | |
| 12) Well Digger, Pile Testing Machine | 37.26 | 24.05 + a |
| | | |
| | | |
| Roofer: Cole Tar Pitch | 41.50 | 17.00 + a |
| | | |

Project: Greenwich High School Locker Room Renovations Phase II

| Roofer: Slate, Tile, Composition, Shingles, Singly Ply and Damp/Waterproofing | 40.00 | 17.00 + a |
|---|-------|-----------|
| 15) Sheetmetal Worker (Trade License required for HVAC and Ductwork: SM-1,SM-2,SM-3,SM-4,SM-5,SM-6) | 43.70 | 42.40 |
| 16) Pipefitter (Including HVAC work) (Trade License required: S-1,2,3,4,5,6,7,8 B-1,2,3,4 D-1,2,3,4, G-1, G-2, G-8 & G-9) | 42.62 | 31.21 |
| TRUCK DRIVERS | | |
| 17a) 2 Axle | 29.13 | 23.33 + a |
| 17b) 3 Axle, 2 Axle Ready Mix | 29.23 | 23.33 + a |

| 17c) 3 Axle Ready Mix | 29.28 | 23.33 + a |
|--|-------|-----------|
| | | |
| | | |
| 17d) 4 Axle, Heavy Duty Trailer up to 40 tons | 29.33 | 23.33 + a |
| | | |
| | | |
| 17e) 4 Axle Ready Mix | 29.38 | 23.33 + a |
| | | |
| | | |
| 17f) Heavy Duty Trailer (40 Tons and Over) | 29.58 | 23.33 + a |
| | | |
| | | |
| 17g) Specialized Earth Moving Equipment (Other Than Conventional Type on-the-Road Trucks and Semi-Trailers, Including Euclids) | 29.38 | 23.33 + a |
| | | |
| | | |
| 18) Sprinkler Fitter (Trade License required: F-1,2,3,4) | 43.92 | 15.84 + a |
| | | |
| | | |

19) Theatrical Stage Journeyman

25.76 7.34

Welders: Rate for craft to which welding is incidental.

*Note: Hazardous waste removal work receives additional \$1.25 per hour for truck drivers.

**Note: Hazardous waste premium \$3.00 per hour over classified rate

ALL Cranes: When crane operator is operating equipment that requires a fully licensed crane operator to operate he receives an extra \$4.00 premium in addition to the hourly wage rate and benefit contributions:

1) Crane handling or erecting structural steel or stone; hoisting engineer (2 drums or over)

- 2) Cranes (100 ton rate capacity and over) Bauer Drill/Caisson
- 3) Cranes (under 100 ton rated capacity)

Crane with 150 ft. boom (including jib) - \$1.50 extra Crane with 200 ft. boom (including jib) - \$2.50 extra Crane with 250 ft. boom (including jib) - \$5.00 extra Crane with 300 ft. boom (including jib) - \$7.00 extra Crane with 400 ft. boom (including jib) - \$10.00 extra

All classifications that indicate a percentage of the fringe benefits must be calculated at the percentage rate times the "base hourly rate".

Apprentices duly registered under the Commissioner of Labor's regulations on "Work Training Standards for Apprenticeship and Training Programs" Section 31-51-d-1 to 12, are allowed to be paid the appropriate percentage of the prevailing journeymen hourly base and the full fringe benefit rate, providing the work site ratio shall not be less than one full-time journeyperson instructing and supervising the work of each apprentice in a specific trade.

The Prevailing wage rates applicable to this project are subject to annual adjustments each July 1st for the duration of the project.

Each contractor shall pay the annual adjusted prevailing wage rate that is in effect each July 1st, as posted by the Department of Labor.

It is the contractor's responsibility to obtain the annual adjusted prevailing wage rate increases directly from the Department of Labor's website.

The annual adjustments will be posted on the Department of Labor's Web page: www.ct.gov/dol. For those without internet access, please contact the division listed below.

The Department of Labor will continue to issue the initial prevailing wage rate schedule to the Contracting Agency for the project.

All subsequent annual adjustments will be posted on our Web Site for contractor access.

Contracting Agencies are under no obligation pursuant to State labor law to pay any increase due to the annual adjustment provision.

Effective October 1, 2005 - Public Act 05-50: any person performing the work of any mechanic, laborer, or worker shall be paid prevailing wage

All Person who perform work ON SITE must be paid prevailing wage for the appropriate mechanic, laborer, or worker classification.

All certified payrolls must list the hours worked and wages paid to All Persons who perform work ON SITE regardless of their ownership i.e.: (Owners, Corporate Officers, LLC Members, Independent Contractors, et. al)

Reporting and payment of wages is required regardless of any contractual relationship alleged to exist between the contractor and such person.

~~Unlisted classifications needed for work not included within the scope of the classifications listed may be added after award only as provided in the labor standards contract clause (29 CFR 5.5 (a) (1) (ii)).

Please direct any questions which you may have pertaining to classification of work and payment of prevailing wages to the Wage and Workplace Standards Division, telephone (860)263-6790.

Sec. 31-53b. Construction safety and health course. New miner training program. Proof of completion required for mechanics, laborers and workers on public works projects. Enforcement. Regulations. Exceptions. (a) Each contract for a public works project entered into on or after July 1, 2009, by the state or any of its agents, or by any political subdivision of the state or any of its agents, described in subsection (g) of section 31-53, shall contain a provision requiring that each contractor furnish proof with the weekly certified payroll form for the first week each employee begins work on such project that any person performing the work of a mechanic, laborer or worker pursuant to the classifications of labor under section 31-53 on such public works project, pursuant to such contract, has completed a course of at least ten hours in duration in construction safety and health approved by the federal Occupational Safety and Health Administration or, has completed a new miner training program approved by the Federal Mine Safety and Health Administration in accordance with 30 CFR 48 or, in the case of telecommunications employees, has completed at least ten hours of training in accordance with 29 CFR 1910.268.

(b) Any person required to complete a course or program under subsection (a) of this section who has not completed the course or program shall be subject to removal from the worksite if the person does not provide documentation of having completed such course or program by the fifteenth day after the date the person is found to be in noncompliance. The Labor Commissioner or said commissioner's designee shall enforce this section.

(c) Not later than January 1, 2009, the Labor Commissioner shall adopt regulations, in accordance with the provisions of chapter 54, to implement the provisions of subsections (a) and (b) of this section. Such regulations shall require that the ten-hour construction safety and health courses required under subsection (a) of this section be conducted in accordance with federal Occupational Safety and Health Administration Training Institute standards, or in accordance with Federal Mine Safety and Health Administration Standards or in accordance with 29 CFR 1910.268, as appropriate. The Labor Commissioner shall accept as sufficient proof of compliance with the provisions of subsection (a) or (b) of this section a student course completion card issued by the federal Occupational Safety and Health Administration Training Institute, or such other proof of compliance said commissioner deems appropriate, dated no earlier than five years before the commencement date of such public works project.

(d) This section shall not apply to employees of public service companies, as defined in section 16-1, or drivers of commercial motor vehicles driving the vehicle on the public works project and delivering or picking up cargo from public works projects provided they perform no labor relating to the project other than the loading and unloading of their cargo.

(P.A. 06-175, S. 1; P.A. 08-83, S. 1.)

History: P.A. 08-83 amended Subsec. (a) by making provisions applicable to public works project contracts entered into on or after July 1, 2009, replacing provision re total cost of work with reference to Sec. 31-53(g), requiring proof in certified payroll form that new mechanic, laborer or worker has completed a 10-hour or more construction safety course and adding provision re new miner training program, amended Subsec. (b) by substituting "person" for "employee" and adding "or program", amended Subsec. (c) by adding "or in accordance with Federal Mine

Safety and Health Administration Standards" and setting new deadline of January 1, 2009, deleted former Subsec. (d) re "public building", added new Subsec. (d) re exemptions for public service company employees and delivery drivers who perform no labor other than delivery and made conforming and technical changes, effective January 1, 2009.

Informational Bulletin

THE 10-HOUR OSHA CONSTRUCTION SAFETY AND HEALTH COURSE

(applicable to public building contracts entered into on or after July 1, 2007, where the total cost of all work to be performed is at least \$100,000)

- (1) This requirement was created by Public Act No. 06-175, which is codified in Section 31-53b of the Connecticut General Statutes (pertaining to the prevailing wage statutes);
- (2) The course is required for public building construction contracts (projects funded in whole or in part by the state or any political subdivision of the state) entered into on or after July 1, 2007;
- (3) It is required of private employees (not state or municipal employees) and apprentices who perform manual labor for a general contractor or subcontractor on a public building project where the total cost of all work to be performed is at least \$100,000;
- (4) The ten-hour construction course pertains to the ten-hour Outreach Course conducted in accordance with federal OSHA Training Institute standards, and, for telecommunications workers, a ten-hour training course conducted in accordance with federal OSHA standard, 29 CFR 1910.268;
- (5) The internet website for the federal OSHA Training Institute is http://www.osha.gov/fso/ote/training/edcenters/fact_sheet.html;
- (6) The statutory language leaves it to the contractor and its employees to determine who pays for the cost of the ten-hour Outreach Course;
- (7) Within 30 days of receiving a contract award, a general contractor must furnish proof to the Labor Commissioner that all employees and apprentices performing manual labor on the project will have completed such a course;
- (8) Proof of completion may be demonstrated through either: (a) the presentation of a bona fide student course completion card issued by the federal OSHA Training Institute; or (2) the presentation of documentation provided to an employee by a trainer certified by the Institute pending the actual issuance of the completion card;
- (9) Any card with an issuance date more than 5 years prior to the commencement date of the construction project shall not constitute proof of compliance;

- (10) Each employer shall affix a copy of the construction safety course completion card to the certified payroll submitted to the contracting agency in accordance with Conn. Gen. Stat. § 31-53(f) on which such employee's name first appears;
- (11) Any employee found to be in non-compliance shall be subject to removal from the worksite if such employee does not provide satisfactory proof of course completion to the Labor Commissioner by the fifteenth day after the date the employee is determined to be in noncompliance;
- (12) Any such employee who is determined to be in noncompliance may continue to work on a public building construction project for a maximum of fourteen consecutive calendar days while bringing his or her status into compliance;
- (13) The Labor Commissioner may make complaint to the prosecuting authorities regarding any employer or agent of the employer, or officer or agent of the corporation who files a false certified payroll with respect to the status of an employee who is performing manual labor on a public building construction project;
- (14) The statute provides the minimum standards required for the completion of a safety course by manual laborers on public construction contracts; any contractor can exceed these minimum requirements; and
- (15) Regulations clarifying the statute are currently in the regulatory process, and shall be posted on the CTDOL website as soon as they are adopted in final form.
- (16) Any questions regarding this statute may be directed to the Wage and Workplace Standards Division of the Connecticut Labor Department via the internet website of http://www.ctdol.state.ct.us/wgwkstnd/wgemenu.htm; or by telephone at (860)263-6790.

THE ABOVE INFORMATION IS PROVIDED EXCLUSIVELY AS AN EDUCATIONAL RESOURCE, AND IS NOT INTENDED AS A SUBSTITUTE FOR LEGAL INTERPRETATIONS WHICH MAY ULTMATELY ARISE CONCERNIG THE CONSTRUCTION OF THE STATUTE OR THE REGULATIONS. November 29, 2006

Notice

To All Mason Contractors and Interested Parties Regarding Construction Pursuant to Section 31-53 of the Connecticut General Statutes (Prevailing Wage)

The Connecticut Labor Department Wage and Workplace Standards Division is empowered to enforce the prevailing wage rates on projects covered by the above referenced statute.

Over the past few years the Division has withheld enforcement of the rate in effect for workers who operate a forklift on a prevailing wage rate project due to a potential jurisdictional dispute.

The rate listed in the schedules and in our Occupational Bulletin (see enclosed) has been as follows:

Forklift Operator:

- Laborers (Group 4) Mason Tenders - operates forklift solely to assist a mason to a maximum height of nine feet only.

- Power Equipment Operator (Group 9) - operates forklift to assist any trade and to assist a mason to a height over nine feet.

The U.S. Labor Department conducted a survey of rates in Connecticut but it has not been published and the rate in effect remains as outlined in the above Occupational Bulletin.

Since this is a classification matter and not one of jurisdiction, effective January 1, 2007 the Connecticut Labor Department will enforce the rate on each schedule in accordance with our statutory authority.

Your cooperation in filing appropriate and accurate certified payrolls is appreciated.

Statute 31-55a

You are here: DOL Web Site + Wage and Workplace Standards + Statute 31-55a

- Special Notice -

To All State and Political Subdivisions, Their Agents, and Contractors

Connecticut General Statute 31-55a - Annual adjustments to wage rates by contractors doing state work.

Each contractor that is awarded a contract on or after October 1, 2002, for (1) the construction of a state highway or bridge that falls under the provisions of section 31-54 of the general statutes, or (2) the construction, remodeling, refinishing, refurbishing, rehabilitation, alteration or repair of any public works project that falls under the provisions of section 31-53 of the general statutes shall contact the Labor Commissioner on or before July first of each year, for the duration of such contract, to ascertain the prevailing rate of wages on an hourly basis and the amount of payment or contributions paid or payable on behalf of each mechanic, laborer or worker employed upon the work contracted to be done, and shall make any necessary adjustments to such prevailing rate of wages and such payment or contributions paid or payable on behalf of each such employee, effective each July first.

- The prevailing wage rates applicable to any contract or subcontract awarded on or after October 1, 2002 are subject to annual adjustments each July 1st for the duration of any project which was originally advertised for bids on or after October 1, 2002.
- Each contractor affected by the above requirement shall pay the annual adjusted prevailing wage rate that is in effect each July 1st, as posted by the Department of Labor.
- It is the *contractor's* responsibility to obtain the annual adjusted prevailing wage rate increases directly from the Department of Labor's Web Site. The annual adjustments will be posted on the Department of Labor Web page: <u>www.ctdol.state.ct.us</u>. For those without internet access, please contact the division listed below.
- The Department of Labor will continue to issue the initial prevailing wage rate schedule to the Contracting Agency for the project. All subsequent annual adjustments will be posted on our Web Site for contractor access.

Any questions should be directed to the Contract Compliance Unit, Wage and Workplace Standards Division, Connecticut Department of Labor, 200 Folly Brook Blvd., Wethersfield, CT 06109 at (860)263-6790.

Workplace Laws

Published by the Connecticut Department of Labor, Project Management Office Last Updated: April 22, 2010

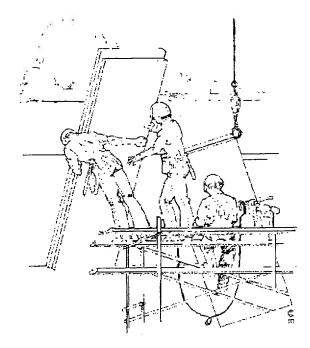
~NOTICE~

TO ALL CONTRACTING AGENCIES

Please be advised that Connecticut General Statutes Section 31-53, requires the contracting agency to certify to the Department of Labor, the total dollar amount of work to be done in connection with such public works project, regardless of whether such project consists of one or more contracts.

Please find the attached "Contracting Agency Certification Form" to be completed and returned to the Department of Labor, Wage and Workplace Standards Division, Public Contract Compliance Unit.

S Inquiries can be directed to (860)263-6543.



CONNECTICUT DEPARTMENT OF LABOR WAGE AND WORKPLACE STANDARDS DIVISION CONTRACT COMPLIANCE UNIT

CONTRACTING AGENCY CERTIFICATION FORM

| I | , ao | cting in my official ca | pacity as |
|--------------------|----------------------------|-------------------------|-----------------------------------|
| authorized | representative | | title |
| for | | , located at | I |
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| Return To: | Connecticut Departm | pent of Labor | |
| Neturn 10. | Wage & Workplace | | |
| | Contract Compliance | | |
| з. | 200 Folly Brook Blv | d. | |
| | Wethersfield, CT 06 | 109 | |
| Date Issued: | | | |

CONNECTICUT DEPARTMENT OF LABOR WAGE AND WORKPLACE STANDARDS DIVISION

CONTRACTORS WAGE CERTIFICATION FORM

| Officer, Owner, Authorized Rep. | of Company Name |
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| | |
| o hereby certify that the | |
| | Company Name |
| | Street |
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| nd all of its subcontractors will pay all wo | orkers on the |
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| he wages as listed in the schedule of preva | ailing rates required for such project (a copy of |
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Certified Payroll Form WWS - CPI

You are here: DOL Web Site + Wage and Workplace Standards + Certified Payroll Form WWS - CPI

In accordance with <u>Connecticut General Statutes</u>, <u>31-53</u> Certified Payrolls with a statement of compliance shall be submitted monthly to the contracting agency.

Note: Once you have downloaded these forms and are ready to print them out, set the print function on your PC to the horizontal print orientation.

Note2: Please download both the Payroll Certification for Public Works Projects **and** the Certified Statement of Compliance for a complete package. The Certified Statement of Compliance appears on the same page as the Fringe Benefits Explanation page.

Announcement: The Certified Payroll Form WWS-CPI can now be completed on-line!

- Certified Payroll Form WWS-CPI (PDF, 727KB)
- Sample Completed Form (PDF, 101KB)

Published by the Connecticut Department of Labor, Project Management Office Last Updated: April 22, 2010

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[New] In accordance with Section 31-53b(a) of the C.G.S. each contractor shall provide a copy of the OSHA 10 Hour Construction Safety and Health Card for each employee, to be attached to the first certified payroll on the project.

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OSHA 10 ~ATTACH CARD TO 1ST CERTIFIED PAYROLL

*FRINGE BENEFITS EXPLANATION (P):

Bona fide benefits paid to approved plans, funds or programs, except those required by Federal or State Law (unemployment tax, worker's compensation, income taxes, etc.).

Please specify the type of benefits provided:

 1) Medical or hospital care ______
 4) Disability ______

 2) Pension or retirement ______
 5) Vacation, holiday ______

3) Life Insurance ______ 6) Other (please specify) _____

CERTIFIED STATEMENT OF COMPLIANCE

For the week ending date of ______

I, ______ of ______, (hereafter known as

Employer) in my capacity as ______ (title) do hereby certify and state:

Section A:

1. All persons employed on said project have been paid the full weekly wages earned by them during the week in accordance with Connecticut General Statutes, section 31-53, as amended. Further, I hereby certify and state the following:

a) The records submitted are true and accurate;

b) The rate of wages paid to each mechanic, laborer or workman and the amount of payment or contributions paid or payable on behalf of each such employee to any employee welfare fund, as defined in Connecticut General Statutes, section 31-53 (h), are not less than the prevailing rate of wages and the amount of payment or contributions paid or payable on behalf of each such employee to any employee welfare fund, as determined by the Labor Commissioner pursuant to subsection Connecticut General Statutes, section 31-53 (d), and said wages and benefits are not less than those which may also be required by contract,

c) The Employer has complied with all of the provisions in Connecticut General Statutes, section 31-53 (and Section 31-54 if applicable for state highway construction);

d) Each such employee of the Employer is covered by a worker's compensation insurance policy for the duration of his employment which proof of coverage has been provided to the contracting agency;

e) The Employer does not receive kickbacks, which means any money, fee, commission, credit, gift, gratuity, thing of value, or compensation of any kind which is provided directly or indirectly, to any prime contractor, prime contractor employee, subcontractor, or subcontractor employee for the purpose of improperly obtaining or rewarding favorable treatment in connection with a prime contract or in connection with a prime contractor in connection with a subcontractor relating to a prime contractor, and

f) The Employer is aware that filing a certified payroll which he knows to be false is a class D felony for which the employer may be fined up to five thousand dollars, imprisoned for up to five years or both.

2. OSHA~The employer shall affix a copy of the construction safety course, program or training completion document to the certified payroll required to be submitted to the contracting agency for this project on which such employee's name first appears.

(Signature)

(Title)

Submitted on (Date)

Section B: Applies to CONNDOT Projects ONLY

That pursuant to CONNDOT contract requirements for reporting purposes only, all employees listed under Section B who performed work on this project are not covered under the prevailing wage requirements defined in Connecticut General Statutes Section 31-53.

(Signature)

Submitted on (Date)

Note: CTDOL will assume all hours worked were performed under Section A unless clearly delineated as Section B WWS-CP1 as such. Should an employee perform work under both Section A and Section B, the hours worked and wages paid must be segregated for reporting purposes.

THIS IS A PUBLIC DOCUMENT ***DO NOT INCLUDE SOCIAL SECURITY NUMBERS***

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[New] In accordance with Section 31-53b(a) of the C.G.S. each contractor shall provide a copy of the USIIA 10 Hour Construction Safety and Health Card for each employee, to be attached in the first certified payroll on the project.

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OSHA 10 ~ATTACH CARD TO 1ST CERTIFIED PAYROLL

*FRINCE BENEFITS EXPLANATION (P):

Bona fide benefits paid to approved plans, funds or programs, except those required by Federal or State Law (unemployment tax, worker's compensation, income taxes, etc.).

Please specify the type of benefits provided:

| 1) | Medical or hospital care Blue Cross | 4) | Disability |
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| 2) | Pension or retirement | 5) | Vacation, holiday |
| 3) | Life Insurance Iropia | 6) | Other (please specify) |

CERTIFIED STATEMENT OF COMPLIANCE

For the week ending date of 9/26/09

Robert Craft of XYZ Corporation , (hereafter known as

Employer) in my capacity as ______ (title) do hereby certify and state:

Section A:

1. All persons employed on said project have been paid the full weekly wages earned by them during the week in accordance with Connecticut General Statutes, section 31-53, as amended. Further, 1 hereby certify and state the following:

a) The records submitted are true and accurate;

b) The rate of wages paid to each mechanic, laborer or workman and the amount of payment or contributions paid or payable on behalf of each such employee to any employee welfare fund, as defined in Connecticut General Statutes, section 31-53 (h), are not less than the provailing rate of wages and the amount of payment or contributions paid or payable on behalf of each such employee to any employee welfare fund, as determined by the Labor Commissioner pursuant to subsection Connecticut General Statutes, section 31-53 (d), and said wages and benefits are not less than those which may also be required by contract;

c) The Employer has complied with all of the provisions in Connecticut General Statutes, section 31-53 (and Section 31-54 if applicable for state highway construction);

d) Each such employee of the Employer is covered by a worker's compensation insurance policy for the duration of his employment which proof of coverage has been provided to the contracting agency;

e) The Employer does not receive kickbacks, which means any money, fee, commission, credit, gift, gratuity, thing of value, or compensation of any kind which is provided directly or indirectly, to any prime contractor, prime contractor employee, subcontractor, or subcontractor employee for the purpose of improperly obtaining or rewarding favorable treatment in connection with a prime contractor in connection with a prime contractor in connection with a subcontractor relating to a prime contractor; and

f) The Employer is aware that filing a certified payroll which he knows to be false is a class D felony for which the employer may be fined up to five thousand dollars, imprisoned for up to five years or both.

2. OSHA~The employer shall affix a copy of the construction safety course, program or training completion document to the certified payroll required to be submitted to the contracting agency for this project on which such employee's name first appears.

Cobert Craft Owner (Signature) (Title)

Section B: Applies to CONNDOT Projects ONLY

That pursuant to CONNDOT contract requirements for reporting purposes only, all employees listed under Section B who performed work on this project are not covered under the prevailing wage requirements defined in Connecticut General Statutes Section 31-53.

tent Craft owner Gignature) (Title) (Signature)

 $\frac{10/2/09}{\text{Submitted on (Date)}}$

Note: CTDOL will assume all hours worked were performed under Section A unless clearly delineated as Section B WWS-CPI as such. Should an employee perform work under both Section A and Section B, the hours worked and wages paid must be segregated for reporting purposes.

THIS IS A PUBLIC DOCUMENT ***DO NOT INCLUDE SOCIAL SECURITY NUMBERS***

Occupational Classification Bulletin

You are here: DOL Web Site + Wage and Workplace Standards + Occupational Classification Bulletin

• Informational Bulletin (PDF, 479KB) updated

Published by the Connecticut Department of Labor, Project Management Office Last Updated: April 22, 2010

Information Bulletin Occupational Classifications

The Connecticut Department of Labor has the responsibility to properly determine "job classification" on prevailing wage projects covered under C.G.S. Section 31-53.

Note: This information is intended to provide a sample of some occupational classifications for guidance purposes only. It is not an all-inclusive list of each occupation's duties. This list is being provided only to highlight some areas where a contractor may be unclear regarding the proper classification.

Below are additional clarifications of specific job duties performed for certain classifications:

ASBESTOS WORKERS

Applies all insulating materials, protective coverings, coatings and finishes to all types of mechanical systems.

ASBESTOS INSULATOR

Handle, install apply, fabricate, distribute, prepare, alter, repair, dismantle, heat and frost insulation, including penetration and fire stopping work on all penetration fire stop systems.

BOILERMAKERS

Erects hydro plants, incomplete vessels, steel stacks, storage tanks for water, fuel, etc. Builds incomplete boilers, repairs heat exchanges and steam generators.

BRICKLAYERS, CEMENT MASONS, CEMENT FINISHERS, MARBLE MASONS, PLASTERERS, STONE MASONS, PLASTERERS. STONE MASONS, TERRAZZO WORKERS, TILE SETTERS

Lays building materials such as brick, structural tile and concrete cinder, glass, gypsum, terra cotta block. Cuts, tools and sets marble, sets stone, finishes concrete, applies decorative steel, aluminum and plastic tile, applies cements, sand, pigment and marble chips to floors, stairways, etc.

• CARPENTERS, MILLWRIGHTS. PILEDRIVERMEN. LATHERS. RESILEINT FLOOR LAYERS, DOCK BUILDERS, DIKERS, DIVER TENDERS

Constructs, erects, installs and repairs structures and fixtures of wood, plywood and wallboard. Installs, assembles, dismantles, moves industrial machinery. Drives piling into ground to provide foundations for structures such as buildings and bridges, retaining walls for earth embankments, such as cofferdams. Fastens wooden, metal or rockboard lath to walls, ceilings and partitions of buildings, acoustical tile layer, concrete form builder. Applies firestopping materials on fire resistive joint systems only. Installation of curtain/window walls only where attached to wood or metal studs. Installation of insulated material of all types whether blown, nailed or attached in other ways to walls, ceilings and floors of buildings. Assembly and installation of modular furniture/furniture systems. Freestanding furniture is not covered. This includes free standing: student chairs, study top desks, book box desks, computer furniture, dictionary stand, atlas stand, wood shelving, two-position information access station, file cabinets, storage cabinets, tables, etc.

• CLEANING LABORER

The clean up of any construction debris and the general cleaning, including sweeping, wash down, mopping, wiping of the construction facility, washing, polishing, dusting, etc., prior to the issuance of a certificate of occupancy falls under the *Labor classification*.

DELIVERY PERSONNEL

If delivery of supplies/building materials is to one common point and stockpiled there, prevailing wages are not required. If the delivery personnel are involved in the distribution of the material to multiple locations within the construction site then they would have to be paid prevailing wages for the type of work performed: laborer, equipment operator, electrician, ironworker, plumber, etc.

An example of this would be where delivery of drywall is made to a building and the delivery personnel distribute the drywall from one "stockpile" location to further sub-locations on each floor. Distribution of material around a construction site is the job of a laborer/tradesman and not a delivery personnel.

ELECTRICIANS

Install, erect, maintenance, alteration or repair of any wire, cable, conduit, etc., which generates, transforms, transmits or uses electrical energy for light, heat, power or other purposes, including the Installation or maintenance of telecommunication, LAN wiring or computer equipment, and low voltage wiring. *License required per Connecticut General Statutes: E-1,2 L-5,6 C-5,6 T-1,2 L-1,2 V-1,2,7,8,9.

ELEVATOR CONSTRUCTORS

Install, erect, maintenance and repair of all types of elevators, escalators, dumb waiters and moving walks. *License required by Connecticut General Statutes: R-1,2,5,6.

• FORK LIFT OPERATOR

Laborers Group 4) Mason Tenders - operates forklift solely to assist a mason to a maximum height of nine (9) feet only.

Power Equipment Operator Group 9 - operates forklift to assist any trade, and to assist a mason to a height over nine (9) feet.

• GLAZIERS

Glazing wood and metal sash, doors, partitions, and 2 story aluminum storefronts. Installs glass windows, skylights, store fronts and display cases or surfaces such as building fronts, interior walls, ceilings and table tops and metal store fronts. Installation of aluminum window walls and curtain walls is the "joint" work of glaziers and ironworkers which requires either a blended rate or equal composite workforce.

• IRONWORKERS

Erection, installation and placement of structural steel, precast concrete, miscellaneous iron, ornamental iron, metal curtain wall, rigging and reinforcing steel. Handling, sorting, and installation of reinforcing steel (rebar). Metal bridge rail (traffic), metal bridge handrail, and decorative security fence installation. Installation of aluminum window walls and curtain walls is the "joint" work of glaziers and ironworkers which requires either a blended rate or equal composite workforce. Insulated metal and insulated composite panels are still installed by the Ironworker.

• INSULATOR

Installing fire stopping systems/materials for "Penetration Firestop Systems": transit to cables, electrical conduits, insulated pipes, sprinkler pipe penetrations, ductwork behind radiation, electrical cable trays, fire rated pipe penetrations, natural polypropylene, HVAC ducts, plumbing bare metal, telephone and communication wires, and boiler room ceilings. Past practice using the applicable licensed trades, Plumber, Sheet Metal, Sprinkler Fitter, and Electrician, is not inconsistent with the Insulator classification and would be permitted.

• LABORERS

Acetylene burners, asphalt rakers, chain saw operators, concrete and power buggy operator, concrete saw operator, fence and guard rail erector (except metal bridge rail (traffic), metal bridge handrail, and decorative security fence installation.), hand operated concrete vibrator operator, mason tenders, pipelayers (installation of storm drainage or sewage lines on the street only), pneumatic drill operator, pneumatic gas and electric drill operator, powermen and wagon drill operator, air track operator, block paver, curb setters, blasters, concrete spreaders.

• PAINTERS

Maintenance, preparation, cleaning, blasting (water and sand, etc.), painting or application of any protective coatings of every description on all bridges and appurtenances of highways, roadways, and railroads. Painting, decorating, hardwood finishing, paper hanging, sign writing, scenic art work and drywall hhg for any and all types of building and residential work.

• LEAD PAINT REMOVAL

Painter's Rate

- 1. Removal of lead paint from bridges.
- 2. Removal of lead paint as preparation of any surface to be repainted.
- 3. Where removal is on a Demolition project prior to reconstruction.

Laborer's Rate

- 1. Removal of lead paint from any surface NOT to be repainted.
- 2. Where removal is on a *TOTAL* Demolition project only.

PLUMBERS AND PIPEFITTERS

Installation, repair, replacement, alteration or maintenance of all plumbing, heating, cooling and piping. *License required per Connecticut General Statutes: P-1,2,6,7,8,9 J-1,2,3,4 SP-1,2 S-1,2,3,4,5,6,7,8 B-1,2,3,4 D-1,2,3,4.

• POWER EQUIPMENT OPERATORS

Operates several types of power construction equipment such as compressors, pumps, hoists, derricks, cranes, shovels, tractors, scrapers or motor graders, etc. Repairs and maintains equipment. *License required, crane operators only, per Connecticut General Statutes.

ROOFERS

Covers roofs with composition shingles or sheets, wood shingles, slate or asphalt and gravel to waterproof roofs, including preparation of surface. (tear-off and/or removal of any type of roofing and/or clean-up of any and all areas where a roof is to be relaid)

• SHEETMETAL WORKERS

Fabricate, assembles, installs and repairs sheetmetal products and equipment in such areas as ventilation, air-conditioning, warm air heating, restaurant equipment, architectural sheet metal work, sheetmetal roofing, and aluminum gutters. Fabrication, handling, assembling, erecting, altering, repairing, etc. of coated metal material panels and composite metal material panels when used on building exteriors and interiors as soffits, facia, louvers, partitions, wall panel siding, canopies, cornice, column covers, awnings, beam covers, cladding, sun shades, lighting troughs, spires, ornamental roofing, metal ceilings, mansards, copings, ornamental and ventilation hoods, vertical and horizontal siding panels, trim, etc. The sheet metal classification also applies to the vast variety of coated metal material panels and composite metal material panels that have evolved over the years as an alternative to conventional ferrous and non-ferrous metals like steel, iron, tin, copper, brass, bronze, aluminum, etc. Insulated metal and insulated composite panels are still installed by the Iron Worker. Fabrication, handling, assembling, erecting, altering, repairing, etc. of architectural metal roof, standing seam roof, composite metal roof, metal and composite bathroom/toilet partitions, aluminum gutters, metal and composite lockers and shelving, kitchen equipment, and walk-in coolers.

• SPRINKLER FITTERS

Installation, alteration, maintenance and repair of fire protection sprinkler systems. *License required per Connecticut General Statutes: F-1,2,3,4.

• TILE MARBLE AND TERRAZZO FINISHERS

Assists and tends the tile setter, marble mason and terrazzo worker in the performance of their duties.

TRUCK DRIVERS

Definitions:

1) "Site of the work" (29 Code of Federal Regulations (CFR) 5.2(l)(b) is the physical place or places where the building or work called for in the contract will remain and any other site where a significant portion of the building or work is constructed, provided that such site is established specifically for the performance of the contact or project;

(a) Except as provided in paragraph (l) (3) of this section, job headquarters, tool yards, batch plants, borrow pits, etc. are part of the "site of the work"; provided they are dedicated exclusively, or nearly so, to the performance of the contract or project, and provided they are adjacent to "the site of work" as defined in paragraph (e)(1) of this section;

(b) Not included in the "site of the work" are permanent home offices, branch plant establishments, fabrication plants, tool yards etc, of a contractor or subcontractor whose location and continuance in operation are determined wholly without regard to a particular State or political subdivision contract or uncertain and indefinite periods of time involved of a few seconds or minutes duration and where the failure to count such time is due to consideration justified by industrial realities (29 CFR 785.47)

2) "Engaged to wait" is waiting time that belongs to and is controlled by the employer which is an integral part of the job and is therefore compensable as hours worked. (29 CFR 785.15)

3) "Waiting to be engaged" is waiting time that an employee can use effectively for their own purpose and is not compensable as hours worked. (29 CFR 785.16)

4) "De Minimus" is a rule that recognizes that unsubstantial or insignificant periods of time which cannot as a practical administrative matter be precisely recorded for payroll purposes, may be disregarded. This rule applies only where there are uncertain and indefinite periods of time involved of a short duration and where the failure to count such time is due to consideration justified by worksite realities. For example, with respect to truck drivers on prevailing wage sites, this is typically less than 15 minutes at a time.

Coverage of Truck Drivers on State or Political subdivision Prevailing Wage Projects

Truck drivers are covered for payroll purposes under the following conditions:

- Truck Drivers for time spent working on the site of the work.
- Truck Drivers for time spent loading and/or unloading materials and supplies on the site of the work, if such time is not de minimus

- Truck drivers transporting materials or supplies between a facility that is deemed part of the site of the work and the actual construction site.
- Truck drivers transporting portions of the building or work between a site established specifically for the performance of the contract or project where a significant portion of such building or work is constructed and the physical places where the building or work outlined in the contract will remain.

For example: Truck drivers delivering asphalt are covered under prevailing wage while" engaged to wait" on the site and when directly involved in the paving operation, provided the total time is not "de minimus"

Truck Drivers <u>are not</u> covered in the following instances:

- Material delivery truck drivers while off "the site of the work"
- Truck Drivers traveling between a prevailing wage job and a commercial supply facility while they are off the "site of the work"
- Truck drivers whose time spent on the "site of the work" is de minimus, such as under 15 minutes at a time, merely to drop off materials or supplies, including asphalt.

These guidelines are similar to U.S. Labor Department policies. The application of these guidelines may be subject to review based on factual considerations on a case by case basis.

For example:

- Material men and deliverymen are not covered under prevailing wage as long as they are not directly involved in the construction process. If, they unload the material, they would then be covered by prevailing wage for the classification they are performing work in: laborer, equipment operator, etc.
- Hauling material off site is not covered provided they are not dumping it at a location outlined above.
- Driving a truck on site and moving equipment or materials on site would be considered covered work, as this is part of the construction process.

Any questions regarding the proper classification should be directed to: Public Contract Compliance Unit Wage and Workplace Standards Division Connecticut Department of Labor 200 Folly Brook Blvd, Wethersfield, CT 06109 (860) 263-6543

Connecticut Department of Labor Wage and Workplace Standards Division FOOTNOTES

Please Note: If the "Benefits" listed on the schedule for the following occupations includes a letter(s) (+ a or + a+b for instance), refer to the information below.

Benefits to be paid at the appropriate prevailing wage rate for the listed occupation.

If the "Benefits" section for the occupation lists only a dollar amount, disregard the information below.

Bricklayers, Cement Masons, Cement Finishers, Concrete Finishers (including caulking), Stone Masons

(Building Construction) and

(Residential-Hartford, Middlesex, New Haven, New London and Tolland Counties)

a. Paid Holiday: Employees shall receive 4 hours for Christmas Eve holiday provided the employee works the regularly scheduled day before and after the holiday. Employers may schedule work on Christmas Eve and employees shall receive pay for actual hours worked in addition to holiday pay.

Bricklayer (Residential-Fairfield County)

a. Paid Holiday: If an employee works on Christmas Eve until noon he shall be paid for 8 hours.

Electricians

Fairfield County: West of the Five Mile River in Norwalk

a. \$2.00 per hour not to exceed \$14.00 per day.

Elevator Constructors: Mechanics

- a. Paid Holidays: New Year's Day, Memorial Day, Independence Day, Labor Day, Veterans' Day, Thanksgiving Day, Christmas Day, plus the Friday after Thanksgiving.
- b. Vacation: Employer contributes 8% of basic hourly rate for 5 years or more of service or 6% of basic hourly rate for 6 months to 5 years of service as vacation pay credit.

a. Paid Holidays: Labor Day and Christmas Day.

Power Equipment Operators

(Heavy and Highway Construction & Building Construction)

a. Paid Holidays: New Year's Day, Good Friday, Memorial day, Independence Day, Labor Day, Thanksgiving Day and Christmas Day, provided the employee works 3 days during the week in which the holiday falls, if scheduled, and if scheduled, the working day before and the working day after the holiday. Holidays falling on Saturday may be observed on Saturday, or if the employer so elects, on the preceding Friday.

Ironworkers

a. Paid Holiday: Labor Day provided employee has been on the payroll for the 5 consecutive work days prior to Labor Day.

Laborers (Tunnel Construction)

a. Paid Holidays: New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day and Christmas Day. No employee shall be eligible for holiday pay when he fails, without cause, to work the regular work day preceding the holiday or the regular work day following the holiday.

Roofers

a. Paid Holidays: July 4th, Labor Day, and Christmas Day provided the employee is employed 15 days prior to the holiday.

Sprinkler Fitters

a. Paid Holidays: Memorial Day, July 4th, Labor Day, Thanksgiving Day and Christmas Day, provided the employee has been in the employment of a contractor 20 working days prior to any such paid holiday.

Truck Drivers

(Heavy and Highway Construction & Building Construction)

a. Paid Holidays: New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day, Christmas day, and Good Friday, provided the employee has at least 31 calendar days of service and works the last scheduled day before and the first scheduled day after the holiday, unless excused.

GREENWICH PUBLIC SCHOOLS GREENWICH, CONNECTICUT

Contract Cover Sheet Letter of Intent / Award Letter Invitation to Bid Bid Sheet Contract for Locker Room Renovations - Phase II Greenwich High School Maintenance and Payment Bond Insurance Procedure Insurance Requirement Sheet Endorsement Letter Acord Form A.M. Best Key Rating Guide Sheet Affirmative Action Compliance Affidavit Consent of Surety Final Payment

CONTRACT

FOR

(LOCKER ROOM RENOVATIONS PHASE II)

AT

(GREENWICH HIGH SCHOOL)

Contract No.

GREENWICH PUBLIC SCHOOLS GREENWICH, CT. BLANK

AWARD LETTER

FORM OF BID BOND

TOWN OF GREENWICH, CONNECTICUT

| Date Bond Executed | |
|--|----------------------------------|
| BID BOND | |
| Principal | |
| | |
| Surety | |
| Penal Sum of Bond (express in words and figures) Date of Bid | |
| KNOW ALL MEN BY THESE PRESENTS, that we, the principal and surety above named, and firmly bound unto the Town of Greenwich, Connecticut, in the penal sum of the amoun above, for the payment of which sum well and truly to be made, we bind ourselves, our heirs, ex administrators, and successors, jointly and severally, firmly by these presents. THE CONDITINE OBLIGATION IS SUCH, that whereas the principal has submitted the accompanying bin as shown above for | nt stated xecutors, ION OF |

(name of bid)

NOW THEREFORE, if the principal shall not withdraw said bid within the period specified therein after the opening of the same, or if no period be specified, within sixty (60) days after said opening, and shall within the period specified therefor, or if no period specified, within ten (10) days after the prescribed forms are presented to him for signature, execute such further contractual documents, if any, as may be required by the terms of the Bid as accepted, and give bonds with good and sufficient surety or sureties as may be required, for the faithful performance and proper fulfillment of the resulting contract, and for the protection of all persons supplying labor and materials in the prosecution of the work provided for in such contract or in the event of the withdrawal of said bid within the period specified, or the failure to enter into such contract and give such bonds within the time specified, if the principal shall pay the Town of Greenwich, Connecticut, the difference between the amount specified in said bid and the amount for which said Town may procure the required work, supplies, and services, if the latter amount be in excess of the former, then the above obligation shall be void and of no effect, otherwise to remain in full force and virtue.

IN WITNESS WHEREOF the above-bounden parties have executed this instrument under their several seals on the date indicated above. The name and corporate seal (if applicable) of each corporate party being hereto affixed:

Business Address Partner – (Hereunto Duly Authorized) IN THE PRESENCE OF: WITNESS INDIVIDUAL PRINCIPAL 1.______AS TO______(SEAL) 2.______AS TO______(SEAL) 3.______AS TO______(SEAL) 4.______AS TO______(SEAL)

CORPORATE / LLC PRINCIPAL

BUSINESS ADDRESS AFFIX CORPORATE SEAL

BY- (HEREUNTO DULY AUTHORIZED)

TITLE

CORPORATE SURETY

BUSINESS ADDRESS AFFIX CORPORATE SEAL

BY – (HEREUNTO DULY AUTHORIZED)

TITLE CERTIFICATE AS TO CORPORATE PRINCIPAL

WITNESS

I OKATE SUKE

WITNESS

| I, | , | certify | that | Ι | am | the |
|-----------------------------------|---------------------------------|------------|-----------|----------|-----------|--------|
| | of the corporation | named as p | principal | in the | within | bond; |
| that | , who signed sa | id bond on | behalf o | of the p | principal | , was |
| then | of the corporation; that | I know his | signatur | e, and | his sigr | nature |
| thereto is genuine; and that sa | id bond was duly signed, sealed | and attest | ed for an | nd in l | behalf of | f said |
| corporation by authority of its g | governing body. | | | | | |

(Corporate Seal)

PERFORMANCE, MAINTENANCE AND PAYMENT BOND

| BOND NO | CONTRACT NO. | _ |
|--|---|---|
| KNOW ALL MEN BY THESE PRES | SENTS. That we | |
| | | , as Principal, and |
| do business in the State of Connecticu | s of the State of ut as Surety, are holden and firmly bound jointly reafter referred to as the Town, a territorial con | and severally unto the TOWN OF |
| | Dollars (\$ |), |
| to be paid to it or its certain attorney Obligors do | y, successors or assigns, to which payment well rs, executors, administrators, and successors firmly | and truly to be made, we the said |
| IN WITNESS WHEREOF we hav | re hereunto set or caused to be set our respec | ctive hands, names and seals this |
| | day of | 20 |
| certain written contract with the TO | IGATION IS SUCH, That whereas the above n OWN OF GREENWICH, CONNECTICUT, dat onstruction of CONTRACT NO. | ted the day |
| | | (Description of work here – |
| | ng to the plans and specifications prepared by the e a part hereof as fully and to the same extent as if | |
| fully indemnify and save harmless the to do, and shall pay for all equipment, said contract, and shall indemnify and | ncipal shall well and faithfully perform said contr Town from all cost and damages which the Town , appurtenances, materials and labor furnished, us save harmless the Town from all suits or claims | n may suffer by reason of failure so sed or employed in the execution of of any nature or description against |

the Town by reason of any injuries or damages sustained by any person or persons on account of any act or omission of said Principal, his servants or agents, or his subcontractors in the construction of the work or in guarding the work, or on account of the use of faulty or improper materials, or by reason of claims under the Workmen's Compensation Laws or other laws by any employee of the Principal or his subcontractors, or by reason of the use of any patented material, machinery, device, equipment, process, method of construction or design in any way involved in the work, and shall indemnify the Town against such defective workmanship, material and equipment as may be discovered within one (1) year after completion and final acceptance of the work, and shall make good in such defective workmanship and material as may be discovered within said period of one year, then this obligation shall be void, otherwise to remain in full force and effect.

The Surety hereby stipulates and agrees that any modifications, omissions or additions in or to the terms of the aforesaid contract, or in or to the plans or specifications therefor, or any extension of time, shall in no wise affect the obligation of the Surety under this bond, the Surety hereby waiving any and all right to any notice of any such modifications, omissions, changes, additions or extensions.

| CONTRACTOR | |
|------------|--|
| BY | |
| | |
| SURETY | |
| RV | |

INSURANCE PROCEDURE

PLEASE NOTE:

THIS PAGE MUST BE RETURNED WITH YOUR BID/PROPOSAL. FAILURE TO DO SO MAY RESULT IN YOUR BID/PROPOSAL BEING REJECTED.

Please take the insurance requirements of the Contract to your agent/broker immediately upon receipt of the bid documents to determine your existing coverage and any costs for new or additional coverage required for the work noted in this Request for Bid/Proposal. Any bids/proposals with deficient insurance requirements will be rejected.

STATEMENT OF VENDOR:

I have read the insurance requirements for this work and have taken the documentation to my insurance agent/broker. The bid/proposal cost reflects any additional costs relating to insurance requirements for this work.

Signature

Date

Contractor

- <u>Insurance Requirements</u>: Before starting and until final completion and acceptance of the work called for in the Contract and expiration of the guarantee period provided for in the Contract, the Contractor and its subcontractors, if any, shall procure and maintain insurance of the types and amounts checked in paragraphs A through F below for all Contract operations.
 - [x] A. General Liability, with minimum coverages for combined bodily injury and property damage liability of \$2,000,000 general aggregate, \$1,000,000 per occurrence including:
 - [x] 1. Commercial General Liability.
 - [x] 2. Town as additional insured.
 - [] 3. Owners and Contractors Protective Liability (separate policy in the name of the Town).
 - [x] B. Comprehensive Automobile Liability, with minimum coverages of \$1,000,000 combined single limit for bodily injury and property damage, including, where applicable, coverage for any vehicle, all owned vehicles, scheduled vehicles, hired vehicles, non-owned vehicles and garage liability.
 - [x] C. Excess Liability with minimum coverage of \$5,000,000 in umbrella form, or such other form as approved by Town Department Head and Risk Management Director.
 - [x] D. Workers' Compensation and Employer's Liability, with minimum coverages as provided by Connecticut State Statutes.
 - [] E. Professional Liability (for design and other professionals for Errors and Omissions) with minimum coverage of \$1,000,000. If the policy is on a claims-made basis, coverage shall be continually renewed or extended for three (3) years after work is completed under the Contract.
 - [] F. Other (Builder's Risk etc.):
 - [x] G. CERTIFICATE HOLDER: TOWN OF GREENWICH, BOARD OF EDUCATION, ATTN: BOARD OF EDUCATION (also fill in on ACORD Certificate of Insurance) 290 Greenwich Avenue, Greenwich, CT 06830.

The Acord certificate of insurance form must be executed by your insurance agent/broker and returned to this office. Company name and address must conform on all documents including insurance documentation. It is required that the agent/broker note the individual insurance companies providing coverage, rather than the insurance group, on the Acord form. The Contract number (provided to the awarded Contractor), project name and a brief description must be inserted in the "Description of Operations" field. It must be confirmed on the Acord Form that the Town of Greenwich is endorsed as an additional insured by having the appropriate box checked off and stating such in the "Description of Operations" field. A letter from the <u>awarded vendor's</u> agent/broker certifying that the Town of Greenwich has been endorsed onto the general liability policy as an additional insured is also <u>mandatory</u>. This letter <u>must follow exactly</u> the format provided by the Purchasing Department and must be signed by the same individual authorized representative who signed the Acord form. If the insurance coverage required is provided on more than one Acord certificate of insurance, then additional endorsement letters are also required. Contract development will begin upon receipt of complete, correct insurance documentation.

The Contractor shall be responsible for maintaining the above insurance coverages in force to secure all of the Contractor's obligations under the Contract with an insurance company or companies with an AM Best Rating of B+:VII or better, licensed to write such insurance in Connecticut and acceptable to the Risk Manager, Town of Greenwich. For excess liability only, non-admitted insurers are acceptable, provided they are permitted to do business through Connecticut excess line brokers per listing on the current list of Licensed Insurance Companies, Approved Reinsurers, Surplus Lines Insurers and Risk Retention Groups issued by the State of Connecticut Insurance Department.

AGENT/BROKER (LETTERHEAD)

(Date)

Eugene H. Watts, Senior Buyer Purchasing Department Town of Greenwich/Board of Education 290 Greenwich Avenue – Havemeyer Building Greenwich, CT 06830

Re:

Town of Greenwich/Board of Education / Contract #

Dear Mr. Watts:

The undersigned hereby certifies as follows:

- (1) I am a duly licensed insurance agent under the laws of the State of [insert State] and an authorized representative of all companies affording coverage under the Acord form submitted herewith;
- (2) The Town of Greenwich has been endorsed as an additional insured under the general liability policy no. [insert policy number], issued by [insert company affording coverage] to [name of insured];
- (3) The general liability policy referenced in paragraph (2) above meets or exceeds the coverage in Commercial General Liability ISO form CG 00 01 10 01, including contractual liability;
- (4) The policies listed in the Acord form submitted to the Town of Greenwich in connection with the abovereferenced contract have been issued to the insured in the amounts stated and for the periods indicated in the Acord form; and
- (5) Should any of the above described policies be cancelled before the expiration date thereof, notice will be delivered in accordance with the policy provisions.

Sincerely,

Authorized Representative for all companies listed in the Acord form

A. M. BEST KEY RATING GUIDE FORM

| The | is l | licensed | in |
|-----|------|----------|-----|
| | 101 | neensea | 111 |

The State of Connecticut as per listing in the 2009 edition of the

A.M. Best Key Rating Guide for Property and Casualty, page

Number _____.

Their rating is _____.

COMMISSION ON HUMAN RIGHTS AND OPPORTUNITIES CONTRACT COMPLIANCE REGULATIONS NOTIFICATION TO BIDDERS

AFFIRMATIVE ACTION COMPLIANCE AFFIDAVIT

The contract to be awarded is subject to contract compliance requirements mandated by Sections 4a-60 and 4a-60a of the Connecticut General Statutes; and, when the awarding agency is the State, Sections 46a-71(d) and 46a-81i(d) of the Connecticut General Statutes. There are Contract Compliance Regulations codified at Section 46a-68j-21 through 43 of the Regulations of Connecticut State Agencies, which establish a procedure for awarding all contracts covered by Sections 4a-60 and 46a-71(d) of the Connecticut General Statutes.

According to Section 46a-68j-30(9) of the Contract Compliance Regulations, every agency awarding a contract subject to the contract compliance requirements has an obligation to "aggressively solicit the participation of legitimate minority business enterprises as bidders, contractors, subcontractors and suppliers of materials." "Minority business enterprise" is defined in Section 4a-60 of the Connecticut General Statutes as a business wherein fifty-one percent or more of the capital stock, or assets belong to a person or persons: "(1) Who are active in the daily affairs of the enterprise; (2) who have the power to direct the management and policies of the enterprise; and (3) who are members of a minority, as such term is defined in subsection (a) of Section 32-9n." "Minority" groups are defined in Section 32-9n of the Connecticut General Statutes as "(1) Black Americans . . . (2) Hispanic Americans . . . (3) persons who have origins in the Iberian Peninsula . . . (4) Women (5) Asian Pacific Americans and Pacific Islanders; (6) American Indians . . ." An individual with a disability is also a minority business enterprise as provided by Section 4a-60g of the Connecticut General Statutes. The above definitions apply to the contract compliance requirements by virtue of Section 46a-68j-21(11) of the Contract Compliance Regulations.

The awarding agency will consider the following factors when reviewing the bidder's qualifications under the contract compliance requirements:

- (a) the bidder's success in implementing an affirmative action plan;
- (b) the bidder's success in developing an apprenticeship program complying with Sections 46a-68-1 to 46a-68-17 of the Administrative Regulations of Connecticut State Agencies, inclusive;
- (c) the bidder's promise to develop and implement a successful affirmative action plan;
- (d) the bidder's submission of employment statistics contained in the "Employment Information Form", indicating that the composition of its workforce is at or near parity when compared to the racial and sexual composition of the workforce in the relevant labor market area; and
- (e) the bidder's promise to set aside a portion of the contract for legitimate minority business enterprises. See Section 46a-68j-30(10)(E) of the Contract Compliance Regulations.

***INSTRUCTIONS:** Bidder must sign acknowledgement below and return acknowledgement to Awarding Agency along with bid proposal.

The undersigned acknowledges receiving and reading a copy of the "Notification to Bidders" form.

Signature

Date

On behalf of:

SAMPLE COPY – DO NOT USE:

BID SHEET

Bids must be submitted to the Greenwich Public Schools, Havemeyer Building, 290 Greenwich Avenue, Greenwich, Connecticut 06830, Attention Mr. Eugene H. Watts, Senior Buyer, Purchasing Department on the following form signed by an authorized company officer.

Greenwich Public Schools Date______ Havemeyer Building Re: 290 Greenwich Avenue Greenwich, CT 06830 Gentlemen: (I, We)______ the undersigned having visited the site of the ______School and having familiarized ourselves with the local conditions affecting the cost of the work and with Contract Documents and all addenda to said Documents, hereby propose to furnish all labor, tools, materials, equipment and insurance, to pay all applicable taxes, and to do and perform all things as provided in the Specifications for ______ for the following sum:

Base Bid

\$

Signed_

(Corporate Seal)

Address____

Telephone Number_____

INFORMATION FOR BIDDERS

1. Form and Submission of Bid

- a. One copy of this document will be furnished to the bidders. The Bid Sheet shall be completed and returned as part of the bid. The copy submitted by the successful bidder shall be completed in its entirety, executed and retained by the Town of Greenwich, sometimes referred to as the Town. From this executed copy, three other conformed copies will be made, one of which will be sent to the Contractor.
- b. Bid Documents must be enclosed in a sealed opaque envelope plainly marked on the outside with the name and address of the Contractor; addressed to the Purchasing Agent, Greenwich Public Schools, Havemeyer Building, 290 Greenwich Avenue, Greenwich, Connecticut, and shall be labeled as indicated in Invitation to Bidders.
- c. It shall be the responsibility of each Bidder to have his Bid Proposal at the Business Office at the time of Bid Opening; neither the Town of Greenwich nor the Board of Education shall be held in any way for failure of bidder to have his Bid Proposal submitted at such time and Bids arriving after the indicated Bid Opening time will not be accepted. Late bids arriving by mail shall be returned to the sender unopened.

2. <u>Bid Security</u>

Each Bid must be accompanied by Bid Bond prepared on the Form of Bid Bond attached hereto duly executed and acknowledged by the Bidder, as Principal, and by a surety satisfactory to Town as Surety. Bid Bond shall be in the sum of <u>10% of bid amount</u> and shall be enclosed in the sealed envelope containing the Bid. Each such Bid Bond may be held by the Town as security for the fulfillment of the Bidder's agreements as hereinabove set forth and as set forth in the Bid. Should the Bidder fail to fulfill such agreements, the Bid Bond shall become payable to the Town as liquidated damages; otherwise, the Bid Bond shall become null and void. A <u>BID BOND</u> will <u>not</u> be required where the total estimated cost of labor and materials under the contract with respect to which such general bid is submitted is less than fifty thousand dollars (\$50,000).

3. Withdrawal of Bids

Except as hereinafter in this subsection expressly provided, once his Bid is submitted and received by the Town for consideration and comparison with the other bids similarly submitted, the Bidder agrees that he may not and will not withdraw it within thirty (30) consecutive calendar days after the actual date of the opening of Bids unless extended by addendum.

Upon proper written request and identification, Bids may be withdrawn only as follows:

- a. At any time prior to the designated time for the opening of bids.
- b. Unless a Bid is withdrawn as provided above, the Bidder agrees that it shall be deemed open for acceptance until the Agreement has been executed by both parties thereto or until the Town notifies a Bidder in writing that his Bid is rejected or that the Town does not intend to accept it. Notice of acceptance of a Bid shall not constitute rejection of any other Bid.

4. <u>Bidders to Investigate</u>

Where applicable, Bidders are required to submit their Bids upon the following express conditions which shall apply to and be deemed a part of every Bid received, "viz".

Bidders must satisfy themselves by personal examination of the site of the work and by such means as they may wish, as to the actual conditions there existing, the character and requirements of the work, and the difficulties attendant upon its execution, and the accuracy of all estimated quantities, if any, stated in the Bid.

5. Ability and Experience of Bidder

No award will be made to any Bidder who cannot satisfy the Town that he has sufficient ability and experience in this class of work and sufficient capital and plant to enable him to prosecute and complete the work successfully within the time named or where such time is not named, within a reasonable period of time as is determined by the contracting officer or agency. The Town's decision or judgment on these matters shall be final, conclusive and binding.

The Town may make such investigations as it deems necessary, and the Bidder shall furnish to the Town, under oath if so required, all such information and data for this purpose as the Town may request.

6. Interpretations

<u>Questions Regarding Drawings and Documents</u>. No answer will be given to prospective Bidders in reply to an oral question if the question involves an interpretation of the intent or meaning of the Drawings, if any, or other Contract Documents or the quality or use of products or methods other than those designated or described on the Drawings, if any, and other Contract Documents, including Addenda, as described below, is given informally, for information and the convenience of the Bidder only, and is not guaranteed. The Bidder agrees that such information shall not be used as the basis of nor shall the giving of such information entitle the Bidder to assess any claim or demand against the Town or Board of Education.

To receive consideration, such questions shall be submitted in writing to the Board of Education at least ten (10) calendar days before the established date for receipt of Bids. If the question involves the quality or use of products or methods, it must be accompanied by Drawings, Specifications, or data in sufficient detail to enable the Board of Education to determine the quality or suitability of the products or method. In general, the Board of Education will neither approve nor disapprove particular products prior to the opening of bids; such products will be considered when offered by the Contractor for incorporation into the work. The Contracting Officer will set forth as addenda, which shall become a part of the Contract Documents, such questions received as above provided as in his sole judgment are appropriate or necessary and his decision regarding each. At least seven (7) days prior to the receipt of Bids, he will send a copy of these addenda to those prospective Bidders known to have taken out sets of the Drawings and other Contract Documents.

The Contractor agrees to use the products and methods designated or described in the specifications or as amended by the addenda.

- a. <u>Bids</u>. The Board of Education reserves the right to reject Bids which in its judgment are either incomplete, conditional, obscure, or not responsible or which contain additions not called for, erasures not properly initialed, alterations or similar irregularities if deemed in the Town's best interest to do so.
- b. <u>Right to Reject or Accept Bids</u>. The Board of Education reserves the right to reject any and all bids not deemed to be in the best interest of the Town of Greenwich. The Board of Education reserves the right to waive any informalities in or reject any or all bids, or any part of any bid.
- c. <u>Execution of Agreement</u>. The Bidder whose Bid is accepted will be required and agrees to duly execute the Agreement and furnish the required Bond within such time as deemed reasonable by the Town or Contracting Officer.

- d. <u>Non-Connecticut Contractors 5 % Tax</u>. Pursuant to Connecticut General Statutes § 12-430(7), as amended by Public Act No11,61, Section 66, a non-resident contractor shall comply with the State of Connecticut's bonding requirements.
- 7. <u>Bid Bond</u>
 - a. The Bid Bond form given on the following pages shall be used.
 - b. The surety on the bond may be any corporation authorized to act as surety in the State of Connecticut.
 - c. The full name and business or residence address of each individual party to the bond shall be inserted in the space provided therefore, and each party shall sign the bond with his usual signature on the line opposite the scroll seal.
 - d. If the principals are partners, their individual names shall appear in the space provided therefore, with the recital that they are partners composing a firm, naming it, and the bond shall be executed by a general partner who has been authorized to act on behalf of the partnership.
 - e. If the principal or surety is a corporation, the name of the state in which incorporate shall be inserted in the space provided therefore, and said instrument shall be executed and attested under the corporate seal, the fact shall be stated, in which case a scroll or adhesive seal shall appear following the corporate name.
 - f. The official character and authority of the person or persons executing the bond for a corporation shall be certified by a proper officer. In lieu of such certificate, there may be attached to the bond copies of so much of the records of the corporation as will show the official character and authority of the officers signing duly certified by a proper officer, under the corporate seal, to be true copies.
 - g. The date of this bond must not be prior to the date of the instrument in connection with which it is given.
- 8. <u>Minimum Wages and Payment to Subcontractors</u>
 - a. The work specified in this contract is subject to prevailing wage rates as fixed by the Labor Commissioner of the State of Connecticut and a schedule of such rates is deemed to be incorporated herein.
 - b. A general or prime contractor is required by Connecticut law to pay his subcontractors for labor performed or materials furnished within forty-five (45) days after payment to such general or prime contractor.

c. The contractor's attention is directed to Section 9 of the Agreement for additional requirements for Employment Preference and Minimum Wage.

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AGREEMENT

This AGREEMENT, executed this 1^{st} day of <u>July</u> in the year <u>Two Thousand and</u> (20)

(herein referred to as the "AGREEMENT"), by and between the Town of Greenwich, Connecticut,

acting through **Board of Education** hereunto duly authorized "OWNER," and

_____ acting through ______ duly authorized, "CONTRACTOR."

WITNESSETH, that the parties to these presents, each in consideration of the undertakings, promises, and agreements on the part of the other herein contained, have undertaken, promised, and agreed and do hereby undertake, promise and agree, the Owner for itself, its successors and assigns, as follows:

1. **DEFINITIONS**: Wherever the words hereinafter defined or pronouns used in their stead occur in the Contract Documents, they shall have the following meaning:

The word "OWNER" shall mean the Greenwich Board of Education, Town of Greenwich, and shall include its authorized representative, the Assistant Facilities Director.

The words "CONTRACTING OFFICER OR AGENCY" shall mean that official or agency of the Town which awards the contract and executed the Agreement.

The Invitation to Bid, Information for Bidders, the Contractor's Bid as accepted by the Owner, the Agreement, the General Conditions, any special conditions, and the General, Technical and Materials Specifications, the Drawings and all addenda and amendments to any of the foregoing, collectively constitute the Contract Documents, and are sometimes herein referred to as the "Contract".

When instructions such as "provide", "furnish", etc. are used herein, these apply to the General Contractor, unless noted otherwise.

- 2. DESCRIPTION OF WORK: The work under this Contract shall consist of everything set forth in the Specifications and any Drawings and any Addenda to either Specifications or Drawings or both. It shall be understood that the Contractor shall be in strict compliance with all municipal, state and federal statutes.
- 3. PAYMENT: The Contractor shall be paid, in general, upon satisfactory completion of the work as

described under "Final Payment". For certain work of substantial cost the Board of Education will make partial payments for work completed and materials provided. Requirements for partial payments are as stipulated in the Special Conditions.

Each requisition for partial payment must be accompanied with a breakdown showing costs of materials provided and percentage of the work which is completed at the time such request is made. Such payments will be made upon approval of the Assistant Facilities Director.

- 4. <u>PERFORMANCE, MAINTENANCE AND PAYMENT BOND</u>: The Contractor shall simultaneously with the signing of the Contract, furnish the Town the executed Performance, Maintenance, and Payment Bond of a SURETY COMPANY AUTHORIZED TO DO BUSINESS IN THE STATE OF CONNECTICUT, and acceptable to the Town, in the sum of the full amount of the Contract Obligation in the form provided by the Town. A <u>PERFORMANCE BOND</u> will <u>not</u> be required where the total estimated cost of labor and materials under the contract with respect to which such general bid is submitted is less than one hundred thousand dollars (\$100,000.00).
- 5. <u>TIME OF COMPLETION</u>: Where time of completion is an essential and applicable part of this Contract each Bidder will be required to indicate his proposed completion date as set forth on the Proposal Sheet. Where time is of the utmost importance because inconvenience, safety or health of persons affected or for any other valid reason as determined by the Board of Education, the Board will establish the time of completion and reserves the right to establish a time charge against the Contractor for non-compliance with this provision. Conditions for the time charge and related costs will be as set forth in the Specifications if such time charge will be made part of this Contract.

<u>NOTE</u>: The Town, at its discretion, may choose to extend the Contract for additional option years.

| Base Contract period is: | 2017 | through | 2018 |
|--------------------------|------|---------|------|
| First option year is: | 2018 | through | 2019 |
| Second option years is: | 2019 | through | 2020 |

6. <u>INSURANCE</u>: Before starting and until final completion and acceptance of the work called for in the Contract and expiration of the guarantee period provided for in the Contract, the Contractor shall procure and maintain insurance of the types and amounts indicated in paragraphs A through F inclusive, below, and such other insurance as is specified under any special conditions to the Contract. The Town shall be named as an additional insured on each such policy of insurance.

The Contractor shall require each of its subcontractors to procure and maintain, until the final completion of each sub-contractor's work, insurance of the types and amounts specified in paragraphs A through F inclusive, below, which shall be in addition to the obligation of the Contractor to secure and maintain at its

expense, during the life of this Contract, public liability and property damage insurance to protect it, its sub-contractors, if any, and the Town from claims for bodily injury, accidental death or property damage arising from the operations under this Contract (including blasting and the handling and storage of explosives) whether such operations be by the Contractor or by anyone directly or indirectly employed by it.

- 7. <u>GUARANTEE</u>: The Contractor guarantees that the work and services to be performed, furnished, used or installed in the construction of the same shall be free of defects and flaws, and shall be performed and furnished in strict accordance with the Drawings, if any, Specifications, and other Contract Documents, that the strength of all parts of all manufactured equipment shall be adequate and as specified and that the performance test requirements of the Contract shall be fulfilled. This guarantee shall be for a period of one year from and after the date of completion and acceptance of the work as stated in the final estimate. The Contractor shall repair, correct or replace as required, promptly and without charge, all work, equipment and material, or parts thereof, which fail to meet the above guarantee or which in any way fail to be in strict accordance with the terms and provisions and requirements of the Contract during such one year period, and also shall cover maintenance/operation, repair, correct, or replace all damage to the work resulting from such failure.
- 8. DEFECTIVE WORK: The inspection of the work shall not relieve the Contractor of any of his obligations to perform and complete the work as required by the Contract. Defective work shall be corrected and unsuitable materials, equipment, apparatus and other items shall be replaced by the Contractor, notwithstanding that such work, materials, and other items may have been previously overlooked or accepted or estimated for payment. If the work or any part thereof shall be found defective at any time before the final acceptance of the work, the Contractor shall forthwith make good such defect in a manner satisfactory to the Board of Education; if any material, equipment, apparatus, or other items brought upon the site for use or incorporation in the work, or selected for the same, is condemned by the Board of Education as unsuitable or not in conformity with the Specifications or any of the other Contract Documents, the Contractor shall forthwith remove such materials, equipment, apparatus and other items from the site of the work and shall at his own cost and expense make good and replace the same and any material furnished by the Board of Education which shall be damaged or rendered defective by the handling or improper installation by the Contractor, his agents, servants, employees or subcontractors.
- 9. <u>EMPLOYMENT PREFERENCE AND MINIMUM WAGE RATES</u>: In the employment of labor to perform the construction, remodeling or repairing of any public building specified herein, by the State or any of its agents, or by persons contracting therewith, preference shall be given to citizens of the United States, who are, and continuously for at least three months prior to the date hereof have been, residents of the labor market area, as established by the labor commissioner of the State of Connecticut, in which such work is to be done, and if no such qualified person is available, then to citizens who have continuously resided in the county in which the work is to be performed for at least three months prior to the date hereof,

and then to citizens of the state who have continuously resided in the state at least three months prior to the date hereof. In no event shall said provisions be deemed to abrogate or supersede, in any manner, any provision regarding residence requirements contained in a collective bargaining agreement to which the Contractor is a party.

In the employment of mechanics or workmen to perform the work specified herein, in connection with any public works project, including, but not limited to construction, remodeling or repairing of any public facility, structure, except public buildings covered by the preceding paragraph, site preparation or site improvement, appurtenances or highways or in preparation or improvement of any land or waterway on or in which a structure is situated or to be constructed by the state or any of its agents or by persons contracting therewith, preference shall be given to residents of the state who are, and continuously for at least six months prior to the date hereof have been, residents of this state, and if no such person is available then to residents of other states.

The provisions of the two immediately preceding paragraphs of this section shall not apply where the state or any subdivision thereof may suffer the loss of revenue granted or to be granted from any agency or department of the federal government as a result of the two immediately preceding paragraphs of this section or regulative procedures pursuant thereto.

The wages paid on an hourly basis to any mechanic, laborer, or workman employed upon the work herein contracted to be done and the amount of payment or contribution paid or payable on behalf of such employee to any employee welfare fund, as defined in Section 31-53(h) Connecticut General Statutes, shall be at a rate equal to the rate customary or prevailing for the same work in the same trade or occupation in the Town of Greenwich. Any Contractor who is not obligated by agreement to make payment or contribution on behalf of such employees to any such employee welfare fund shall pay to each employee as part of his wages the amount of payment or contribution for his classification on each pay day.

The provisions of the immediately preceding paragraph shall not apply where the total cost of all work to be performed by all contractors and subcontractors in connection with new construction of any public works project is less than four hundred thousand dollars (\$400,000) or where the total cost of all work to be performed by all contractors and subcontractors in connection with any remodeling, refinishing, refurbishing, rehabilitation, alteration or repair of any public works projects is less than one hundred thousand dollars (\$100,000).

10. <u>COMPLIANCE WITH LAWS</u>: The Contractor shall keep himself fully informed of all existing and future federal, state and local laws, ordinances, rules and regulations affecting those engaged or employed on the work, the materials and equipment used in the work or the conduct of the work and of all orders, decrees and other requirements of bodies or tribunals having any jurisdiction or authority over the same. If any discrepancy or inconsistency is discovered in the Drawings, if any, Specifications or other Contract

documents in relation to any such law, ordinance, rule, regulation, order, decree or other requirement, the Contractor shall at all times observe and comply with, and cause all his agents, servants, employees and subcontractors to observe and comply with all such existing and future laws, ordinances, rules, regulations, orders, decrees and other requirements, and he shall protect, indemnify and save harmless the Town, its officers, agents, servants, and employees, from and against any and all claims, demands, suits, proceedings, liabilities, judgments, penalties, losses, damages, costs, and expenses, including attorneys' fees, arising from or based upon any violation or claimed violation of any such law, ordinance, rule regulation, order, decree or other requirement, whether committed by the Contractor or any of his agents, servants, employees or subcontractors.

11. <u>INDEMNITY</u>: The Contractor shall indemnify and save harmless the Town and its officers, agents, servants and employees, from and against any and all claims, demands, suits, proceedings, liabilities, judgments, awards, losses, damages, costs and expenses, including attorneys' fees, on account of bodily injury, sickness, disease or death sustained by any person or persons or injury or damages to or destruction of any property, directly or indirectly arising out of, relating to or in connection with the work, whether or not due to whole or in part to the active, passive or concurrent negligence or fault of the Contractor, his officers, agents, servants, or employees, any of his subcontractors, the owner or any of his respective officers, agents, servants, or employees and whether or not such demands suits or proceedings are just, unjust, groundless, false, or fraudulent; and the Contractor shall and does hereby assume and agrees to pay for the defense of all such claims, demands, suits, and proceedings; and provided that the Contractor shall not be required to indemnify the owner, his officers, agents, servants, or employees, against any such damages occasioned solely by acts or omissions of the owner other than supervisory acts or omissions of the owner in connection with the work.

<u>Indemnity Against Subcontractors' Claims</u>: If any other Contractor or any such other Contractor shall suffer or claim to have suffered loss, damage or delay by reason of the acts or omissions of the Contractor or of any of his subcontractors, the Contractor agrees to assume the defense against any such claim and to reimburse such other Contractor or subcontractor for such loss or damage. The Contractor agrees to and does hereby indemnify and save harmless the Town from and against any and all claims by such other Contractors, alleging such loss, damage, or delay and from and against any and all claims, demands, suits, expenses including attorneys' fees, arising out of, relating to or resulting from such claims.

12. <u>PATENTS</u>: The Contractor shall indemnify and save harmless the Town and all persons acting for or on behalf of the Town from all claims and liability of any nature or kind, and all damages, costs and expenses, including attorneys' fees, arising from or occasioned by an infringement or alleged infringement of any patents or patent rights on any invention, process, materials, equipment, article, or apparatus, or any part hereof, furnished and installed by the Contractor, or arising from or occasioned by the use of manufacture thereof, including their use by the Town.

13. <u>CHANGES</u>: The Board of Education, through its designated Agent, may make changes in the work and in the Drawings, if any, and Specifications therefore by making alterations therein, additions thereto or omissions therefrom. All work resulting from such changes shall be performed and furnished under and pursuant to the terms and conditions of the Contract. If such changes result in an increase or decrease in the work to be done hereunder, or increase or decrease the quantities thereof, adjustment in compensation shall be made therefore. For eliminated or decreased work the Contractor shall allow the Board of Education a reasonable credit as determined by the Parties. Except in an emergency endangering life or property, no change shall be made unless in pursuance of a written order from the Board of Education authorizing the change, and no claim for additional compensation shall be valid unless the change is so ordered.

The Contractor agrees that he shall neither have nor assert any claim for or be entitled to any additional compensation for changes or for loss of anticipated profits on work that is eliminated.

- 14. <u>CLAIMS FOR DAMAGES</u>: If the Contractor makes claim for any damages alleged to have been sustained by breach of contract or otherwise, he shall within ten (10) days after occurrence of the alleged breach or within ten (10) days after such damages are alleged to have been sustained whichever date is the earlier, file with the Assistant Facilities Director and the Contracting Officer a written, itemized statement of the details of the alleged breach and the details and amount of the alleged damages. The Contractor agrees that unless such statement is made and filed as so required, his claim for damages shall be deemed waived, invalid and unenforceable, and that he shall not be entitled to any compensation for any such alleged damages. Within ten (10) days after the timely filing of such statement, the Contracting Officer shall file with the Assistant Facilities Director one (1) copy of the statement, and shall file with the Assistant Facilities Director his determination thereon. The Contractor shall not be entitled to claim any additional compensation for damages by reason of any direction, instruction, determination or decision of the owner or its agents, nor shall any such claims be considered, unless the Contractor shall be complied in all respects with the provisions of this paragraph.
- 15. <u>ABANDONMENT OF THE WORK OR OTHER DEFAULT</u>: If the work shall be abandoned, or any part thereof shall be sublet without previous written consent of the Board of Education, or the Contract or any moneys payable hereunder shall be assigned otherwise than as herein specified or if at any time the Contracting Officer shall be of the opinion, and shall so certify in writing, that the conditions herein specified as to rate of progress are not being complied with, or that the work or any part thereof is being unnecessarily or unreasonably delayed, or that the Contractor has violated or is in default under any of the provisions of the Contract, or if the Contractor becomes bankrupt or insolvent or goes or is put into liquidation or dissolution, either voluntarily or involuntarily, or petitions for an agreement or reorganization under the Bankruptcy Act, or makes a general assignment for the benefit of creditors or otherwise acknowledges insolvency, the happening of any of which shall be and constitutes a default

under the Contract, the Town may notify the Contractor in writing, with a copy of such notice mailed to the surety to discontinue all work or any part thereof; thereupon the Contractor shall discontinue such work or such part thereof as the Town may designate; and the Board of Education may designate; and the Board of Education may, upon giving such notice, by Contract or otherwise as it may determine, complete the work or such part thereof and charge the entire cost and expense of so completing the work, the Town shall be entitled to reimbursement from the Contractor and the Contractor agrees to pay to the Town any losses, damages, costs and expenses, including attorneys' fees, sustained or incurred by the Town by reason of any of the foregoing causes. For the purpose of such completion the Board of Education may for itself or for any Contractors employed by the Board of Education take possession of and use or cause to be used any and all materials, equipment, plant, machinery, appliances, tools, supplies and such other items of every description that may be found or located at the site of the work.

All costs, expenses, losses, damages, attorneys' fees, and any and all other charges incurred by the Board of Education under this subsection shall be charged against the Contractor and deducted and/or paid by the Board of Education out of any moneys due and payable or to become due or payable under the Contract to the Contractor; in computing the amounts chargeable to the Contractor, the Board of Education shall not be held to a basis of the lowest prices for which the completion of the work or any part thereof might have been accomplished, but all sums actually paid or obligated therefore to effect its prompt completion shall be charged to and against the account of the Contractor. In case the costs, expenses, losses, damages, attorneys' fees and other charges, together with all payments theretofore made to or for the account of the Contractor, shall exceed the said sum, the Contractor shall pay the amount of the excess to the Board of Education.

- 16. <u>LIENS</u>: If at any time notices of lien or other legal process are filed for labor performed or materials or equipment manufactured, furnished or delivered to or for the work, the Contractor shall, at its own cost and expense, promptly discharge, removal or disposition, the Board of Education shall have the right to retain any moneys payable hereunder so much thereof as, in its sole judgement, it may deem necessary to settle or otherwise dispose of such claims and to pay the costs and expenses, including attorneys' fees, of defending any actions brought to enforce such claims or incurred in connection therewith or by reason thereof.
- 17. <u>CLAIMS</u>: If at any time there be any evidence of any claims for which the Contractor is or may be liable or responsible hereunder, the Contractor shall promptly settle or otherwise dispose of the same, and until such claims are settled or disposed of, the Board of Education may retain from any moneys which would otherwise settle or otherwise dispose of such claims and to pay the costs and expenses, including attorneys' fees, of defending any actions brought to enforce such claims or incurred in connection therewith or by reasons thereof.

As required by Section 49-41a of the Connecticut General Statutes, within thirty days after payment from the Town for work under this Contract he shall pay any amounts due any subcontractor, whether for labor

performed or materials furnished when such labor or materials has been included in a requisition submitted by such Contractor and paid by the Town.

- 18. <u>LIABILITY OF TOWN</u>: No person, firm or corporation, other than the Contractor who signed this Contract as such, shall have any interest herein or rights hereunder. No claim shall be made or be valid either against the Board of Education or any agent of the Board of Education shall be liable for or be held to pay any money, except the final estimate shall operate as and shall be a full and complete release of any and all claims, demands and liabilities of, by or to the Contractor for anything done or furnished for or arising out of or relating to or by reason of the work or for or on account of any act or neglect of the Board of Education or of any agent of the Board of Education for the unpaid balance, if any there be, of the amounts retained as herein provided.
- 19. <u>PROVISIONS REQUIRED BY LAW DEEMED INSERTED</u>: Each and every provision of law and clause required by law to be inserted in the Contract shall be deemed to be inserted herein, and the Contract shall be read and enforced as though they were included herein. If through mistake or otherwise any such provision is not inserted, or is not correctly inserted, then upon the application of either party, the Contract shall forthwith be physically amended to make such insertion.
- 20. <u>PERMITS</u>: The Contractor shall, at his own expense, take out and maintain all necessary permits, including sewer and drainage permits from the State, Town or other public authorities; shall give all notices required by law; and shall post all bonds and pay all fees and charges incident to the due and lawful prosecution of the work.

Local building officials are required, before issuing any building permit pursuant to 29-263 C.G.S., to require proof of workers' compensation insurance coverage **for all persons** employed or engaged to perform services on the construction site, whenever the TOTAL cost of all work to be performed is \$100,000 or more.

- 21. <u>NOT TO SUBLET OR ASSIGN</u>: The Contractor shall constantly give his personal attention to the faithful prosecution of the work, shall keep the same under his personal control, shall not assign the Contract or sublet the work or any part thereof without the previous written consent of the Board of Education, and shall not assign any of the moneys payable under the Contract, or his claim thereto, unless by and with the like written consent of the Board of Education and the surety on the Contract Bonds. Any assignment or subletting in violation hereof shall be void and unenforceable.
- 22. <u>EMPLOY COMPETENT WORKERS</u>: The Contractor shall employ only competent workers on the project and shall not employ workers or means which may cause strikes, work stoppages, and/or disturbances by workers employed by the Contractor, and subcontractor, the Board of Education, the

Contracting Officer or any other Contractor. Whenever the Contracting Officer notifies the Contractor in writing that in his opinion any worker on the project is incompetent, unfaithful, disorderly, or otherwise unsatisfactory or not employed in accordance with the provisions of the Contract, such worker shall be discharged from the project and shall not again be employed on it, except with the written consent of the Contracting Officer.

- 23. <u>EMPLOY SUFFICIENT LABOR AND EQUIPMENT</u>: If in the sole judgment of the Contracting Officer the Contractor is not employing sufficient labor, plant, equipment or other means to complete the work within the time specified the Contracting Officer may, after giving written notice, require the Contractor to employ such additional labor, plant, equipment and other means as the Contracting Officer deems necessary to enable the work to progress properly.
- 24. <u>INTOXICATING LIQUORS</u>: The Contractor shall not sell and shall neither permit nor suffer the introduction or use of intoxicating liquors upon or about the work.
- 25. <u>ACCESS TO WORK</u>: The Board of Education, the Contracting Officer, and their officers, agents, servants, and employees may at any and all times and for any and all purposes, enter upon the work and the site thereof and the premises used by the Contractor, and the Contractor shall at all times provide safe and proper facilities therefore.
- 26. <u>EXAMINATION OF WORK</u>: The Contracting Officer shall be furnished by the Contractor with every reasonable facility for examining and inspecting the work and for ascertaining that work is being performed in accordance with the requirements and intent of the Contract, even to the extent of requiring the uncovering or taking down portions of finished work by the Contractor.
- 27. <u>EXTRA WORK</u>: The Contractor shall perform any extra work (work in connection with the Contract but not provided for herein) when as ordered in writing by the Contracting Officer, at the unit prices stipulated in the Contract for such work or, if none are stipulated, either (a) at the price agreed upon before such work is commenced and named in the written order for such work, or (b) if the Contracting Officer so elects, by cost, based on determination of reasonable expenditures of labor and materials, as approved by the Contracting Officer, plus an allowance of **10** % of the cost for combined overhead and profit
- 28. <u>CHANGES NOT TO AFFECT BONDS</u>: It is distinctly agreed and understood that any changes made in the work or the Drawings or Specifications therefore (whether such changes increase or decrease the amount thereof or the time required for its performance) or any changes in manner or time of payment made by the Board of Education to the Contractor, or any other modifications of the Contract, shall in no way annul, release, diminish or affect the liability of the surety on the Contract Bonds given by the Contractor, it being the intent hereof that notwithstanding such changes the liability of the surety on said bonds continue and remain in full force and effect.

- 29. <u>PRICES FOR WORK</u>: The Town shall pay and the Contractor shall receive the prices stipulated in the Bid made a part hereof as full compensation for everything performed and furnished and for all risks and obligations undertaken by the Contractor under and as required by the Contract.
- 30. <u>MONEYS MAY BE RETAINED</u>: The Board of Education may at any time retain from any moneys, which would otherwise be payable hereunder, so much thereof as the Board of Education may deem necessary to complete the work hereunder and to reimburse it for all costs, expenses, losses, damages chargeable to the Contractor hereunder.
- 31. <u>USE OR PARTIAL PAYMENT NOT ACCEPTANCE</u>: It is agreed that this is an entire contract for one whole and complete work or result and that neither the Town's entrance upon or use of the work or any part thereof nor any partial payments by the Board of Education shall constitute an acceptance of the work or any part thereof before its entire completion and final acceptance.

32. <u>PREVAILING WAGE RATES: CONSTRUCTION SAFETY AND HEALTH COURSE</u>

Except as noted below, the Contractor shall comply with the current provisions of Section 31-53 of the General Statutes of the State of Connecticut, a part of which is quoted as follows.

"The wages paid on an hourly basis to any person performing the work of any mechanic, laborer or worker on the work herein contracted to be done and the amount of payment or contribution paid or payable on behalf of each such person to any employee or welfare fund, as defined in subsection (h) of section 31-53 of the General Statutes, shall be at a rate equal to the rate customary or prevailing for the same work in the same trade or occupation in the town in which such public works project is being constructed. Any contractor who is not obligated by agreement to make payment or contribution on behalf of such persons to any such employee welfare fund shall pay to each mechanic, laborer or worker as part of such person's wages the amount of payment or contribution for such person's classification on each pay day."

All Contractors and subcontractors shall submit certified weekly payrolls, on forms furnished by the Town, for all contracts meeting the aforementioned monetary limits. The certified payrolls shall be submitted with the Contractor's monthly certificate for payment.

Section 31-55a of the General Statutes of the State of Connecticut provides that the prevailing wage rates applicable to any awarded contract or subcontract are subject to annual adjustments each July 1st for the duration of the project.

Each Contractor that is awarded a contract shall pay the annual adjusted prevailing wage rate that is in effect each July 1st, as posted by the Department of Labor.

It is the Contractor's responsibility to obtain the annual adjusted prevailing wage rate increases directly

from the Department of Labor's web site. The annual adjustments will be posted on the Department's of Labor web page: <u>www.ctdol.state.ct.us</u>. For those without Internet access, contact the division listed below.

The Contractor shall also furnish proof with the weekly certified payroll for the first week each employee begins work that any person performing the work of a mechanic, laborer or worker has completed a course of at least ten (10) hours in duration in construction safety and health approved by the federal Occupational Safety and Health Administration in accordance with Connecticut General Statutes Section 31-53b and regulations adopted by the State of Connecticut Labor Commissioner.

The provisions of this section (4.48) shall not apply where the total cost of all work to be performed by all Contractors and subcontractors in connection with new construction of any public works project is less than four hundred thousand dollars (\$400,000) or where the total cost of all work to be performed by all contractors and subcontractors in connection with any remodeling, refinishing, refurbishing, rehabilitation, alteration or repair of any public works project is less than one hundred thousand dollars (\$100,000).

Questions can be directed to the Contract Compliance Unit, Wage and Workplace Standards Division, Connecticut Department of Labor, 200 Folly Brook Blvd., Wethersfield, CT 06109 at 860-263-6790.

33. <u>NON-CONNECTICUT CONTRACTORS</u>:

Pursuant to Connecticut General Statues Section 12-430(7), as amended by Connecticut Public Act #11-61, Section 66, a non-resident contractor shall comply with the State of Connecticut's bonding requirements.

34. <u>FINAL PAYMENT</u>: When the Contractor has completed the work under this Contract he shall submit his bill for final payment to the Assistant Facilities Director for approval. The bill shall be submitted on the Contractor's billhead indicating date, contract number, work performed, and amount of bill along with an executed Affidavit for Final Payment which is part of the Contractor's conformed copy of the Contract.

Receipt of this bill shall in no way obligate the Board of Education to accept the work under this Contract as complete and satisfactory.

Within one week from date of receipt of the bill, the Assistant Facilities Director or his representative will inspect the work and if deficiencies are found the Contractor shall be notified in writing of each deficiency. The final payment shall not be made until the Assistant Facilities Director approves the work as complete, satisfactory and in compliance with the Contract Document.

35. <u>RIGHT TO ALTER FORM, QUANTITY, ETC., OF WORK</u>: The Board of Education further reserves the right to make alterations in the lines, grade, plan, the commencement of work because of the priority restrictions, insufficient funds in appropriations, or other cause. If such alterations diminish the quantity of

the work to be done, they shall not constitute a claim for damage, or for anticipated profits on the work dispensed with, or affect the prices bid for the various classes of work remaining. If they increase the amount of work, such increase shall be paid for according to the quantity actually done and at the price or prices bid for various classes of work, or if not susceptible of classification, to so agree, the Contractor shall do the work as aforesaid as extra work.

36. <u>SAFETY SPECIFICATIONS</u>

<u>Site Conduct</u>: Contractor acknowledges that the Work will be conducted at an operating public school, which may inhibit the operations of Contractor and its Subcontractors and Vendors. Parking for workers, vendors, and visitors will be allowed only at an area designated by Owner.

If necessary, Contractor shall provide transportation for all workers between the Site and such remote parking as will be provided to the Contractor. Contractor shall prohibit, and shall use all reasonable efforts to prevent its, and its Subcontractors' and Vendors', personnel from loitering or wandering in the School. Contractor shall also prohibit, and shall use all reasonable efforts to prevent, on or near the Site, the use or consumption of alcoholic beverages, drugs, or other mind-altering substances, the carrying of firearms or other weapons, fighting, and conduct that is disorderly, or disruptive, in a business setting. Contractor, or a Subcontractor or Vendor, whose employment Owner designates to be terminated due to violation of any laws or rules applicable to the site or the school.

Safety: The safety of Contractor, Subcontractors, Vendors and their employees, agents, representative and invitees, and any other person who enters the Site for any purpose relating to Contractor's carrying out its obligations under this Agreement (including Owner and its employees, agents, representatives and invitees) shall be Contractor's responsibility. Contractor shall promptly notify Owner, in writing, of any hazardous conditions, property or Equipment at the Site. If Owner requests that Contractor provide certain safeguards required in Owner's reasonable judgment for the protection of persons, or property, on or near the Site and Contractor fails to comply with such request within a reasonable time, Owner may provide such safeguards, and Contractor shall promptly reimburse Owner for the costs thereof. Such provision by Owner shall not relieve Contractor of its obligations or liabilities hereunder, nor shall it make Owner responsible for Site safety or Contractor's means and methods to ensure Site safety. Contractor shall initiate and maintain safety precautions and programs to conform with applicable laws and otherwise to protect against and prevent injury to persons or damage to property on, about, or adjacent to the Site and shall incorporate all such safety precautions and programs (the "Site Safety Program") in a written safety program manual (the "Site Safety Manual"). Contractor shall erect and maintain safeguards for the protection of workers and the public consistent with its obligations under the Agreement. Contractor shall exercise efforts to eliminate, or abate, all reasonably foreseeable safety hazards created by or otherwise resulting from performance of the Work. Contractor shall ensure that it, its employees, agents and invitees and its Subcontractors,

Vendors and their employees, agents and invitees, during performance of any of the Work, comply with (i) all applicable laws relating to health and safety, including the Occupational Safety and Health Act of 1970 (OSHA) and the rules and regulations promulgated thereunder, and (ii) all directions by Owner regarding protective clothing, head covering, eye protection, and the like. Prior to commencing Work, Contractor or designate to Owner (i) one of its employees to act as the Site's safety officer (the "Site Safety Officer") and (ii) certain of its employees to act as the Site's first aid staff, which employees shall be properly trained and qualified. Contractor's Site Safety Officer shall attend and pass Owner's fire watch training session, or a similar session, with advance approval by Owner. Contractor shall not terminate the employment of the Site Safety Officer without Owner's prior written consent. Contractor's Site Safety Officer and first aid staff shall have such responsibilities as Owner and Contractor may from time to time agree. Owner may from time to time designate its own Site safety officer or first aid staff to whom Contractor's Site Safety Officer and staff shall report.

<u>Safety Records</u>: Contractor shall furnish the safety records of Contractor and its Subcontractors, including their experience modification rate, OSHA Injury Index, OSHA Days Away From Work Index.

<u>Hot Work Permits</u>: At least twenty-four (24) hours in advance of performing Work in Hazardous Areas, Contractor's Representative shall notify General Contractor that such work is necessary, obtain General Contractor's prior written approval to perform such work, and, if approved, provide General Contractor with Hot Work Maps and obtain Hot Work Permits from General Contractor's Representative.

<u>Daily Safe Work Permits</u>: On a daily basis, prior to performing any Work, Contractor shall obtain Daily Safe Work Permits from the Owner.

<u>Differing Site Conditions</u>: Contractor shall, promptly after actual discovery, and before such conditions are disturbed (to the extent reasonably practicable), notify Owner in writing of (i) any subsurface or latent physical conditions at the Site, differing materially from those indicated in, or reasonably inferable from, the Supplied Project Documents that could not have been observed through a reasonable inspection of the Site, prior to commencing Work, or (ii) unknown physical conditions at the Site of an unusual nature differing materially from those ordinarily encountered and generally recognized as inherent in work of the character provided for in this Agreement. After receipt of such notice, Owner shall promptly investigate the conditions. In the event that such conditions do materially differ and actually result in a material increase or decrease in Contractor's cost of, or the time required for performance of, the Work, Contractor may be entitled to additional or a reduction in compensation under Agreement as applicable. No adjustment in compensation shall be allowed under this Paragraph unless Contractor has promptly given the notice required in this Paragraph.

Site Housekeeping: Contractor shall keep the Site free from trash, contamination, refuse, rubbish, scrap

materials, and debris caused, or created by, Contractor or its Subcontractors and shall keep the Site in a reasonably presentable condition given the nature of the Work and in a neat, orderly, and workmanlike apace. Owner may from time to time instruct Contractor to place the Site in such condition. If Contractor fails to do so within a reasonable period of time, Owner may do so and charge Contractor for the actual cost thereof. Contractor shall dispose of trash, refuse, rubbish, scrap material, and debris in an authorized landfill. Contractor shall not burn, or bury, any such items. Contractor shall cause all Contractor generated Hazardous Substances that are transported by Contractor to the Site to be disposed of by licensed transporters in accordance with the requirements of all applicable laws.

<u>Maintenance of Roadways</u>: Contractor shall protect all maintained roads, driveways, and bridges which may be damaged in connection with the work, and shall repair, or replace, them if damaged, at its own expense, to the satisfaction of the governmental authorities or Owner. It is the responsibility of the Contractor to identify the potential for damage and take proper preventative measures to prevent damage to maintained or unmaintained roads, drives, or bridges. Cost of preventative measures shall be submitted to Owner, prior to commencement of work and will be on a reimbursable basis. Contractor shall not block any main thoroughfares in School property without prior approval from Owner. No lug type rigs, bulldozers, or other tract type equipment may be used without prior approval from the Owner. If these rigs are used, appropriate protection must be used to prevent damage to roadways.

<u>Clean-Up</u>: As part of the work included in this Contract, the Contractor shall completely remove and satisfactorily dispose of all temporary buildings placed by the Contractor; shall remove or grade, to the extent directed, all embankments or cofferdams made for construction purposes; shall satisfactorily dispose of all rubbish resulting from the operations under this Agreement; and

shall do all work necessary to restore the territory embraced within the site of its operations to at least as good order and conditions at the beginning of the work under this contract. Notwithstanding the foregoing, any work concerning Hazardous Substances shall be performed only in accordance with the contract and all applicable laws.

<u>Training and Operations Manuals</u>: Contractor shall provide, either itself or through its subcontractors or vendors, specific operations and maintenance training to Owner's personnel for the Equipment and systems that Contractor provides. As to such Equipment and systems, Contractor shall provide to Owner final operations manuals, record drawings, specifications, priced spare parts lists and design sheets.

IN WITNESS WHEREOF, the parties of this AGREEMENT have hereunto set their hands and seals the day first above written.

| TOWN | OF | GREEN | WICH. | CONNECTI | CUT |
|--------|-----|-------|---------------------|-----------|-----|
| 10,111 | OI. | OIGLE | , , , ICII , | CONTRACTI | |

BY_____ Benjamin B. Branyan Contracting Officer Managing Director of Operations

Date:_____

CONTRACTOR

BY_____

Date:_____

(Corporate Seal)

CONSENT OF SURETY

The undersigned surety, being the surety company which issued Bond No. ______ for the Town of Greenwich Contract No. ______ hereby consents to release of final payment and all retainages to the contractor – principal.

(Name of Surety)

By_____

Its

ACKNOWLEDGMENT

STATE OF

ss:

COUNTY OF

This is to certify that the above named signatory who executed this instrument was either known to me or satisfactorily proven to me to be the person whom he purports to be.

Notary Public

AFFIDAVIT FOR FINAL PAYMENT

The undersigned, being duly sworn, deposes and says:

- 1. That he is the ______ (Title) of the contractor in the project hereinafter referred to and is authorized to execute this affidavit on behalf of the contractor;
- 3. This Affidavit is made at the request of the Town of Greenwich for the purpose of inducing final payment and knowing that it will rely upon the truth of the representation herein made.

Subscribed and sworn to before me this day of 2018

Notary Public

(Type or print name of person authorized to sign) Department of Revenue Services State of Connecticut Attn: Discovery Unit 25 Sigourney Street Hartford CT 06106-5032 (New 09/03)

Form AU-764 Deposit by a Person Doing Business With a Nonresident Contractor



Purpose: A person doing business with a nonresident contractor uses **Form AU-764** to deposit 5% of the total contract price with the Department of Revenue Services (DRS) for a specific project in the state. The deposit ensures all taxes due to the State of Connecticut from the contractor are paid to DRS. Read the instructions on the reverse side before you complete this form. If you need help, call **860-541-3280**, Monday through Friday, 8:00 a.m. to 5:00 p.m., and choose Option 7.

| Part I: Nonresident C | Contractor Information | | | | | | | |
|--|---|----------------------------------|--------------------------|--|--|--|--|--|
| Name | | Connecticut Tax Registration No. | | | | | | |
| Address (Street or PO Box | , City, State, and ZIP Code) | - | | | | | | |
| Part II: Person Doing | Business With a Nonre | esident Contractor Infor | mation | | | | | |
| Name | | | Connecticut Tax Registra | ation No., Federal ID No., or SSN | | | | |
| Address (Street or PO Box | x, City, State, and ZIP Code) | | | | | | | |
| Part III: Project Infor | mation | | | | | | | |
| Physical Location of Proje | ct (Street, City or Town) | | Name of Project | | | | | |
| Commencement Date | Completion Date for Nonresident Contractor | Total Contract Price or Amou | | Amount of Deposit | | | | |
| The nonresident co The person doing to ensure all taxes that The deposit is mad The deposit will be its records and detored an | ensure all taxes that become due and owing during the period of the contract will be paid.The deposit is made within 30 days of the completion of the project. | | | | | | | |
| penalty of law that I hat I ha | Declaration: I, an authorized agent of the person doing business with a nonresident contractor named above, declare under the penalty of law that I have examined Form AU-764 and, to the best of my knowledge and belief it is true, complete, and correct. I understand the penalty for willfully delivering a false document or return to DRS is a fine of not more than \$5,000, or imprisonment for not more than five years, or both. | | | | | | | |
| Print Name | | | Title | | | | | |
| Authorized Signature | | | Date | | | | | |
| | DRS acknowledges receip business with a nonresic | | eal property at the Co | from the person nnecticut location noted above. | | | | |
| Signature of Authorized DF | RS Representative | Tele | phone | Date | | | | |

General Instructions

A person doing business with a nonresident contractor working in Connecticut must submit **Form AU-764**, *Deposit by a Person Doing Business With a Nonresident Contractor*, with a deposit of 5% of the total contract price, including change orders and add-ons, not later than 30 days after the completion of the contract. This applies to all contracts with nonresident contractors, regardless of the nature of the real property affected or the tax-exempt status of the property owner. For more information, see **Special Notice 2003(20)**, *Legislation Affecting Contracts With Nonresident Contractors*.

A nonresident contractor is a contractor who does not maintain a regular place of business in this state. A regular place of business means any bona fide office, factory, warehouse, or other space in Connecticut at which a contractor is doing business in its own name in a regular and systematic manner, and which place is continuously maintained, occupied, and used by the contractor in carrying on its business through its employees regularly in attendance to carry on the contractor's business in the contractor's own name. A regular place of business does not include a place of business for a statutory agent for service of process or a temporary office whether or not it is located at the site of construction. A regular place of business also does not include locations used by the contractor only for the duration of the contract, such as short-term leased offices, warehouses, storage facilities, or facilities that do not have full time staff with regular business hours. An office maintained, occupied and used by a person affiliated with a contractor is not a regular place of business of the contractor.

Specific Instructions

- Part I: Enter the name and complete address of the nonresident contractor on whose behalf the deposit is being made. Include the nonresident contractor's Connecticut tax registration number.
- **Part II:** Enter the name and complete address of the person doing business with the nonresident contractor. If the nonresident contractor is the general contractor, enter the name and address of the owner of the property. If the nonresident contractor is a subcontractor, enter the name and address of the general contractor.

Enter the Connecticut tax registration number of the person doing business with the nonresident contractor. If the person doing business with the nonresident contractor does not have a Connecticut tax registration number, enter that person's Federal Employer Identification Number or Social Security Number. Part III: Enter the name of the project and the complete address, including the street address and the city or town where the project is physically located.

Enter the commencement date of this project. The commencement date is the date the contract is signed or the date the nonresident contractor begins work on the project, but it is never later than the date the nonresident contractor begins work.

Enter the date on which work on this project was completed, which is the date the final periodic billing for the contract was made by the nonresident contractor. Note the final periodic billing may be due before payment of any retainage becomes due. The person making the deposit must attach a copy of the final periodic billing to **Form AU-764**.

If this is a deposit for a change order occurring after the deposit for the initial contract has been remitted to DRS, enter the additional amount being deposited for the change order and check the box. For a change order made after the final periodic billing for the original contract, the change order is deemed complete when it is billed by the nonresident contractor. Attach a copy of the final billing for the change order.

Enter, in words and figures, the total amount paid to the nonresident contractor under the contract or for the change order. Check the box if the deposit is for a change order.

Multiply the total contract price or the amount of the change order by 5% (.05) and enter the result on this line.

Declaration: An authorized representative of the person doing business with a nonresident contractor must sign and date the declaration. Return **Form AU-764**, with the copy of the final periodic billing, to:

Department of Revenue Services State of Connecticut Discovery Unit 25 Sigourney Street Hartford CT 06106

Receipt: DRS will acknowledge receipt of the deposit by completing the bottom of Form AU-764 and returning a copy of it to the person making the deposit. Unless indicated otherwise, the person doing business with the nonresident contractor will not be liable for any claim of the nonresident contractor for the amount or for any claim of DRS for any taxes arising from the activities of the nonresident contractor on the project for which the bond deposit was made, once DRS has verified that total deposits represent 5% of the total contract price paid to the nonresident contractor for this project, including any change orders, and that the deposit is made within 30 days of completion of the project.

Purpose of Form REG-1

Use Form REG-1 to obtain a Connecticut tax registration number or to register for additional tax types under your current Connecticut tax registration number.

Use Form REG-1 to register for any of these taxes:

- Business entity tax
- Business use tax
- Corporation business income tax (including PIC)
- Income tax withholding
- Prepaid wireless E 9-1-1 fee
- Room occupancy tax
- Sales and use taxes
- Unrelated business income tax

In addition to Form REG-1, you must complete and attach the appropriate addendum to register for any of the taxes noted below. Visit the Department of Revenue Services (DRS) website at **www.ct.gov/DRS** to preview and download forms.

REG-1 Addendum A

- Cigarette taxes
- Tobacco products tax

REG-1 Addendum B

- Admissions and dues taxes
- · Dry cleaning surcharge
- Rental surcharge
- Tourism surcharge

REG-1 Addendum C

- Motor fuels tax
- Petroleum products gross earnings tax

REG-1 Addendum D

Alcoholic beverages tax

REG-1 Addendum E

- · Bottle deposit initiator
- Certified competitive video service provider companies tax
- Community antenna television system companies tax
- · Electric generation
- Nursing home provider
- Railroad companies tax
- Satellite companies tax
- Solid waste assessment
- Suppliers of natural gas
- Utility companies tax

Registering for Other Tax Types

To register for these taxes, use the form listed:

- Authority to Collect Use TaxREG-7
- International Fuel Tax Agreement (IFTA) CT-IFTA-2
- Motor Carrier Road Tax REG-3MC

For information on registering with DRS, visit the DRS website at **www.ct.gov/DRS** or call **1-800-382-9463** (Connecticut calls outside the Greater Hartford calling area only) or **860-297-5962** (from anywhere).

How to Register

Online Registration

You may register for most taxes online using the **Taxpayer Service Center** (*TSC*). If you register online and there is a fee, you must make direct payment from your savings or checking account. Credit card payments are not accepted. If you register for sales tax, room occupancy tax, or as an over-the-counter cigarette dealer (retailer), a temporary permit will be available to print immediately. Be sure to print a copy of the temporary permit for your records. Once you have the temporary permit you may begin using it immediately. After you complete the registration, you will receive a confirmation number which serves as an official acknowledgement that your application has been received by DRS and acts as your temporary tax identification number. You will receive your registration package with your permanent Connecticut tax registration number in approximately ten business days.

If you are registering for a tax type that requires you to attach Addendum B to the REG-1 or if you are registering as a cigarette retailer (included on Addendum A), you may register online. If you are registering for another tax type that requires you to attach Addendum A, C, D, or E to the REG-1, you must register by mail or in person at the DRS office in Hartford.

Mail-In Registration

Complete Form REG-1 and mail it to DRS at: Department of Revenue Services PO Box 2937 Hartford CT 06104-2937

If you owe a registration fee, you must include payment by check or money order with the application. You will receive your Connecticut tax registration number in the mail in **two to three** weeks.

Walk-In Registration

You may file Form REG-1 in person at any of the DRS offices:

Bridgeport - 10 Middle Street

Hartford - 25 Sigourney Street Norwich - 401 West Thames Street, Building #700

Waterbury - 55 West Main Street, Suite 100

You will be issued a Connecticut tax registration number **immediately**. Bring photo identification, such as a driver's license, and cash, a check, or a money order if you owe a registration fee. DRS does not accept credit or debit cards.

The application must be signed by the individual owner, partner, officer of the corporation, member of the limited liability company, or another who has an executed Power of Attorney with the authority to sign. If anyone other than the owner brings the signed application to the office and wants to obtain the registration for the owner, he or she must have written authorization from the owner to obtain the registration on his or her behalf.

Electronic Filing Methods for Certain Tax Forms

Once you are registered with DRS, you may file certain tax forms by Internet or telephone using the DRS **Taxpayer Service Center** (*TSC*) program. Look for this logo.



Who Needs to Complete Form REG-1

Businesses must register with the Connecticut DRS if they:

- Have people working in Connecticut;
- Withhold Connecticut income tax;
- Carry on a business in Connecticut;
- Are a corporation, S corporation, LLC, SMLLC, LP, or LLP formed under Connecticut law;
- Are a non-Connecticut corporation, S corporation, LLC, SMLLC, LP, or LLP required to register with or to obtain a certificate of authority from the Connecticut Secretary of the State;
- · Provide taxable services in Connecticut;
- · Are a loan-out company providing services in Connecticut;
- Sell, rent, or lease goods in Connecticut (wholesale or retail);
- Furnish space for storage of tangible personal property;
- · Have a manufacturing facility in Connecticut;
- · Serve meals or beverages in Connecticut;
- · Purchase taxable goods or services for use in Connecticut;
- Provide lodgings in Connecticut subject to the room occupancy tax;
- Carry on a business as a corporation in Connecticut;
- · Distribute alcoholic beverages in Connecticut;
- Distribute motor fuel used to propel motor vehicles on public highways or roads in Connecticut;
- Sell petroleum products in Connecticut;
- Operate a place of amusement, entertainment, or recreation in Connecticut;
- Operate a social, health, athletic, or sporting club in Connecticut;
- · Sell or distribute cigarettes or tobacco products in Connecticut;
- Own, lease, maintain, operate, manage, or control a community antenna television system in Connecticut;
- Provide satellite television services to Connecticut;
- Provide video service under a certificate of video franchise authority issued by the Connecticut Public Utility Regulatory Authority formerly known as the Department of Public Utility Control;
- · Operate a railroad in Connecticut on a for-profit basis;
- Are a resources recovery facility in Connecticut;
- · Market natural gas to an end user in Connecticut;
- Provide distribution or transmission services for electricity in Connecticut;
- Sell electricity as a municipality to customers in Connecticut;
- Manufacture, sell, or distribute gas to be used for light, heat, or power in Connecticut;
- · Operate a dry cleaning establishment in Connecticut.
- Are the first distributor to collect the deposit on a beverage container sold to any person within Connecticut;
- · Are a nursing home provider;
- Provide electric generation services and upload electricity to the regional bulk power grid at their electric generation facility in Connecticut; or
- Sell prepaid wireless telecommunications service in Connecticut.

Filing Requirements for State Taxes

Visit the DRS website at **www.ct.gov/DRS** to preview and download the **Informational Publication**, *Getting Started in Business*.

Registration Fees

| Sales and use taxes\$ | 100 |
|---|------|
| Room occupancy tax*\$ | 100 |
| Cigarette dealer's license | \$50 |
| Cigarette distributor's license\$1,2 | 250 |
| Cigarette distributor chain operator | |
| 5 to 14 retail locations\$ | 315 |
| 15 to 24 retail locations\$6 | 325 |
| 25 or more retail locations\$1,2 | 250 |
| Cigarette manufacturer\$5,2 | 250 |
| Distributor of tobacco products\$2 | 200 |
| No fee is nearlined for an one concurrency to the state on an anister | a al |

No fee is required for room occupancy tax if you are registered or are registering for sales and use taxes.

Other Connecticut Licensing Requirements

Visit **www.ct-clic.com** for information on other Connecticut licensing requirements.

How to Get Help

Visit the DRS website at **www.ct.gov/DRS** and click on *Businesses.*

Personal assistance is available by telephone or at the DRS office at 25 Sigourney Street in Hartford, Monday through Friday, during business hours.

CONN-TAX, the DRS telephone information line, is available anytime.

- **1-800-382-9463** (Connecticut calls outside the Greater Hartford calling area only); **or**
- 860-297-5962 (from anywhere).

TTY, TDD, and Text Telephone users only may transmit inquiries anytime by calling 860-297-4911.

Additional forms and publications are available anytime. Visit the DRS website at **www.ct.gov/DRS** to download and print Connecticut tax forms and publications.

Application Instructions

Complete the entire application unless the section instructions indicate otherwise. Answering **Yes** to any question in Sections 7 through 12 means you may have a Connecticut tax liability for that tax. In each section where you answer **Yes** to any question, you must indicate the date you first incurred a tax liability in Connecticut for that tax type.

Exceptions:

- Taxpayers with a valid Connecticut tax registration number who wish to register for another tax must complete Sections 1 through 6, Section 14, and the section for the specific tax type(s) for which you wish to register. See the section *Purpose* of *Form REG-1* on Page 1 of these instructions to determine if you have to complete an addendum to Form REG-1.
- Household employers who pay wages to and intend to withhold Connecticut income tax for housekeepers, nannies, health aides, caretakers, etc. complete Sections 1 through 7 and 14 only.

Department of Revenue Services State of Connecticut PO Box 2937 Hartford CT 06104-2937

Form REG-1 Business Taxes Registration Application

| (Rev. 12/12) | | | | | | | | |
|--|--|--|--|--|--|--|--|--|
| 1. Reason for Filing Form REG-1 Check the applicable box: DRS use only Connecticut Tax Registration Number Opening a new business including but not limited to: a. An existing out-of-state business opening a location in Connecticut; b. Selling at a craft show, flea market, fair, or other venue in Connecticut or selling over the Internet; or c. An existing out-of-state business having employees in Connecticut or selling over the Internet; or c. An existing out-of-state business having employees in Connecticut or selling over the Internet; or c. An existing out-of-state business having employees in Connecticut or selling over the Internet; or c. An existing out-of-state business. Enter your Connecticut Tax Registration No: Copening a new location. Enter your Connecticut Tax Registration No: | | | | | | | | |
| 2. Business Information: Type of organization | | | | | | | | |
| Sole proprietorship Single member LLC (SMLLC) Corporation | | | | | | | | |
| □ Single member LLC taxed as a corporation □ S Corporation □ | | | | | | | | |
| | | | | | | | | |
| Limited liability partnership (LLP) Limited liability company (LLC) taxed as a partnership Limited liability company (LLC) taxed as a corporation Limited partnership (LP) Limited liability company (LLC) taxed as an S corporation Limited partnership taxed as a corporation Other (explain): | | | | | | | | |
| 3. Nature of Business Activity Check the box(es) that best describe your business: Retailer Wholesaler Manufacturer Service provider Other (explain): | | | | | | | | |
| 4. Major Business Activity Describe your major business activities: | | | | | | | | |
| 5. Business Name and Address | | | | | | | | |
| Organization name: Enter the name of the sole proprietor, partnership, corporation, or LLC. Federal Employer Identification Number, if applicable | | | | | | | | |
| Business trade name CT Secretary of the State Business ID No., if applicable | | | | | | | | |
| Business Location: Enter the physical address of the business. A post office box or rural route number is not acceptable. Home-based businesses and | | | | | | | | |
| flea market or craft show vendors must enter a home address. Address line 1 Address line 2 | | | | | | | | |
| | | | | | | | | |
| City State ZIP code | | | | | | | | |
| Mailing address line 1 (Street or PO Box) Address line 2 | | | | | | | | |
| City State ZIP code | | | | | | | | |
| Business telephone number Email address Bank name | | | | | | | | |

| 6. List All Owners, Partners, Corpora | te Officers, or LLC Meml | bers Attach a separat | e sheet if needed. |
|---|------------------------------|------------------------|--|
| Name (last, first, middle initial) | | | Title |
| Home address line 1 (street) | | Home address line 2 | |
| City | State | ZIP code | Home telephone number |
| SSN | Date of birth | Bank name | |
| Name (last, first, middle initial) | | .] | Title |
| Home address line 1 (street) | | Home address line 2 | |
| City | State | ZIP code | Home telephone number |
| SSN | Date of birth | Bank name | • |
| Name (last, first, middle initial) | | | Title |
| | | _ | The second secon |
| Home address line 1 (street) | | Home address line 2 | |
| City | State | ZIP code | Home telephone number |
| SSN | Date of birth | Bank name | |
| Name (last, first, middle initial) | | | Title |
| Home address line 1 (street) | | Home address line 2 | |
| City | State | ZIP code | Home telephone number |
| SSN | Date of birth | Bank name | |
| Z Income Tex Mith helding | | | |
| 7. Income Tax Withholding Are you an employer that transacts b | ousiness or maintains an o | ffice in Connecticut : | and intends |
| to pay wages to resident employees | | | |
| If you have a Connecticut tax registra and intend to file withholding for this here: | new location under that nu | umber, enter that nur | |
| Are you an out-of-state company volu income tax for your Connecticut resid | untarily registering to with | nold Connecticut | cut? Yes No |
| Do you intend to withhold Connecticu retirement distributions, or gambling | • | | - |
| Do you pay nonresident athletes or e | ntertainers for services the | ey render in Connec | ticut? Yes No |
| Do you only have household employ | ees and wish to withhold 0 | Connecticut income t | ax? Yes No |
| Do you only have agricultural employ | ees and wish to withhold | Connecticut income | tax? Yes No |
| If Yes , do you file federal Form 943, I and wish to file Form CT-941 , <i>Conne</i> | | | |
| If you answered Yes to any of the inc enter the date you will start withhold | | | |
| If you use a payroll service, enter the | name of the payroll comp | oany: | |

| 8. Sales and Use Taxes Do you sell, or will you be selling, goods in Connecticut (either wholesale or retail)? | |
|--|---|
| Do you rent equipment or other tangible personal property to individuals or businesses | |
| in Connecticut? Yes No Do you serve meals or beverages in Connecticut? | |
| Do you provide a taxable service in Connecticut? See the Informational Publication, | |
| Getting Started in Business, and the Special Notice on Legislative Changes Affecting the Sales | |
| and Use Taxes, on the DRS website, for a list of taxable services | |
| If you answered Yes to any of the sales and use taxes questions, enter the date you will start selling or leasing goods or taxable services | |
| 8a Prepaid Wireless Service E 9-1-1 | _ |
| Do you sell prepaid wireless service in Connecticut? | |
| If you answered Yes, enter the date you will start to sell these in Connecticut. | |
| 9. Room Occupancy Tax | - |
| Do you provide lodging rooms for rent in a hotel, motel, or rooming house in Connecticut for 30 consecutive days or less? I Yes I No | |
| If you answered Yes, enter the date you will start to provide rooms for rent | |
| for lodging purposes in Connecticut. | |
| 10. Business Entity Tax Do not complete this section if the entity is liable for the corporation business tax. The business entity tax applies to all of the following business types formed under Connecticut law and to those non-Connecticut entitie required to register with or obtain a certificate of authority from the Connecticut Secretary of the State before transacting business in the state, whether or not the business has registered or filed a certificate of authority, as the case may be, with the Connecticut Secretary of the State. | e |
| S corporations (Qualified subchapter S subsidiaries (QSSS) are not liable for the business entity tax.); Limited liability companies (LLCs or SMLLCs) — any limited liability company that is, for federal income tax purposes, either: Treated as a partnership if it has two or more members; or Disregarded as an entity separate from its owner if it has a single member; Limited liability partnerships (LLPs); and Limited partnership (LPs). | |
| Are you a business entity as described above? I Yes No Enter state you are organized under: | |
| If not organized in Connecticut, enter the earlier of the date you started business in | |
| Connecticut or the date you registered with the Connecticut Secretary of the State | |
| | _ |
| Corporation and Unrelated Business Income Taxes Corporation Business Tax Do not complete this section if the entity is liable for the business entity tax. | |
| Are you a corporation? | |
| Are you an LLC, SMLLC, or other association taxed as a corporation? | |
| Is this corporation exempt from federal income tax? | |
| Have you received a determination from the Internal Revenue Services (IRS) that this | |
| corporation is exempt from federal income tax? | |
| If Yes , enclose a copy of your IRS letter of determination. | |
| Enter state you are organized under: Enter date of organization. | |
| If not a Connecticut corporation, enter the earlier of the date you started business in Connecticut or the date you registered with the Connecticut Secretary of the State | |
| Unrelated Business Income Tax | |
| Are you a federally exempt organization that has unrelated business income | |
| If you answered Yes, enter the date the unrelated business income tax liability started | |
| Passive Investment Company (PIC) Is this corporation a passive investment company as defined in Conn. Gen. Stat.§12-213(a)(27)? | |
| Enter the date the PIC was organized. | |
| Enter Connecticut tax registration number of the PIC's related financial service or insurance company: | |

| 12. | Business Use Tax | | | | | | | | | | |
|-----|--|--|--|--|--|--|--|--|--|--|--|
| | If you are registered for or are registering for sales and use taxes, you do not need to complete this section. | | | | | | | | | | |
| | Business use tax is due when a business purchases taxable goods or services including the purchase or lease of assets, consumable goods, and promotional items, for use in Connecticut without paying Connecticut sales tax. | | | | | | | | | | |
| | Will you be purchasing taxable goods or services for use in Connecticut without paying Connecticut sales tax? | | | | | | | | | | |
| | If you answered Yes to the business use tax question, enter the tax liability start date | | | | | | | | | | |
| | If you answered No , you must complete the <i>Business Use Tax Declaration</i> section below. | m m d d y y | | | | | | | | | |
| | Business Use Tax Declaration: By registering for any of the taxes listed in this application, the Department of Revenue Services (DRS) that you may have a business use tax liability. The application, you will be automatically registered for the business use tax unless you complete the | erefore, based on your | | | | | | | | | |
| | I,(name of taxpayer or authoriz taxpayer), acknowledge I have read and understand the information concerning the business us not be liable for business use tax. Please initial here | zed representative of se tax and declare I will | | | | | | | | | |
| 13. | Registration Fee Schedule | · · · · · · · · · · · · · · · · · · · | | | | | | | | | |
| | Enter the registration fee amount indicated. If you are liable for either sales and use taxes or ro both, as indicated in Sections 8 or 9, you must pay a \$100 registration fee. Enter the appropriate in Addendum A if you are registering for the cigarette tax. You must include the total registration fee or your registration application will not be processed and will be returned. Make your check payable to: Commissioner of Revenue Services . If you register by mail, send payment to: Department of Revenue Services, PO Box 2937, Hartford CT 06104-2937 | registration fee(s) from due with Form REG-1 | | | | | | | | | |
| | | Registration Fee | | | | | | | | | |
| a | If registering for sales and use taxes or room occupancy tax, enter \$100.* | а. | | | | | | | | | |
| b. | If registering for cigarette tax, see Addendum A. | b. | | | | | | | | | |
| C. | Total registration fee due: Add Line a and Line b. | C. | | | | | | | | | |
| , | No fee is required for room occupancy tax if you are registered or are registering for sales and | use taxes. | | | | | | | | | |
| 14. | All Applicants Must Sign the Following Declaration I declare under penalty of law that I have examined this application and, to the best of my knowle complete, and correct. I understand the penalty for willfully delivering a false application to DRS i \$5,000, or imprisonment for not more than five years, or both. | edge and belief, it is true, is a fine of not more than | | | | | | | | | |
| and | n here Signature of owner, partner, LLC member, or corporate officer Date Telephone r | number | | | | | | | | | |
| | Print name of owner, partner, LLC member, or corporate officer Title | | | | | | | | | | |
| L | | | | | | | | | | | |

COMMISSION ON HUMAN RIGHTS AND OPPORTUNITIES CONTRACT COMPLIANCE REGULATIONS NOTIFICATION TO BIDDERS

AFFIRMATIVE ACTION COMPLIANCE AFFIDAVIT

The contract to be awarded is subject to contract compliance requirements mandated by Sections 4a-60 and 4a-60a of the Connecticut General Statutes; and, when the awarding agency is the State, Sections 46a-71(d) and 46a-81i(d) of the Connecticut General Statutes. There are Contract Compliance Regulations codified at Section 46a-68j-21 through 43 of the Regulations of Connecticut State Agencies, which establish a procedure for awarding all contracts covered by Sections 4a-60 and 46a-71(d) of the Connecticut General Statutes.

According to Section 46a-68j-30(9) of the Contract Compliance Regulations, every agency awarding a contract subject to the contract compliance requirements has an obligation to "aggressively solicit the participation of legitimate minority business enterprises as bidders, contractors, subcontractors and suppliers of materials." "Minority business enterprise" is defined in Section 4a-60 of the Connecticut General Statutes as a business wherein fifty-one percent or more of the capital stock, or assets belong to a person or persons: "(1) Who are active in the daily affairs of the enterprise; (2) who have the power to direct the management and policies of the enterprise; and (3) who are members of a minority, as such term is defined in subsection (a) of Section 32-9n." "Minority" groups are defined in Section 32-9n of the Connecticut General Statutes as "(1) Black Americans . . . (2) Hispanic Americans . . . (3) persons who have origins in the Iberian Peninsula . . . (4) Women . . . (5) Asian Pacific Americans and Pacific Islanders; (6) American Indians" An individual with a disability is also a minority business enterprise as provided by Section 4a-60g of the Connecticut General Statutes. The above definitions apply to the contract compliance requirements by virtue of Section 46a-68j-21(11) of the Contract Compliance Regulations.

he awarding agency will consider the following factors when reviewing the bidder's qualifications under the contract compliance requirements:

- (a) the bidder's success in implementing an affirmative action plan;
- (b) the bidder's success in developing an apprenticeship program complying with Sections 46a-68-1 to 46a-68-17 of the Administrative Regulations of Connecticut State Agencies, inclusive;
- (c) the bidder's promise to develop and implement a successful affirmative action plan;
- (d) the bidder's submission of employment statistics contained in the "Employment Information Form", indicating that the composition of its workforce is at or near parity when compared to the racial and sexual composition of the workforce in the relevant labor market area; and
- (e) the bidder's promise to set aside a portion of the contract for legitimate minority business enterprises. See Section 46a-68j-30(10)(E) of the Contract Compliance Regulations.
- *INSTRUCTIONS: Bidder must sign acknowledgement below and return acknowledgement to Awarding Agency along with bid proposal.

The undersigned acknowledges receiving and reading a copy of the "Notification to Bidders" form.

Signature

Date

 \neg u behalf of:

CONNECTICUT COMMISSION ON HUMAN RIGHTS & OPPORTUNITIES CONTRACT COMPLIANCE REGULATIONS AND NOTIFICATION TO BIDDERS Sections 462-68j-23 (1)-(10) and 46a-68j-24 (a)

<u>CONTRACT COMPLIANCE</u> Sec. 46a-68i-23. Obligations of Contractors:

Every contractor awarded a contract subject to contract compliance requirement shall:

- 1) Comply fully with all federal and state anti-discrimination laws, and shall not discriminate or permit a discriminatory practice to be committed;
- 2) Cooperate fully with the commission;
- 3) Submit periodic reports of its employment and subcontracting practices in such a form, in such a manner and at such a time as may be prescribed by the Commission;
- 4) Provide reasonable technical assistance and training to minority business enterprises to promote the participation of such concerns in state contracts and subcontracts;
- 5) Make a good faith effort, based upon the availability of minority business enterprises in the labor market area, to award a reasonable proportion of all subcontractors to such enterprises;
- 6) Maintain full and accurate support data for a period of two (2) years from the date the record is made or the date the contract compliance form is submitted, whichever is later, provided that this provision shall not excuse compliance with any other applicable record retention, state regulation or policy providing for a period of retention in excess of two (2) years;
- 7) Not discharge, discipline or otherwise discriminate against any person who has filed a complaint, testified or assisted in any proceeding with the commission;
- 8) Make available for inspection and copying any support data requested by the commission, and make available for interview any agent, servant or employee having knowledge of any matter concerning the investigation of a discriminatory practice complaint or any matter related to a contract compliance review;
- 9) Include a provision in all subcontracts with minority enterprises requiring that the minority business enterprise provide the Commission with such information on its structure and operations as the Commission finds necessary to make an informed determination as to whether the standards of Section 4a-60 of the Connecticut General Statutes as amended by Sec. 2 of Public Act 89-253 have been met; and
- 10) Undertake such other reasonable activities or efforts as the Commission may prescribe to ensure the participation of minority business enterprises as state contractors and subcontractors.

Sec 46a-68i-24. Utilization of Minority Business Enterprises:

a) Contractors shall make good faith efforts to employ minority business enterprises as subcontractors and suppliers of materials on all projects subject to contract compliance requirements.

CONNECTICUT COMMISSION ON HUMAN RIGHTS AND OPPORTUNITIES WORKFORCE ANALYSIS

| Contractor Name: | |
|------------------|------|
| Address: | |

| Total number | of CT employees: |
|--------------|------------------|
| Full-time | Part time |

| Complete the following Analysis for employees of Connecticut work sites who are: | | | | | | | | | | | | | |
|--|--|--------------------|------------------------|-----------------|--------------------------------|---------|-------------|----------|-------------------------|-------------|--------------------------------|------|------------------------|
| JOB CATEGORIES | OVERALL TOTALS (SUM OF ALL COLS MALE & FEMALE) | (NO HISI ORI | LITE PANIC IGIN) | (N HIS OI | ACK ot of Panic NGIN) | HIS | PANIC | PA | IN OR LIFIC INDER | INDI ALA | RICAN AN OR SKAN TIVE | W | ople ITH ILITIES |
| | | MALE | FEMALE | MALE | FEMALE | MALE | FEMALE | MALE | FEMALE | MALE | FEMALE | MALE | FEMALE |
| OFFICIALS & MANAGERS | | | | | | | | | | | | | |
| PROFESSIONALS | | | | | | | | | | | | | |
| TECHNICIANS | | | | | | | | | : | | | | |
| PARAPROFESSIONAL | | | | | | | | | | | | | |
| SALES WORKER | | | | | | | | | | | | | |
| OFFICE & CLERICAL | | | | | | | | | | | | | |
| CRAFT WORKERS (Skilled) | | | | | | | | | | | | | |
| OPERATIVES (Semi-skilled) | | | | | | · | | | | | | | |
| LABORERS (unskilled) | | | | | | | | | | | | | |
| SERVICE WORKERS | | | | | | | | | | | | | |
| TOTALS ABOVE | | | | | | | • . | | | | | | |
| TOTALS ONE YEAR AGD | | | | | | | | | | | | | |
| | FORMAL, O | N - THE | E JOB TI | AINE | ES (Enter | figures | for the sar | ne categ | ories as a | re show | 'n above). | | |
| Apprentices | | | | | | | | | | | | | |
| Trainees | | | | | | | | | | | | | |
| EMPLOYMENT FIGU | RES WERE OBT | AINED FR | OM VIS | UAL CH | ECK. | EMPLOY | MENT REC | ORDS: | . ОТ | HER: | | , | · |
| 1. Have you suc | cessfully im | lemente | ed an Afi | firmativ | ve Action | Plan? | Yes: | Date o | f implem | entatio | n | | |
| | 1. Have you successfully implemented an Affirmative Action Plan? Yes: Date of implementation Not Applicable: Explain: | | | | | | | | | | | | |

(a) Please submit a summary of your Affirmative Action Plan.

2. Have you successfully developed an apprenticeship program complying with Sec. 46a-68-17 of the Connecticut Department of Labor Regulations, inclusive? Yes: <u>No:</u> Not Applicable: <u>Explanation</u>:

3. According to EEO-1 data, is the composition of your workforce at or near parity when compared with the race and gender composition of the workforce in the relevant labor market area? Yes: ____ No: ____ Explanation:

If you plan to subcontract, will you set aside a portion of the contract for legitimate minority business enterprises?
 Yes: _____ No: ____ Explanation:

Contractor's Authorized Signature

Date

DEFINITIONS FOR WORKFORCE ANALYSIS

RACE/ETHNIC IDENTIFICATION:

You may acquire the race/ethnic information necessary for this report either by visual surveys of the Workforce, or from records as to the identity of employees after the starting date of employment.

Please note that conducting a visual survey and keeping records of the race/ethnic identity of employees is legal in all jurisdictions and under all Federal and State Laws.

Race/ethnic designations as used by the Equal Employment Opportunity Commission do not denote scientific definitions of anthropological origins. For the purpose of this report, an employee may be included in the group to which he or she appears to belong, identifies with, or is regarded in the community as belonging. However, no person should be counted in more than one race/ethnic group.

DESCRIPTION OF JOB CATEGORIES:

<u>Officials and managers</u>: Occupations requiring administrative managerial personnel who set broad policies, exercise overall responsibility for execution of these policies, and direct individual departments or special phases of a firm's operations. <u>Includes</u>: officials, executives, middle management, plan managers, department managers, and superintendents, salaried supervisors who are members of management, purchasing agents and buyers, railroad conductors and yard masters, ship captains, mates and other officers, farm operators and managers, and kindred workers.

(

<u>Professionals</u>: Occupations requiring either college graduation or experience of such kind and amount as to provide a comparable background. <u>Includes</u>: accountants and auditors, airplane pilots, and navigators, architects, artists, chemists, designers, dietitians, editors, engineers, lawyers, librarians, mathematicians, natural scientists, registered professional nurses, personnel and labor relations specialists, physical scientists, physicians, social scientists, teachers, and kindred workers.

<u>Technicians</u>: Occupations requiring a combination of basic scientific knowledge and manual skill which can be obtained through two (2) years of post-high school education, such as is offered in many technical institutes and junior colleges, or through equivalent on-the-job training. <u>Includes</u>: computer programmers, drafters, engineering aides, junior engineers, mathematical aides, licensed practical or vocational nurses, photographers, radio operators, scientific assistants, surveyors, technical illustrators, technicians (medical, dental, electronic, physical science), and kindred workers.

Sales: Occupations engaging wholly or primarily in direct selling. Includes kindred workers.

Office and clerical: All clerical type work regardless of level of difficulty. Includes kindred workers.

<u>Craft Workers</u>: (skilled) - Manual workers of relatively high skill level having a thorough comprehensive knowledge of the processes involved in their work. Exercise considerable independent judgment and usually receive an extensive period of training. <u>Includes kindred</u> workers.

Operatives: (semiskilled) - Workers who operate machine or processing equipment or perform other factory-type duties of intermediate skill level which can be mastered in a few weeks and require only limited training. Includes kindred workers.

Laborers: (unskilled) - Workers in manual occupations which generally require no special training, perform elementary duties that may be learned in a few days and require the application of little or no independent judgment. Includes kindred workers.

On-the job trainees:

Production: Persons engaged in formal training as a craft worker - when not trained under apprentice programs - operative, laborer and service occupations.

White collar: Persons engaged in formal training for clerical, managerial, professional, technical, sales office and clerical occupations.

CONTRACTOR'S MINORITY BUSINESS ENTERPRISES

UTILIZATION FORM

f

(.

| NAME AND ADDRESS OF AWARDING AGENCY: | NAME AND ADDRESS OF CONTR | ACTOR |
|---|--|--|
| | | |
| | | |
| | * | ·· · |
| | | |
| | | |
| PROJECT NO: | | a. |
| DATE AWARDED: | | |
| DATE BID OPENED | | 3 00.° |
| NOTICE TO CONTRACTORS: Under Section 46a-68J-23(5) of the C | antract Commission Permittions entracted | : |
| FALLH EFFORIS to employ Minority Business Enterprises (MBEs) as sul | contractors and suppliers of materials on a | Il projecto mibient |
| to contract compliance requirements. The contract which is referenced abo | | |
| INSTRUCTIONS: List the name and addresses of all MBEs you have sel the MBEs selected as subcontractors and suppliers of materials meet the cri | ected as subcontractors and suppliers of m | aterials for this project. If |
| contractors MUST complete the attached affidavit. If such business are not | currently registered with the Department of | FECODOMIC Development and if |
| an unregistered MBE in the evaluation of the contractor's good faith effe | (CHRO) to consider favorably the selection rts. contractors MUST committee the attack | D of |
| and davit must be niled out in triplicate, with the original sent to the CHRO | Contract Compliance Unit 21 Grand Stre | of Hartford Connections OCIDC. |
| one copy sent to the Awarding Agency; and one copy retained by contractor | . If the contractor opes not wish the CHRC | to consider selection of an |
| unregistered MBE in its evaluation of the contractor's good faith efforts, no | affidavit need be made. | |
| | | |
| Unregistered MBE in its evaluation of the contractor's good faith efforts, no (Attached additional pages if no | | |
| (Attached additional pages if ne NAME AND ADDRESS OF ALL MBE SUBCONTRACTOR(S) OR | ccessary, using same headings.) Check here if MBE(s) | Check here if MBE is |
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This form developed pursuant to Section 46a-68j-23(5) of Regulations of Connecticut state Agencies concerning Contract Compliance.

AFFIDAVIT

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| I further certify and affirm that I have | ve read and understand the contract compliance requirements cod |
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| I understand that false statements made | Ade herein are punishable by law. (Name of Corporation or Firm) (Signature and Title of Official Making the Affidavit) day of 19 |

CERTIFICATE OF CORPORATION

I, ______ certify that I am the Secretary of the Corporation named in the foregoing instrument; that I have been duly authorized to affix the seal of the Corporation to such papers as require the seal; that ______, who signed said instrument on behalf of the Corporation was then _______ of said Corporation; that said instrument was duly signed for and in behalf of said Corporation by authority of its governing body and is within the scope of its Corporation powers.

(Signature of person Certifying)

(Corporate Seal)

SAMPLE: (You may use this as an example or you may use it as your statement by placing it on your letterhead).

AFFIRMATIVE ACTION POLICY STATEMENT

will continue to take affirmative action to ensure that no persons are discriminated against with regard to their race, color, sex, sexual orientation, national origin, ancestry, religion, age, physical disability, mental retardation, marital status, present or past history of mental disorder, learning disability or criminal record. Such action includes, but is not limited to, employment, upgrading, demotion or transfer; recruitment or recruitment advertising; layoff or termination; rates of pay or other forms of compensation and selection for training including apprenticeship. _______will continue to make good faith efforts to comply with all federal and state laws and policies which speak to Equal Employment Opportunity and Affirmative Action.

Equal Employment Opportunity is essential, but is not enough to guarantee the full and fair employment of minorities, women or other protected classes. Therefore, Affirmative Action is necessary. Affirmative Action is results - oriented programs used to address and overcome the present effects of past discrimination.

Sexual Harassment, another form of sex discrimination, will not be tolerated in the work place. Therefore, engaging in acts of sexual harassment or any other forms of unlawful discrimination will constitute grounds for disciplinary action.

This Policy Statement is based on both the spirit and the letter of state and federal anti discrimination laws, regulations and executive orders. Accordingly, care is taken to ensure that no person shall be excluded from participation in, be denied the benefits of, or otherwise be unlawfully discriminated against. Further,

with any business, contractor, subcontractor or agency that engages in acts of unlawful discrimination.

This Affirmative Action Policy Statement reaffirms my personal commitment to the principles of Equal Employment Opportunity and Affirmative Action.

SIGNATURE

SUPPLEMENTARY CONDITIONS

PART 1 GENERAL

1.1 SUMMARY

- A. These Supplementary Conditions amend and supplement the Agreement and other provisions of the Contract Documents as indicated below. All provisions that are not so amended or supplemented remain in full force and effect.
- B. The terms used in these Supplementary Conditions that are defined in the Agreement Information for Bidders, have the meanings assigned to them in the Agreement.

1.2 RELATED SECTIONS

A. Section 01 1000 - Summary of Contract for additional definitions.

1.3 MODIFICATIONS TO INFORMATION TO BIDDERS PART 2

A. Insurance Procedure - Insurance Requirements, Par G: Certificate Holder: Add the following: "Fuller and D'Angelo, P.C. Architects and Planners and their Consultants. Add to aall applicable insurance polices"

1.4 MODIFICATIONS TO THE AGREEMENT

- A. Article 1 Definitions
 - 1. Add "Supplements to Bid Form" to list of documents which constitute the "Contract"
- B. Article 20 Permits
 - 1. Delete and substitute the following:

"Permits: The Owner will obtain and pay for all permits required for this project. Contractor shall provide all insurance certificates to local officials, as required, to activate the permits."

- C. Article 27 Moneys May Be Retained
 - 1. Add the following: Refer to Section 01 2000 Price and Payment Procedures for retainage and other additional requirements."
- D. Article 27
 - 1. Extra Work, Add at the end of the Paragraph, "that no Extra Work, in the form of Change Order Work to the project is to take place without formal written consent from the Owner. The Contractor at the Owners request is to expeditiously obtain pricing both labor and materials and OH+P for the full total amount of additional work and present same to the Owner and Construction Manager for review and approvals of the work prior to executing the work except in the case of emergency as decided by the Contractor, Owner and Construction Management Team. All standard Extra Work performed shall started only after written approval of the formal Change Order by the Owner. Extra Work performed by the Contractor prior to written consent is subject to not being fully and or partially reimbursed to the Contractor if approvals are not acquired prior to performing the work."
- E. Add New Article
 - 1. "Article 37 Sub-contractor/Vendor Town Review and Approval: The Contractor Prior to awarding a subcontractor or making purchases from a vendor who will be performing the work requires to have their credentials produced for the Town's review.
- F. Add New Article 38

"Abandonment of Work or other Default: If the work shall be abandoned, or any part thereof shall be sublet without previous written consent of the Town/Board of Education, or the contract or any monies payable hereunder shall be assigned otherwise than as herein specified, or if at any time the Superintendent or designee shall be of the opinion and shall so certify in writing, that the conditions herein specified as to rate of progress are not being complied with, or that the work or any part thereof is being unnecessarily or unreasonably delayed, or that the Contractor has violated

GREENWICH PUBLIC SCHOOLS GREENWICH HIGH SCHOOL LOCKER ROOM RENOVATIONS PHASE II SUPPLEMENTARY CONDITIONS

or is in default under any of the provisions of the contract, or if the Contractor becomes bankrupt or insolvent or goes or is put into liquidation or dissolution, either voluntarily or involuntarily, or petitions for an arrangement or reorganization under the bankruptcy act, or makes a general assignment for the benefit of creditors or otherwise acknowledges insolvency, the happening of any of which shall be and constitute a default under the contract, the Town/Board of Education may designate, and the Town/Board of Education may, upon giving such notice, by contract or otherwise as it may determine, complete the work of such part thereof and charge the entire cost and expense of so completing the work, the Town/Board of Education shall be entitled to reimbursement from the Contractor and the Contractor agrees to pay to the Town/Board of Education any losses, damages, costs and expenses, including attorney's fees, sustained or incurred by the Town/Board of Education by reason of any of the foregoing causes. For the purpose of such completion, the Town/Board of Education may for itself or for any Contractors employed by the Town/Board of Education, take possession of and use or cause to be used, any and all materials, equipment, plant, machinery, appliances, tools, supplies and such other items of every description that may be found or located at the site of the work.

All costs, expenses, losses, damages, attorney's fees, and any and all other charges incurred by the Town/Board of Education under this deducted and/or paid by the Town/Board of Education out of any monies due or article shall be charged against the Contractor and deducted and/or paid by the Town/Board of Education out of any monies due to payable or to become due or payable under the Contract to the Contractor. In computing the amounts chargeable to the Contractor, the Town/Board of Education shall not be held to a basis of the lowest prices for which the completion of the work or any part thereof might have been accomplished, but all sums actually paid or obligated therefore to effect is prompt completion shall be charged to and against the account of the Contractor. In case the costs, expenses, losses, damages, attorneys' fees and other charges together with all payments therefore made to and for the account of the Contractor are less than the sum which would have been payable under the Contract if the work had been properly performed and completed by the Contractor, the Contractor shall be entitled to receive the difference, and in case such costs, expenses, losses, damages, attorneys' fees and other charges, together with all payments, theretofore made to or for the account of the Contractor shall exceed the said sum, the Contractor shall pay the amount of the excess to the Town/Board of Education.

PART 2 PRODUCTS - NOT USED PART 3 EXECUTION - NOT USED

SUMMARY OF CONTRACT

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 PROJECT

| A. | Owner's Name: | Greenwich Public Schools |
|----|---------------|--------------------------|
| | | 290 Greewnich Avenue |

Greenwich CT 06830

 B. Architect's Name: Fuller and D'Angelo, P.C.
 45 Knollwood Road Elmsford, NY 10523

1.3 PROJECT DESCRIPTION

A. The Project consists of the alteration of Locker Room Renovations - Phase II, Greenwich High School, 10 Hillside Road, Greenwich, Ct 06830.

1.4 **DEFINITIONS**

- A. General: Refer to Agreement for additional Basic Contract definitions.
- B. Owner: The term "Owner shall mean Greenwich Public Schools and their duly authorized representative.
- C. The word "Owner" and the words "School Board", "City School District", "Board of Education", "Union Free School District", "Central School District", "Town/School Board" etc., shall have the same meaning.
- D. Architect: The term "Architect" or "Engineer" or the words "Architect/Engineer" shall mean the Professional Engineer/Architect responsible for the contract documents Fuller & D'Angelo, P.C. Architects & Planners 45 Knollwood Road, Elmsford, N.Y. 10523.
- E. Owner's Representative: The term Owner's Representative shall mean Ron Matten, Director of Facilities.
- F. Contractor for Construction: The term "Contractor for Construction", "General Contractor", "Mechanical Contractor", "Contractor for General Work", "Construction Contractor", "Plumbing Contractor", "Electrical Contractor", and "Roofing Contractor' shall have the same meaning.
- G. "Approved": The term "approved," when used in conjunction with Architect's action on Contractor's submittals, applications, and requests, is limited to Architect's duties and responsibilities as stated in the Section 01 3000 Administrative Requirements.
- H. "Directed": Terms such as "directed," "requested," "authorized," "selected," "approved," "required," and "permitted" mean directed or requested by Contracting Officer or Agency, and similar phrases.
- I. "Indicated": The term "indicated" refers to graphic representations, notes, or schedules on Drawings; or to other paragraphs or schedules in Specifications and similar requirements in the Contract Documents. Terms such as "shown," "noted," "scheduled," and "specified" are used to help the user locate the reference.
- J. "Regulations": The term "regulations" includes laws, ordinances, statutes, and lawful orders issued by authorities having jurisdiction, as well as rules, conventions, and agreements within the construction industry that control performance of the Work.
- K. "Furnish": The term "furnish" means to supply and deliver to Project site, ready for unloading, unpacking, assembly, installation, and similar operations.
- L. "Install": The term "install" describes operations at Project site including unloading, temporary storage, unpacking, assembling, erecting, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning, and similar operations.

- M. "Provide": The term "provide" means to furnish and install, complete and ready for the intended use.
- N. "Installer": An installer is Contractor or another entity engaged by Contractor, as an employee, subcontractor, or contractor of lower tier, to perform a particular construction operation, including installation, erection, application, and similar operations.
- O. The term "experienced," when used with the term "installer," means having successfully completed a minimum of five previous projects similar in size and scope to this Project; being familiar with the special requirements indicated; and having complied with requirements of authorities having jurisdiction.
 - 1. Using a term such as "carpentry" does not imply that certain construction activities must be performed by accredited or unionized individuals of a corresponding generic name, such as "carpenter." It also does not imply that requirements specified apply exclusively to trades people of the corresponding generic name.
- P. "Project site" is the space available for performing construction activities, either exclusively or in conjunction with others performing other work as part of Project. The extent of Project site is shown on the Drawings and may or may not be identical with the description of the land on which Project is to be built.
- Q. The term "Building Code" shall mean the Building Code of the State of Connecticut including all amendments and reference standards to date.
- R. "Work" Labor, materials, equipment, apparatus, controls, accessories, and all other items customarily furnished and/or required for proper and complete disconnection and reconnection, installation of new work.
- S. "Wiring" Conduit, fittings, wire, junction and outlet boxes, switches, cutouts, and receptacles and all items necessary or required in connection with or relating to such wiring.
- T. "Concealed" Embedded in masonry or other construction, installed behind wall furring, within double partitions, or hung ceilings, in trenches, or in crawl spaces.
- U. "Exposed" Not installed underground or "Concealed" as defined above.

1.5 CONTRACT DESCRIPTION

- A. Contract Type: A single prime contract based on a Stipulated Price as described in the Form of Agreement including asbestos/Lead Abatement.
- B. Local custom and trade-union jurisdictional settlements do not control the scope of Work included in each prime contract. When a potential jurisdictional dispute or similar interruption of work is first identified or threatened, the affected prime contracts shall promptly negotiate a reasonable settlement to avoid or minimize the pending interruption and delays.
- C. Liquidated Damages See 01 1000 Article 1.13.

1.6 SUBCONTRACTORS/SUPPLIERS

- A. Submittal of Primary Sub Contractors and Suppliers include but not limited to the following:
- B. General Contractor:
 - 1. Asbestos/Lead.
 - 2. Removals
 - 3. Interior Excavation
 - 4. Concrete
 - 5. Louvers
 - 6. Masonry.
 - 7. Doors and Frames
 - 8. Steel Doors and Frames.
 - 9. Hardware Supplier and Installer.
 - 10. Gypsum Wallboard Assemblies

GREENWICH PUBLIC SCHOOLS GREENWICH HIGH SCHOOL LOCKER ROOM RENOVATIONS PHASE II SUMMARY OF CONTRACT

- 11. Acoustical Tile/ Grid
- 12. Ceramic Tile.
- 13. Casework modifications and relocations.
- 14. Cutting and Patching
- 15. Painting and special floor coatings.
- 16. Plumbing Sub-Contractor
 - a. Plumbing Work and Fixture Supplier.
 - b. Plumbing equipment/Suppliers.
- 17. Mechanical Sub-Contractor
 - a. HVAC Units
- 18. Controls
- 19. BMS
- C. Electrical Sub-Contractor
 - 1. Electrical Work and Supplier
 - 2. Switchboard/Panelboards.
- D. Fire Alarm Sub Contractor

1.7 DESCRIPTION OF ALTERATIONS WORK

- A. Scope of selective removal work is shown on drawings and is specified .
- B. Scope of alterations and new walls are shown on drawings.
- C. Renovate the following rooms and spaces, complete including operational mechanical and electrical work and finishes:
- D. Fire Suppression Sprinklers: Alter existing systems, keep operational as best as possible for changes in shortest timeline for work, notify Owner of any days system will not be operational. Fire Marshall to be contacted to de-energize/ re-enegize system.
- E. Fire Alarm: Alter existing system and add new construction, keeping existing in operation.
- F. Telephone: Alter existing system and add new construction, keeping existing in operation.
- G. Security System: Alter existing system and add new construction, keeping existing in operation.

1.8 WORK BY OWNER

A. Greenwich Public Schools will remove and re-install all loose equipment, furniture, etc. Contractor shall provide minimum 4 mil plastic covering over fixed furniture, casework, etc.

1.9 WORK SCHEDULE

- A. Project is designed for opening the Locker Rooms by September 1, with a CO from the Town in place. Alternate Areas of work also require to be opened by this date. . -
- B. Provide 2 days for future installation of furnishings. Alternate areas that are affected.

1.10 OWNER OCCUPANCY

- Greenwich Public Schools intends to occupy the Project upon Substantial Completion. The construction completion date is for Locker Rooms/ Team Rooms by September 1, 2019. Close-out documents due by October 30, 2019
- B. Cooperate with Greenwich Public Schools to minimize conflict and to facilitate Greenwich Public Schools's operations. Coordinate any shut downs with the District Five (5) days in advance, no shut downs will be permitted without prior authorization.
- C. Schedule the Work to accommodate Owner's occupancy.

1.11 CONTRACTOR USE OF SITE AND PREMISES

A. Construction Operations: Limited to areas noted on Drawings.

- B. Arrange use of site and premises to allow:
 - 1. Greenwich Public Schools occupancy.
 - 2. Use of site and premises by the public.
- C. Provide access to and from site as required by law and by Greenwich Public Schools:
 - 1. Emergency Building Exits During Construction: Keep all exits required by code open during construction period; provide temporary exit signs if exit routes are temporarily altered.
 - 2. Do not obstruct roadways, sidewalks, or other public ways without Owner permission and coordination.
- D. Time Restrictions:
 - 1. Limit conduct of especially noisy exterior work to when the building is unoccupied.
 - 2. Contractors shall comply with Local Noise Ordinance. Work disrupting the community must be performed with the following hours:
 - a. Monday thru Friday: 8 AM to 8 PM.
 - b. Saturdays: 9 AM to 6 PM
 - c. Sundays: No Work on the Exterior
- E. Construction deliveries shall not occur during the hours of 7:30 AM and 9:00 AM and 2:00 PM and 3:00 PM, when school buses are arriving or leaving the school grounds, or for Summer events.
- F. Only materials and equipment, which are to be used directly in the work, shall be brought to and stored on the project site by the Contractor. After equipment is no longer required for the work, it shall be promptly removed from the project site. Protection of construction materials and equipment stored at the project site from weather, theft, damage and all other adversity is solely the responsibility of the Contractors.
- G. Contractor shall ensure that the work, at all times, is performed in a manner that affords reasonable access, both vehicular and pedestrian, to the site of the work and all adjacent areas. The work shall be performed, to the fullest extent reasonably possible, in such a manner that public areas adjacent to the site of the work shall be free from all debris, building materials and equipment likely to cause hazardous conditions. Without limitation of any other provision of the Contract Documents, the contractor shall use its best efforts to minimize any interference with the occupancy or beneficial use of:
 - 1. Any areas and buildings adjacent to the site of the work or;
 - 2. The Building in the event of partial occupancy as more..
- H. Without prior approval of the Owner, the Contractor shall not permit any workers to use any existing facilities at the Project site, including, without limitations, lavatories, toilets, entrances and parking areas other than those designated by the Owner. Without limitation of any other provision of the Contract Documents, the Contractor shall use its best efforts to comply with the rules and regulations promulgated by the Owner in connection with the use and occupancy of the Project Site, and the Building, as amended from time to time. The Contractor shall immediately notify the Owner in writing if during the performance of the Work, the Contractor finds compliance with any portion of such rules and regulations to be impracticable, setting forth the problems of such compliance and suggesting alternatives through which the same results intended by such portions of the rules and regulations can be achieved. The Owner may, in the Owner's sole discretion, adopt such suggestions, develop new alternatives or require compliance with the existing requirements of the rules and regulations. The Contractor shall also comply with all insurance requirements, applicable to use, and occupancy of the Project Site and the Building.
- I. Schedule deliveries to minimize space and time requirements for storage of materials and equipment on-site.
- J. Lock automotive type vehicles such as passenger cars and trucks and other types of mechanized and motorized construction equipment, when parked and unattended, to prevent unauthorized use. Do not leave such vehicles or equipment unattended with the motor running or the ignition key in place.
- K. Keep public areas such as hallways, stairs, elevator lobbies and toilet rooms free from accumulation of waste material, rubbish or construction debris.

L. Smoking, drinking of alcoholic beverages or open fires will not be permitted on the project site.

1.12 AVAILABILITY OF EXISTING SITE

- A. The existing building and site work areas for Base Bid and Alternate Work will be available to the Contractors as follows:
 - 1. While school is in session work is permitted:
 - a. 7:00AM thru 10:00 PM (However disruption to the educational system will not be permitted.) Close coordination with the Owner shall be required.
 - b. All work spaces shall be required to be clean and ready for School children the next day.
 - 2. **While school is not in session** school holidays, summer school recess and weekends work hours Monday through Saturday are:
 - a. 7:00 AM thru 10:00 PM
- B. Upon request by the Contractor, the building may be made available, at the discretion of the Owner in addition to the above listed hours, before the formal contract date. A request for use during these off-regular hours must be made at least two (2) days before the use. Such off-hours may include Saturdays, and Holidays.
- C. If the Contractor requests the use of the facility for off-hours to maintain the scheduled completion date, the Contractor shall pay all additional costs in connection with opening, providing security and project management expenses incurred with no costs to the Owner. All expenses shall be deducted from the Contractors contract price. Comply with other portions of this Section.
 - 1. Weekend, Holiday and Night Work:
 - a. The contractor shall make no claim for delay for the inability of the Owner to make the site available for off-hours work. Should the Owner make the site available during these hours at the contractor's request, the cost will be borne by the Contractor.
- D. THE CONTRACTOR SHALL BE REQUIRED TO PERFORM SCHEDULED WORK WITHIN THE EXISTING BUILDING ONLY DURING THE TIME PERIODS INDICATED AND SHALL INCLUDE IN THE BID ALL COSTS FOR LABOR, MATERIAL, ETC. INCLUDING PREMIUM TIME TO PERFORM THE WORK, PER THE TIME PERIOD.

1.13 WORK SEQUENCE

- A. Letter of Award of Contract.
- B. Start of Construction:
 - 1. PHASE 1 Administrative
 - a. Start Date: Letter of Award
 - a) Tasks: Schedule of Values, Progress Schedule, Contracts, Bonds and Insurance, Field verification of existing conditions, and submittals, ordering of equipment.
 - b. Completion Date: July 5th, 2019
 - 2. PHASE 2 Construction:
 - a. Start Date: July 5, 2019.
 - a) Tasks: Removals and Installations of all work and selected alternates, if any.
 - b) Work phase for completion including punchlist
 - b. Completion Date: September 1, 2019
 - 3. PHASE 3 Project Close out/ paperwork
 - a. START DATE: September 1, 2019
 - b. COMPLETION DATE: October 15, 2019
- C. Project Completion Date: October 30, 2019
- D. See Milestone Schedule SECTION 01 1010 for further detail.
- E. Coordinate construction schedule and operations with Owner and Construction Manager.

1.14 CONTRACT NO. 1 - GENERAL CONSTRUCTION

- A. The work of the Contract includes but not limited to the following: Base Bid, Alternates, and Allowances
 - 1. All front end documentation, schedules, submittals, field measurements and preparation of shop drawings, followed by ordering of piping and equipment.
 - 2. Excavation for underslab piping.
 - 3. Scoping of work area
 - 4. Removals.
 - 5. Concrte slab repairs
 - 6. Ceramic tile.
 - 7. Msonry
 - 8. Ceilings
 - 9. Doors and Windows
 - 10. Epoxy floor coating system
 - 11. Light fixtures
 - 12. Plumbing fixtures.
 - 13. Mechanical Equipment
 - 14. Removal and reinstallation of fire alarm and security/exit devices.
 - 15. Sealants.
 - 16. Painting
 - 17. Cutting and Patching.
 - 18. Roof penetrations and portal installation (maintain roof warranty)
 - 19. Temporary Protection of openings and work areas .
 - 20. Provision of piping.
 - 21. Provision of close out documents, including but not limited to as-builts, operations manuals and warranty /guarantees.
 - 22. Maintenance Training.
 - 23. Provision of close out documents, including but not limited to as-builts, operations manuals and warranty /guarantees.

1.15 LIQUIDATED DAMAGES

A. Failure to meet the Schedule or Milestones shall have a \$500 per day penalty applied by the Owner. Should school start and work not be completed per the schedule, this amount increases to \$1000 per day.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

MILESTONE SCHEDULE

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 MILESTONE

A. The following milestone schedule serves as a basis for bidding. A schedule will be submitted as required in 01 3000 - Administrative Requirements The Ccontractor will coordinate activities, forward submittals, deliver materials and provide necessary manpower to meet the milestones listed below.

B. z MILESTONE SCHEDULE

- 1. Project Start Date:
 - a. Letter of Award
- 2. Contract Requirement Dates:
 - a. Contract returned to Greenwich Public Schools (10 working days after receiving agreement.)
- 3. Removal of Loose Furniture: (By District in Alternate Areas only)
 - a. Start Date: June 26, 2019
 - b. Completion: July 1, 2019
- 4. Construction of Accessways and related areas per documents
 - a. Start Date: July 5, 2019
 - b. Completion: September 1, 2018
- 5. Punch List for Item 1.2.B 4 work:
 - a. Start Date: August 26, 2019
 - b. Completion: August 31, 2019
- 6. Closeout Paperwork:
 - a. October 15, 2019
- 7. Work complete in accordance with the Contract Documents so that the Owner can occupy or use the Work or a portion thereof for its intended use. Any work beyond this date will be subject to Time Charge / Liquidated Damages beyond this date will be subject to Time Charge / Liquidated Damages (See Section 01 1000)
- 8. The Owner, Architect, and Construction Manager will make the determination whether the project is substantially complete.
- 9. Final Project Completion: October 30, 2019
 - a. ALL WORK must be checked, tested and fully operational, and punch list completed.
- 10. All work required by any of the Owner's representatives and consultants, including the Construction Manager, Architect, Architect's consultants, Owner's Attorneys, etc., to execute final close-out of contract after 60 days beyond Milestone dates if determined to be caused by contractor, shall result in payment(s) to the Owner's representatives and consultants, including the Construction Manager, Architect, Architect's consultants, Owner's Attorneys, etc., in the form of a change order deduct to the base contract.

PART 2 PRODUCTS (NOT APPLICABLE)

PART 3EXECUTION (NOT APPLICABLE)

PRICE AND PAYMENT PROCEDURES

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SECTION INCLUDES

- A. Procedures for preparation and submittal of applications for progress payments.
- B. Change procedures.
- C. Procedures for preparation and submittal of application for final payment.

1.3 RELATED REQUIREMENTS

A. Owner's Agreement and Front End documents.

1.4 SCHEDULE OF VALUES

- A. Form to be used: AIA G702/ AIA G703.
- B. Forms filled out by hand will not be accepted.
- C. Submit Schedule of Values in duplicate within 10 days after date Notice of Award.
- D. Format: Utilize the Table of Contents of this Project Manual. Identify each line item with number and title of the specification Section.
- E. Revise schedule to list approved Change Orders, with each Application For Payment.
- F. Provide a separate line item for the following: (where applicable)
 - 1. Labor and materials, when payment is anticipated for material not yet installed
 - 2. Each Allowance.
 - 3. Bonds, if required.
 - 4. Each alternates
 - 5. As-built Drawings.
 - 6. Testing.
 - 7. Punch List
 - 8. Final Cleaning
 - 9. Closeout Documents
 - 10. Identify line items being performed by subcontractors.

1.5 APPLICATIONS FOR PROGRESS PAYMENTS

- A. Payment Period: Submit no more that two (2) payment per month until scheduled completion date. After completion date one payment per month
- B. Forms filled out by hand will not be accepted.
- C. For each item, provide a column for listing each of the following:
 - 1. Item Number.
 - 2. Description of work.
 - 3. Scheduled Value.
 - 4. Previous Applications.
 - 5. Work in Place and Stored Materials under this Application.
 - 6. Total Completed and Stored to Date of Application.
 - 7. Percentage of Completion.
 - 8. Balance to Finish.
 - 9. Retainage.

- D. Execute certification by signature of authorized officer.
- E. Use data from approved Schedule of Values. Provide dollar value in each column for each line item for portion of work performed and for stored Products.
- F. List each authorized Change Order as a separate line item, listing Change Order number and dollar amount as for an original item of Work.
- G. Submit three copies of each Application for Payment.
- H. Include the following with the application:
 - 1. Transmittal letter as specified for Submittals in Section 01 3000.
 - 2. Construction progress schedule, revised and current as specified in Section 01 3000.
 - 3. Waivers of Mechanic's Lien: With each Application for Payment, submit waivers of mechanic's liens from contractor, subcontractors, sub-subcontractors, and suppliers for construction period covered by the previous application.
 - 4. Owner reserves the right to designate which entities involved in the Work must submit waivers.
 - 5. Submit Final Application for Payment with or preceded by final waivers from every entity involved with performance of the Work covered by the application who is lawfully entitled to a lien.
 - 6. Waiver Forms: Submit waivers of lien on forms, acceptable to Owner.
 - 7. Certified Payrolls; All Applications for Payment must be accompanied with certified payrolls for all Contract Work performed. In addition each contractor and sub-contractor shall submit to the Owner each application, a transcript of the original payroll record subscribed and affirmed as true under penalties of perjury. The Owners shall be required to receive and maintain such payroll records. The original payrolls or transcripts shall be preserved for three years from the completion of the work on the awarded project.
 - a. Submit certification that all personnel listed on certified payrolls have successfully completed an OSHA construction safety and health course of at least 10 hours prior to performing any work on the project.
- I. Project record documents as specified in Section 01 7800, shall be available for review by Greenwich Public Schools as a prerequisite for approval of payment.
- J. Affidavits attesting to off-site stored products.
- K. The Owner shall retain Five (5) percent of the amount of each payment.

1.6 INITIAL APPLICATION FOR PAYMENT:

- A. Administrative actions and submittals that must precede or coincide with submittal of first Application for Payment include the following:
 - 1. Names of full time project manager, on site superintendent, and foreman. Refer to the Agreement for addition requirements.
 - 2. List of subcontractors, suppliers and fabricators: Refer to Section 01100 Summary of Contract(s) .
 - 3. Schedule of Values.
 - 4. Contractor's Construction Schedule (preliminary if not final).
 - 5. Products list.

1.7 APPLICATION FOR PAYMENT AT SUBSTANTIAL COMPLETION

A. Refer to the Agreement and with Requirements of Section 01 7800 - Closeout Submittals.

1.8 MODIFICATION PROCEDURES

- A. Refer to the Agreement for requirements.
- B. The Contractor shall be responsible for informing others in it's employ, subcontractor's whose work is affected by any modifications.
- C. Computation of Change in Contract Amount:

- 1. Refer to the Agreement.
- D. Execution of Change Orders: The Owner will issue Change Orders for signatures of parties as provided in the Conditions of the Contract.
- E. After execution of Change Order, promptly revise Schedule of Values and Application for Payment forms to record each authorized Change Order as a separate line item and adjust the Contract Sum.
- F. Promptly revise progress schedules to reflect any change in Contract Time, revise sub-schedules to adjust times for other items of work affected by the change, and resubmit.
- G. Promptly enter changes in Project Record Documents.

1.9 APPLICATION FOR PAYMENT AFTER SCHEDULED COMPLETION DATE

- A. In the event the work is not completed by the schedule date, listed in Section 01 1000 Summary of Contract, and in addition to the other remedies described, the Architect will not review progress payment requisitions submitted after the construction completion date, and the District will not issue any progress payments after that date, until all work is completed.
 - 1. Only one requisition for work performed after the construction completion date may be submitted, and it may be submitted only when all work is complete and a Punch List inspection is conducted; said requisition may be submitted when the work at 100% complete, less 5% retainage.

1.10 APPLICATION FOR FINAL PAYMENT

- A. Submit Affidavit for Final Payment included in the Project Manual.
- B. Comply with Section 01 7800 Closeout Submittals
- C. It is understood by the Contractor that the maximum payment due the contractor prior to final payment shall be Ninety (95%) of the Contract amount and the final Five (5%) will be due only after the completion and submittal of all requirements of Section 01 7800 Closeout Submittals are met, including completion of all "punch list" items.

ALLOWANCES

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SECTION INCLUDES

- A. Cash allowances.
- B. Contingency allowance.
- C. Commissioning Allowance

1.3 RELATED REQUIREMENTS

A. Section 01 2000 - Price and Payment Procedures: Additional payment and modification procedures.

1.4 CASH ALLOWANCES

- A. Contractor's costs for products, delivery, installation, labor, insurance, payroll, taxes, bonding, equipment rental, overhead and profit will be included in Change Orders authorizing expenditure of funds from this Cash Allowance.
- B. Fuller and D'Angelo, P.C. Responsibilities:
 - 1. Consult with Architect, for consideration and selection of products, suppliers, and installers.
 - 2. Select products in consultation with Greenwich Public Schools and transmit decision to Contractor.
 - 3. Prepare Change Order.
- C. Contractor Responsibilities:
 - 1. Assist Fuller and D'Angelo, P.C. in selection of products, suppliers, and installers.
 - 2. Obtain proposals from suppliers and installers and offer recommendations.
 - 3. On notification of which products have been selected, execute purchase agreement with designated supplier and installer.
 - 4. Arrange for and process shop drawings, product data, and samples. Arrange for delivery.
 - 5. Promptly inspect products upon delivery for completeness, damage, and defects. Submit claims for transportation damage.
- D. Differences in costs will be adjusted by Change Order.

1.5 COMMISSIONING ALLOWANCE

A. Costs Included in the Commissioning Allowances: Cost of an Commissioning Agent selected by the Owner to perform commissioning of the CONDENSORS, FANS and BMS as directed by the AKF Group MEP Engineers.

1.6 ALLOWANCES SCHEDULE

- A. CONTRACT GENERAL CONTRACTOR
 - 1. CASH ALLOWANCE
 - a. Cash Allowance **GC-1**: Include an allowance of FortyThousand 00/100 (\$40,000.00) DOLLARS for use according to the Owner's instructions.
 - 2. COMMISIONING ALLOWANCE
 - a. Commissioning allowance **GC-2**: Include an allowance of Ten Thousand 00/100 (\$10,000) for use according to Owner Instructions for commissioning.
 - 3. CONTIGENCY ALLOWANCES
 - a. Contingency Allowance GC-3 Removal of Asbestos containing fittings

- a) Removal of twelve asbestos containing fittings and installation of new insulated fitting, up to 4" diameter. Allowance shall include up to (12) twelve separate locations.
- b) Unit of Measure: Each
- c) Quantity: Twelve

Twelve asbestos containing fittings and installation of new insulated fitting, up to 4" diameter fittings: Twelve @______each=

b. Contingency Allowance - GC-4 Removal of asbestos containing Insulation

a) Description: Removal of 10 Linear Feet of asbestos containing insulation and installation of new installation. Allowance shall include up to (3) three seperate locations.

(

- b) Unit of Measure: Thirty Linear feet (30)
- c) Quantity: Thirty (30) @ _____ per LF=

) DOLLARS

) DOLLARS

- c. Contingency Allowance GC- 5 Removal of Asbestos wtaerproofing membrane within floor slabs and repalcement of concrete.
 - a) Description: Removal of Asbestos waterproofing membrane conatined in floor slab Remove entire slab as ACM, and replace. Allowance shall include up to (3) three locations.

(\$

(\$

(\$

- b) Unit of Measure: Square Feet
- c) Quantity: Fortyfive (45) @ \$_____ per SF=

) DOLLARS

- Contingency Allowance GC-6 Removal of Quarry tile and infill with specified material.
 a) Description: Removal of Exisitng loose or hollow backed Quarry Tile areas and replacement with infill material prior to expoxy coat toppings. Multiple lesser SF locations to be included
- b) Unit of Measure: Square Feet
- c) Quantity: Two Hundred (200) @ ____per SF=
- d)

d.

) DOLLARS

Contingency Allowance - **GC-7** Provision of new ADA plastic signage for various spaces, to match exsiting.

- (a) Description: Provision of new 8"x8"photopolymer painted signage with raised letters and braille, meeting ADA requirements, backer 1/8" thick to match existing signage. 4 hole mounting, per details on drawings. Allowance shall include up to (8) eight locations.
- (b) Unit of Measure: Each
- (c) Quantity: Eight (8) @ ____ Each=

| | (\$ |) DOLLARS |
|---------------------------------------|-----|---|
| TOTAL ALLOWANCES GENERAL CONSTRUCTION | | |
| | _(|) DOLLARS |
| | | JLLER AND D'ANGELO, PC ITECTS AND PLANNERS |

GREENWICH PUBLIC SCHOOLS GREENWICH HIGH SCHOOL LOCKER ROOM RENOVATIONS PHASE II ALLOWANCES

(Sum of 1.6.A.1, 1.6.A.2, and 1.6.A.3 to be inserted on bid form). Section 01 2100 - Allowances to be submitted with bid and shown on bid form.

PART 2 PRODUCTS - NOT USED PART 3 EXECUTION - NOT USED

ALTERNATES

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SECTION INCLUDES

A. Description of alternates for selection by the Owner, not included in the Base Bid.

1.3 RELATED REQUIREMENTS

- A. Document 00 2113 INSTRUCTIONS TO BIDDERS: Instructions for preparation of pricing for Alternates.
- B. Section 00 4100 Bid Form for listing amount of each alternate.
- C. Document 00 5200 Form of Agreement: Incorporating monetary value of accepted Alternates.

1.4 ACCEPTANCE OF ALTERNATES

- A. Alternates quoted on Bid Forms will be reviewed and accepted or rejected at Greenwich Public Schools's option. Accepted Alternates will be identified in the Owner-Contractor Agreement.
- B. Coordinate related work and modify surrounding work to integrate the Work of each Alternate.

1.5 SCHEDULE OF ALTERNATES GENERAL CONSTRUCTION

- A. Alternate No. 1 New Training Room with Existing Training Room Converting to Team Room:
 - 1. The Contractor for the above work shall state the combined amount to be ADDED TO the Base Bid to provide, furnish and install all labor, equipment and material required to construct new and convert old training room to a team room in accordance with Contract documents.
- B. Alternate No. 2 Rehabilitatation of three existing team locker rooms (limited work in associated teamroom toilet areas):
 - 1. The Contractor for the above work shall state the combined amount to be ADDED TO the Base Bid to provide, furnish and install all labor, equipment and material required to remove existing and provide new work in accordance with Contract Documents.
- C. Alternate No. 3 Corridor Rehabilitation:
 - 1. The Contractor for the above work shall state the amount to be ADDED TO the Base Bid to provide, furnish and install all labor, equipment and material required to rehabilitate Corridor walls, floors and ceilings in accordance with the Contract Documents
- D. Alternate No. 4 Renovate/Expand Male and Female Pysical Education Instructional Offices:
 - 1. The Contractor for the above work shall state the amount to be ADDED TO the Base Bid to provide, furnish and install all labor, equipment and material required to renovate and expand Pysical Education Instructional Offices Room 704B and Room 705D in accordance with Construction Documents

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

ADMINISTRATIVE REQUIREMENTS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SECTION INCLUDES

- A. Preconstruction meeting.
- B. Progress meetings.
- C. Construction progress schedule.
- D. Submittals for review, information, and project closeout.
- E. Number of copies of submittals.
- F. Submittal procedures.

1.3 RELATED REQUIREMENTS

- A. Section 01 1000 Summary of Contract: Work covered by .
- B. Section 01 3553 Site Safety and Security Procedures
- C. Section 01 7000 Execution: Additional coordination requirements.
- D. Section 01 7419 Construction Waste Management and Disposal.
- E. Section 01 7800 Closeout Submittals: Project record documents.

1.4 PROJECT COORDINATION

- A. Project Coordinator: Ron Matten, Director of Facilities .
- B. During construction, coordinate use of site and facilities through the Project Coordinator.
- C. Comply with Project Coordinator's procedures for intra-project communications; submittals, reports and records, schedules, coordination drawings, and recommendations; and resolution of ambiguities and conflicts.
- D. Comply with instructions of the Project Coordinator for use of temporary utilities and construction facilities.
- E. Make the following types of submittals to Owner's Representative.
 - 1. Requests for interpretation.
 - 2. Requests for substitution.
 - 3. Shop drawings, product data, and samples.
 - 4. Test and inspection reports.
 - 5. Design data.
 - 6. Manufacturer's instructions and field reports.
 - 7. Applications for payment and change order requests.
 - 8. Progress schedules.
 - 9. Correction Punch List and Final Correction Punch List for Substantial Completion.

10. Closeout submittals.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.1 PRECONSTRUCTION MEETING

- A. Project Coordinator will schedule a meeting after Notice of Award.
- B. Attendance Required:

- 1. Greenwich Public Schools.
- 2. Fuller and D'Angelo, P.C..
- 3. Contractor and Major Sub- Conttractors.
- C. Agenda:
 - 1. Letter of Award
 - 2. Execution of Greenwich Public Schools-Contractor Agreement.
 - 3. Submission of executed bonds and insurance certificates within 7 days after LOI.
 - 4. Distribution of Contract Documents.
 - 5. Submission of list of Subcontractors, schedule of values, and progress schedule within 7 days.
 - 6. Designation of personnel representing parties to Contract and Architect.
 - 7. Procedures and processing of field decisions, submittals, substitutions, applications for payments, proposal request, Change Orders, and Contract closeout procedures.
 - 8. Scheduling of the project.
 - 9. Use of premises by Greenwich Public Schools and Contractor(s).
 - 10. Greenwich Public Schools's requirements and occupancy prior to completion.
 - 11. Construction facilities and controls provided by Greenwich Public Schools.
 - 12. Temporary utilities provided by Greenwich Public Schools.
 - 13. Survey existing facilities prior to staring construction.
 - 14. Security and housekeeping procedures.
 - 15. Procedures for testing.
- D. Owner's Representative or Architect will record minutes and distribute copies within five days after meeting to all participants. Objections to the Minutes should be submitted in writing within three business days otherwise they will be considered substantially correct. Contactor shall distribute to all entities of the Contractor affected by decisions made.

3.2 PROGRESS MEETINGS

- A. Schedule and administer meetings throughout progress of the Work at maximum at two week intervals.
- B. Attendance Required:
 - 1. Contractor.
 - 2. Greenwich Public Schools.
 - 3. Fuller and D'Angelo, P.C..
 - 4. Contractor's Superintendent.
 - 5. Major Subcontractors.
- C. Agenda:
 - 1. Review minutes of previous meetings.
 - 2. Review of Work progress.
 - 3. Field observations, problems, and decisions.
 - 4. Identification of problems that impede, or will impede, planned progress.
 - 5. Review of submittals schedule and status of submittals.
 - 6. Review construction safety programs.
 - 7. Review exiting and and separation of construction
 - 8. Maintenance of progress schedule.
 - 9. Corrective measures to regain projected schedules.
 - 10. Planned progress during succeeding work period.
 - 11. Coordination of projected progress.
 - 12. Maintenance of quality and work standards.
 - 13. Effect of proposed changes on progress schedule and coordination.

- 14. Review change Orders, RFI's and Clarification Sketches.
- 15. Other business relating to Work.
- D. Owner's Representative or Architect will record minutes and distribute copies within five days after meeting to all participants. Objections to the Minutes should be submitted in writing within three business days otherwise they will be considered substantially correct. Contactor shall distribute to all entities of the Contractor affected by decisions made.

3.3 WEEKLY COORDIATION MEETINGS

- A. The Contractor shall schedule and hold weekly general project coordination meetings with the Owner's Representative, to review the work schedule for the week in order to insure the planned work does not conflict with facility operations.
 - 1.

3.4 CONSTRUCTION PROGRESS SCHEDULE

- A. Responsibility
 - 1. The Contractor shall be responsible for preparing and updating the contract progress schedule.
 - 2. Within 15 days after date of the Notice of Award, the Contractor shall submit preliminary schedule .
 - 3. If preliminary schedule requires revision after review, submit revised schedule within 2 days.
 - 4. Within 1 days after joint review, submit complete schedule.
 - 5. Submit updated schedule with each Application for Payment.

3.5 SUBMITTALS FOR REVIEW

- A. All submittals are the product and the property of the Contractor. The Owner, Owner's Representative, or Architect shall not be responsible for the contractor's construction means, methods or techniques: safety precautions or programs; Acts or admissions; or failure to carry out the work in accordance to the contract documents
- B. Shop Drawing Submittal Log no later than five (5) days after award of contract.
- C. When the following are specified in individual sections, including but not limited to the following, submit them for review:
 - 1. Product data.
 - 2. Shop drawings.
 - 3. Samples for verification.
- D. Submit to Fuller and D'Angelo, P.C. for review for the limited purpose of checking for conformance with information given and the design concept expressed in the contract documents.
- E. Samples will be reviewed only for aesthetic, color, or finish selection.
- F. The Architect shall review and approve or take other appropriate action on the Contractor submittals, such as shop drawings, product data, samples and other data, which the Contractor is required to submit, but only for the limited purpose of checking for conformance with the design concept and the information shown in the Construction Documents. This review shall not include review of the accuracy or completeness of details, such as quantities, dimensions, weights or gauges, fabrication processes, construction means or methods, coordination of the work with other trades or construction safety precautions, all of which are the sole responsibility of the Contractor. The Architect's review shall be conducted with reasonable promptness while allowing sufficient time in the Architect's judgment to permit adequate review. Review of a specific item shall not indicate that the Architect has reviewed the entire assembly of which the item is a component. The Architect shall not be responsible for any deviations from the Construction Documents not brought to the attention of the Architect, in writing, by the Contractor. The Architect shall not be required to review partial submissions or those for which submissions of correlated items have not been received.

- G. Marking or comments on shop drawings shall not be construed as relieving the Contractor from compliance with the contract project plans and specifications, nor departure therefrom. The contractor remains responsible for details and accuracy for conforming and correlating all quantities, verifying all dimensions, for selecting fabrication processes, for techniques of assembly and for performing their work satisfactorily and in a safe manner.
- H. Initial Review: Allow 5 working days for initial review of each submittal. Allow additional time if processing must be delayed to permit coordination with subsequent submittals. Architect will advise Contractor when a submittal being processed must be delayed for coordination.
- I. Architect will review the original submittal and one (1) re submittal. Additional reviews will be additional services provided to the Owner and charged accordingly. The Owner will back charge the contractor accordingly.
- J. No extension of the Contract Time will be authorized because of failure to transmit submittals enough in advance of the Work to permit processing.
- K. Deviations: Highlight, encircle, or otherwise identify deviations from the Contract Documents on submittals.

3.6 SUBMITTALS FOR INFORMATION

- A. When the following are specified in individual sections, submit them for information:
 - 1. Design data.
 - 2. Certificates.
 - 3. Test reports.
 - 4. Inspection reports.
 - 5. Manufacturer's instructions.
 - 6. Manufacturer's field reports.
 - 7. Other types indicated.
- B. Submit for Fuller and D'Angelo, P.C.'s knowledge as contract administrator or for Greenwich Public Schools. No action will be taken.

3.7 SUBMITTALS FOR PROJECT CLOSEOUT

A. Refer to Section 01 7800 for requirements.

3.8 NUMBER OF COPIES OF SUBMITTALS

- A. All submittals shall be in electronic PDF formate and conforming to the following:
 - 1. Each item shall be in a separate file.
 - 2. Each file name shall start with the specification section number and contain an abbreviated explanation of what it contains; for example:
 - a. 09 9000 Painting.
 - Add Revision number (Rev2 Rev3, etc) to the file name when resubmitting items, for example:
 a. 09 9000 Painting Rev 1.
 - 4. Use capital letters and spaces to make the names "readable" do not use special characters, underscores, hyphens, etc.
 - 5. Keep the file names short, no more than 25 characters.
 - 6. Provide a transmittal with each electronic submittal and list each item that's included.
 - 7. Provide a Cover Sheet with each item in the same file as the technical submittal.
 - 8. Do not add dates to the file names, the files are automatically dated when created..
 - 9. Do not zip the files, and do not put the files in Folders.
 - 10. Do not email electronic submittal attachments larger than 5 MB.
 - 11. Do not email multiple electronic submittals- rather bum the submittals on a CD and send the CD via FedEx or other overnight mail.

- 12. Make all technical submittals at one time per trade- refer to the specification for additional submittal requirements for example:
 - a. Concrete; Masonry; Miscellaneous Fabrications; Roofing; etc.
- 13. Do not send MSDS with the technical submittals; collate all of the MSDS needed for the entire project in three ring binders, organized by specification section, and submit the binders to the Owner's Representative and maintain one copy at the project site.
- B. Documents for Information: Submit two copies.
- C. Samples: Submit the number specified in individual specification sections; one of which will be retained by Fuller and D'Angelo, P.C..
 - 1. After review, produce duplicates.
 - 2. Approved sample will be retained at the project site.
 - 3. Retained samples will not be returned to Contractor unless specifically so stated.
 - 4. Submit with each sample, in electronic PDF, data, cuts, photos, color, charts, etc.

3.9 SUBMITTAL PROCEDURES

- A. Shop Drawing Procedures:
 - 1. Prepare accurate, drawn-to-scale, original shop drawing documentation by interpreting the Contract Documents and coordinating related Work.
 - 2. Generic, non-project specific information submitted as shop drawings do not meet the requirements for shop drawings.
- B. Transmit each submittal with a copy of approved submittal form.
- C. Transmit each submittal with transmittal.
- D. Sequentially number the transmittal form. Revise submittals with original number and a sequential alphabetic suffix.
- E. Identify Project, Contractor, Subcontractor or supplier; pertinent drawing and detail number, and specification section number, as appropriate on each copy.
- F. Apply Contractor's stamp, signed or initialed certifying that review, approval, verification of Products required, field dimensions, adjacent construction Work, and coordination of information is in accordance with the requirements of the Work and Contract Documents.
 - 1. Contractor's submittal of shop drawings certifies that the contractor has reviewed and coordinated this shop drawing and they are in conformance to the plans, specifications, applicable codes and other provisions of the Contract Documents.
- G. Deliver submittals to Architect at business address.
- H. Schedule submittals to expedite the Project, and coordinate submission of related items.
- I. Identify variations from Contract Documents and Product or system limitations that may be detrimental to successful performance of the completed Work.
- J. Provide space for and Fuller and D'Angelo, P.C. and consultants review stamps.
- K. When revised for resubmission, identify all changes made since previous submission.
- L. Distribute copies of reviewed submittals as appropriate. Instruct parties to promptly report any inability to comply with requirements.
- M. Submittals not requested will not be recognized or processed.

3.10 ARCHITECT'S ACTION

A. General: Architect will not review submittals that do not bear Contractor's approval stamp and will return them without action.

- B. General: Except for submittals for the record and similar purposes, where action and return on submittals is required or requested, the Architect/Engineer will review each submittal, mark with appropriate "Action".
- C. Action Submittals: Architect will review each submittal, make marks to indicate corrections or modifications required, and return it. Architect will stamp each submittal with an action stamp and will mark stamp appropriately to indicate action taken, as follows:
- D. Final Unrestricted Release: Where the submittals are marked as follows, the work covered by the submittal may proceed provided it complies with the requirements of the contract documents; acceptance of the work will depend upon that compliance.
 - 1. Marking: "No Exceptions Taken"
- E. Final-But-Restricted Release: When the submittals are marked as follows, the work covered by the submittal may proceed provided it complies with both the Architect's/Engineer's notations or corrections on the submittal and with the requirements of the contract documents; acceptance of the work will depend on that compliance.
 - 1. Markings: "Make Correction Noted"
- F. Returned for Re-submittal: When the submittal is marked as follows, do not proceed with the work covered by the submittal, including purchasing fabrication, delivery or other activity. Revise the submittal or prepare a new submittal in accordance with the Architect's/Engineer's notations stating the reasons for returning the submittal; resubmit the submittal without delay. Repeat if necessary to obtain a different action marking. Do not permit submittals with the following marking to be used at the project site, or elsewhere where work is in progress.
 - 1. Marking: "Revise and Resubmit"
- G. Marking: "Rejected".
- H. Other Action: Where the submittal is returned, marked with the Architect/Engineer's explanation, for special processing or other Contractor activity, or is primarily for information or record purposes, the submittal will not be marked.

SUBMITTAL COVERSHEET

| Architect: | | Owner: Greenwich Public Schools 290 Greewnich Avenue Greenwich, CT 06830 Contract: | | |
|---------------------------|--------------------|--|-------------|--|
| Fuller and D'Angelo, P.C. | | | | |
| 45 Knollwood Rd. | | | | |
| Elmsford, NY 10523 | | | | |
| Contractor: | | | | |
| Address: | | | | |
| | Fax: | | | |
| Facility: Greenwich High | | | | |
| Type of Submittal:Re-sub | mittal: []No []Yes | | | |
| [] Shop Drawings | [] Product Data | [] Schedule | [] Sample | |
| [] Test Report | [] Certificate | [] Color Sample | [] Warranty | |
| Submittal Description: | | | | |
| Product Name: | | | | |
| Manufacturer: | | | | |
| | | | | |
| | | | | |
| Spec. Section No.: | Drawing No(s): | | | |
| | Rm. or Det | | | |

Remarks:

SITE SAFETY AND SECURITY PROCEDURES

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SECTION INCLUDES

- A. The safety requirements, which must be followed by the Contractor during the execution of this contract.
- B. The Contractor agrees that the work will be completed with the greatest degree of safety and:
 - 1. To conform to the requirements of the Occupational Safety and Health Act (OSHA) and the Construction Safety Act including all standards and regulations that have been or shall be promulgated by the governmental authorities which administer such acts, and shall hold the Owner, Owner's Representative, the Architect, and all their employees, consultants and representatives harmless from and against and shall indemnify each and everyone of them for any and all claims, actions, liabilities, costs and expenses, including attorneys fees, which any of them may incur as a result of non-compliance.
- C. Security measures including entry control, personnel identification, and miscellaneous restrictions.

1.3 REFERENCES:

A. Code of Federal Regulations OSHA Safety and Health.

1.4 RELATED REQUIREMENTS

- A. Section 01 1000 Summary of Contract: Use of premises and occupancy.
- B. Section 01 5000 Temporary Facilities and Controls: Temporary lighting.
- C. Section 10 00250 10 00250
- D. Seaction 01 7000 Execution.

1.5 **DEFINITIONS**

- A. Public shall mean anyone not involved with or employed by the contractor to perform the duties of this contract.
- B. Site shall mean the limits of the work area.
- C. Contractor shall mean the contractor, his/her subcontractors and any other person related to the contract execution.

1.6 ENTRY CONTROL

- A. The existing building contains a security alarm system maintained and operated by the Owner. Access into the existing building shall not be permitted unless the owner is notified and arrangements made to deactivate the system
- B. Restrict entrance of persons and vehicles into Project site and existing facilities.
- C. Allow entrance only to authorized persons with proper identification.
- D. Greenwich Public Schools will control entrance of persons and vehicles related to Greenwich Public Schools's operations.
- E. Coordinate access of Greenwich Public Schools's personnel to site in coordination with Greenwich Public Schools's security forces.
- F. Install substantial and durable general temporary enclosure of partially completed areas of construction. Provide locking entrances adequate to prevent unauthorized entrance, vandalism, theft and similar violations of project security. Ensure contractor assesibility to each working area not completed during the Summer months.
- G. Traffic Control

- 1. Contractor shall maintain access for emergency vehicles, fireman and pedestrians and protect from damage all persons and property within the limits of and for the duration of the contract; all in accordance with the plans and specifications.
- 2. Conduct construction operations so that the traveling public and pedestrian safety is subjected to a minimum of hazard and delay.
- 3. Contractor shall perform the following minimum requirements as directed by Owner's Representative, Owner, or Construction Manager.
 - a. Keep the surface of the traveled way free from mounds, depressions, and obstructions of any type which could present hazards or annoyance to traffic.
 - b. Keep the surface of all pavements used by the public free and clean of all dirt, debris, stone, timber or other obstructions to provide safe traveled ways.
 - c. Control dust and keep the traveled way free from materials spilled from hauling and construction equipment.
 - d. Provide all cones, barricades, signs and warning devices as may be required and/or as ordered by Ron Matten, Director of Facilities to safely carry out the foregoing. All such signs and devices shall be fabricated and placed in accordance with the latest "Federal Manual on Uniform Control Devices". Use of Open Flares Is Prohibited.
 - e. Contractor shall cover with proper materials all open trenches at the close of each work day. Such plates to abut each other and be wedged at each end of trench to prevent plates from sliding open.
- 4. Ingress and Egress
 - a. Contractor shall provide and maintain at all times safe and adequate ingress and egress to and from site at existing or at new access points consistent with work, unless otherwise authorized by the Owner's Representative or Construction Manager
- 5. If, upon notification by Owner's Representative or Construction Manager, and the contractor fails to correct any unsatisfactory condition within 24 hours of being so directed, Owner's Representative and Construction Manager will immediately proceed with adequate forces to properly maintain the project and the entire cost of such maintenance shall be deducted (back charged) from any moneys due the contractor
- 6. All traffic control costs shall include the base bid of furnishing all labor, material and equipment including the cost of any and all incidental required by job conditions as ordered by Greenwich Public Schools

1.7 FIRE PREVENTION AND CONTROL

- A. The Contractor shall provide Fire Extinguishers as follows: Provide type "A" fire extinguishers for temporary offices and similar spaces where there is minimal danger of electrical fires or grease-oil-flammable liquid fires. In other locations provide either type "ABC" dry chemical extinguishers, or a combination of several extinguishers of NFPA recommended types for the exposures in each case.
 - 1. All required exits, fire alarm, security, automatic temperature control, PA, sprinkler and similar systems shall be maintained and operable throughout the entire construction contract.
 - a. Contractor(s) will be back-charged for all fines imposed for false alarms or service calls.
- B. Free access to fire hydrants and standpipe connections shall be maintained at all times during construction operations. Portable fire extinguishers shall be provided by the Construction Contractor and made conveniently available throughout the construction site. Contractor(s) shall notify their employees of the location of the nearest fire alarm box at all locations where work is in progress.
- C. The Contractor shall take all possible precautions for the prevention of fires. Where flame cutting torches, blow torches, or welding tools are required to be used within the building, their use shall be as approved by the Construction Manager at the site. When welding tools or torches of any type are in use, have available in the immediate vicinity of the work a fire extinguisher of the dry chemical 20 lbs. Type. The fire extinguisher(s) shall be provided and maintained by the Contractor doing such work.

- D. Fuel for cutting and heating torches shall be gas only and shall be contained in Underwriters laboratory approved containers.
- E. Storage of gas shall be in locations as approved by the Owner and subject to Fire Department regulations and requirements.
- F. No volatile liquids shall be used for cleaning agents or as fuels for motorized equipment or tools within a building except with the express approval of the Owner and/or Architect and in accordance with local codes. On-site bulk storage of volatile liquids shall be outside the buildings at locations directed by the Owner, who shall determine the extent of volatile liquid allowed within the building at any given time.

1.8 PERSONNEL IDENTIFICATION

- A. Provide identification badge or other approved identification to each person authorized to enter premises.
- B. Maintain a list of accredited persons, submit copy to Greenwich Public Schools on request.
- C. Background checks and clearances shall be required for workers on this site, coordinate with Greenwich BOE.

1.9 **RESTRICTIONS**

A. Do not allow cameras on site or photographs taken except by written approval of Greenwich Public Schools.

PART 2 PRODUCTS -

2.1 MATERIALS

- A. Refer to Section 01 5000 Temporary Facilities and Controls for additional barrier requirements.
- B. Signs shall be made of sturdy plywood of 1/2" minimum thickness and shall be made to legible at a distance of 50 feet.

PART 3 EXECUTION

3.1 GENERAL

- A. In the performance of its contract, the Contractor shall exercise every precaution to prevent injury to workers and the public or damage to property.
 - 1. The Contractor shall, at their own expense, provide temporary structures, place watchmen, design and erect barricades, fences and railings, give warnings, display such lights, signals and signs, exercise such precautions against fire, adopt and enforce such rules and regulations, and take such other precautions as may be necessary, desirable or proper or as may be directed.
 - 2. The Contractor shall be responsible for initiating, maintaining and supervising all safety precautions and programs in connection with the work to be done under this contract. The Contractor shall take all necessary precautions for the safety of, and shall provide the necessary protection to prevent damage, injury or loss including but not limited to:
 - a. All employees working in connection with this contract, and other persons who may be affected thereby.
 - b. All the work materials and equipment to be incorporated therein whether in storage on or off site; and including trees, shrubs, lawns, walks, pavements, facilities not designated for removal, relocation or replacement in the course of construction.
- B. The Contractor's duties and responsibilities for the safety and protection of the work: shall continue until such time as all the work is completed and contractor has removed all workers, material and equipment from the site, or the issuance of the certificate of final completion, whichever shall occur last.
- C. The Contractor shall use only machinery and equipment adapted to operate with the least possible noise, and shall so conduct his operations that annoyance to occupants of the site and nearby homes and facilities shall be reduced to a minimum

- D. It shall be the responsibility of the Contractor to insure that all employees of the contractor and all subcontractors, and any other persons associated with the performance of their contract shall comply with the provisions of this specification.
- E. The Contractor shall clean up the site daily and keep the site free of debris, refuse, rubbish, and scrap materials. The site shall be kept in a neat and orderly fashion. Before the termination of the contract. The Contractor shall remove all surplus materials, falsework, temporary fences, temporary structures, including foundations thereof.
- F. The Contractor shall follow all rules and regulations put forth in the Code of Federal Regulations (OSHA Safety and Health Standards).

QUALITY REQUIREMENTS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SECTION INCLUDES

- A. Submittals.
- B. Testing and inspection agencies and services.
- C. Control of installation.
- D. Mock-ups.
- E. Manufacturers' field services.
- F. Defect Assessment.

1.3 RELATED REQUIREMENTS

- A. Section 01 3000 Administrative Requirements: Submittal procedures.
- B. Section 01 4219 Reference Standards.
- C. Section 01 6000 Product Requirements: Requirements for material and product quality.

1.4 REFERENCE STANDARDS

- A. ASTM C1021 Standard Practice for Laboratories Engaged in Testing of Building Sealants; 2008 (Reapproved 2014).
- B. ASTM C1077 Standard Practice for Laboratories Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Laboratory Evaluation; 2014.
- C. ASTM C1093 Standard Practice for Accreditation of Testing Agencies for Masonry; 2013.
- D. ASTM E543 Standard Specification for Agencies Performing Nondestructive Testing; 2013.

1.5 SUBMITTALS

- A. See Section 01 3000 Administrative Requirements, for submittal procedures.
- B. Testing Agency Qualifications:
 - 1. Prior to start of Work, submit agency name, address, and telephone number, and names of full time specialist and responsible officer.
 - 2. Submit copy of report of laboratory facilities inspection made by NIST Construction Materials Reference Laboratory during most recent inspection, with memorandum of remedies of any deficiencies reported by the inspection.
- C. Certificates: When specified in individual specification sections, submit certification by the manufacturer and or installation/application subcontractor to Owner and Fuller and D'Angelo, P.C., in quantities specified for Product Data.
 - 1. Certificates may be recent or previous test results on material or product, but must be acceptable to Owner and Fuller and D'Angelo, P.C..
- D. Manufacturer's Instructions: When specified in individual specification sections, submit printed instructions for delivery, storage, assembly, installation, adjusting, and finishing, for the Greenwich Public Schools's information. Indicate special procedures, perimeter conditions requiring special attention, and special environmental criteria required for application or installation.
- E. Manufacturer's Field Reports: Submit reports for Fuller and D'Angelo, P.C.'s benefit as contract administrator or for Greenwich Public Schools.
 - 1. Submit report in duplicate within 5 days of observation to Fuller and D'Angelo, P.C. for information.

1.6 REFERENCES AND STANDARDS - See Section 01 4219

A. Should specified reference standards conflict with Contract Documents, request clarification from Fuller and D'Angelo, P.C. before proceeding.

1.7 TESTING AND INSPECTION AGENCIES AND SERVICES

- A. Greenwich Public Schools will employ services of an independent testing agency to perform certain specified testing; in addition to what is required by the contractor if required.
- B. Employment of agency in no way relieves Contractor of obligation to perform Work in accordance with requirements of Contract Documents.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.1 CONTROL OF INSTALLATION

- A. Monitor quality control over suppliers, manufacturers, products, services, site conditions, and workmanship, to produce Work of specified quality.
- B. Comply with manufacturers' instructions, including each step in sequence.
- C. Should manufacturers' instructions conflict with Contract Documents, request clarification from Fuller and D'Angelo, P.C. before proceeding.
- D. Comply with specified standards as minimum quality for the Work except where more stringent tolerances, codes, or specified requirements indicate higher standards or more precise workmanship.
- E. Have Work performed by persons qualified to produce required and specified quality.
- F. Verify that field measurements are as indicated on shop drawings or as instructed by the manufacturer.
- G. Secure products in place with positive anchorage devices designed and sized to withstand stresses, vibration, physical distortion, and disfigurement.

3.2 TESTING AND INSPECTION

- A. See individual specification sections for testing and inspection required.
- B. Limits on Testing/Inspection Agency Authority:
 - 1. Agency may not release, revoke, alter, or enlarge on requirements of Contract Documents.
 - 2. Agency may not approve or accept any portion of the Work.
 - 3. Agency may not assume any duties of Contractor.
 - 4. Agency has no authority to stop the Work.
- C. Contractor Responsibilities:
 - 1. Deliver to agency at designated location, adequate samples of materials proposed to be used that require testing, along with proposed mix designs.
 - 2. Balancing reports for air and water.
 - 3. Cooperate with laboratory personnel, and provide access to the Work and to manufacturers' facilities.
 - 4. Provide incidental labor and facilities:
 - a. To provide access to Work to be tested/inspected.
 - b. To obtain and handle samples at the site or at source of Products to be tested/inspected.
 - c. To facilitate tests/inspections.
 - d. To provide storage and curing of test samples.
 - 5. Notify Owner and Fuller and D'Angelo, P.C. and laboratory 24 hours prior to expected time for operations requiring testing/inspection services.
 - 6. Employ services of an independent qualified testing laboratory and pay for additional samples, tests, and inspections required by Contractor beyond specified requirements.

- 7. Arrange with Greenwich Public Schools's agency and pay for additional samples, tests, and inspections required by Contractor beyond specified requirements.
- D. Re-testing required because of non-conformance to specified requirements shall be performed by the same agency on instructions by Fuller and D'Angelo, P.C.. Payment for re testing will be charged to the Contractor by deducting testing charges from the Contract Price.

3.3 CONTRACTOR'S TESTING AND INSPECTION

- A. Testing and Inspections shall be conducted by a qualified testing agency or special inspector as required by authorities having jurisdiction and as indicated in individual Specification Sections as the contractor's responsibility including:
 - 1. Verifying that manufacturer maintains detailed fabrication and quality-control procedures and reviewing the completeness and adequacy of those procedures to perform the Work.
 - 2. Notifying Owner's Representative, Contractor, or Architect promptly of irregularities and deficiencies observed in the work during performance of its services.
 - 3. Submitting a certified written report of each test, inspection, and similar quality-control service to Architect, through Owner's Representative, with copy to Contractor and to authorities having jurisdiction.
 - 4. Submitting again a final wiring termination report book of special tests and inspections at Substantial Completion, which includes a list of unresolved deficiencies.
 - 5. Interpreting tests and inspections and stating in each report whether tested and inspected work complies with or deviates from the Contract Documents.
 - 6. Retesting and re-inspecting corrected work.

3.4 MANUFACTURERS' FIELD SERVICES

- A. When specified in individual specification sections, require material or product suppliers or manufacturers to provide qualified staff personnel to observe site conditions, conditions of surfaces and installation, quality of workmanship, as applicable, and to initiate instructions when necessary.
- B. Submit qualifications of observer to Fuller and D'Angelo, P.C. 10 days in advance of required observations.
 - 1. Observer subject to approval of Greenwich Public Schools.
- C. Report observations and site decisions or instructions given to applicators or installers that are supplemental or contrary to manufacturers' written instructions.

3.5 DEFECT ASSESSMENT

A. Replace Work or portions of the Work not conforming to specified requirements.

REFERENCE STANDARDS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SECTION INCLUDES

A. Requirements relating to referenced standards.

1.3 QUALITY ASSURANCE

- A. For products or workmanship specified by reference to a document or documents not included in the Project Manual, also referred to as reference standards, comply with requirements of the standard, except when more rigid requirements are specified or are required by applicable codes.
- B. Conform to reference standard of date of issue current on date for receiving bids, except where a specific date is established by applicable code.
- C. Obtain copies of standards when required by the Contract Documents.
- D. Maintain copy at project site during submittals, planning, and progress of the specific work, until Date of Substantial Completion.
- E. Should specified reference standards conflict with Contract Documents, request clarification from the Fuller and D'Angelo, P.C. before proceeding.
- F. Neither the contractual relationships, duties, or responsibilities of the parties in Contract nor those of the Fuller and D'Angelo, P.C. shall be altered by the Contract Documents by mention or inference otherwise in any reference document.

1.4 **DEFINITIONS**

A. General: Basic Contract definitions are included in the Agreement and Section 01100 Summary of Contracts.

1.5 INDUSTRY STANDARDS

- A. Applicability of Standards: Unless the Contract Documents, including reference standards in codes having jurisdiction, include more stringent requirements, applicable construction industry standards have the same force and effect as if bound or copied directly into the Contract Documents to the extent referenced. Such standards are made a part of the Contract Documents by reference.
- B. Minimum Quantity or Quality Levels: The quantity or quality level shown or specified shall be the minimum provided or performed. The actual installation may comply exactly with the minimum quantity or quality specified, or it may exceed the minimum within reasonable limits. To comply with these requirements, indicated numeric values are minimum or maximum, as appropriate, for the context of the requirements. Refer uncertainties to Architect for a decision before proceeding.
- C. Copies of Standards: Each entity engaged in construction on Project must be familiar with industry standards applicable to its construction activity. Copies of applicable standards are not bound with the Contract Documents.
- D. Where copies of standards are needed to perform a required construction activity, obtain copies directly from the publication source and make them available on request.

PART 2 CONSTRUCTION INDUSTRY ORGANIZATION DOCUMENTS

2.1 ABBREIVIATIONS AND NAMES:

A. Abbreviations and acronyms are frequently used in the Specifications and other Contract Documents to represent the name of a trade association, standards-developing organization, authorities having jurisdiction, or other entity in the context of referencing a standard or publication. Where abbreviations and acronyms are used in the Specifications or other Contract Documents, they mean the recognized name of these entities. Refer to Gale Research's "Encyclopedia of Associations" or Columbia Books' "National Trade & Professional Associations of the U.S.," which are available in most libraries.

TEMPORARY FACILITIES AND CONTROLS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of each prime contract, including General Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SECTION INCLUDES

- A. Temporary electric power and light.
- B. Temporary sanitary facilities.
- C. Temporary Controls: Barriers, enclosures, and fencing.
- D. Temporary enclosures.
- E. Waste removal facilities and services enclosed by fencing.
- F. Construction aids and miscellaneous services and facilities.
- G. Temporary fire protection.
- H. Environmental protection.

1.3 RELATED REQUIREMENTS

- A. Section 01 3553 Site Safety and Security Procedures
- B. Section 01 3000 Administrative Requirements for Submittals.
- C. Section 01 7000 Execution for Progress cleaning requirements.

1.4 SITE PLAN

A. Provide site plan indicating exiting, fencing, staging areas, and parking areas for construction personnel.

1.5 REPORTS:

A. During the progress of the work, contractor shall submit copies of reports required by governing authorities, or necessary for the installation and efficient operation of temporary services and facilities.

1.6 QUALITY ASSURANCE

- A. Regulations: The contractor shall comply with industry standards and with applicable laws and regulations of authorities having jurisdiction including, but not limited to, the following:
 - 1. Building code requirements.
 - 2. Health and safety regulations.
 - 3. Police, fire department and rescue squad rules.
 - 4. Environmental protection regulations
- B. Standards: The contractor shall comply with NFPA 241 "Standard for Safeguarding Construction, Alterations, and Demolition Operations," ANSI-A10 Series standards for "Safety Requirements for Construction and Demolition," and NECA Electrical Design Library "Temporary Electrical Facilities."

1.7 PROJECT CONDITIONS

- A. General: The Contractor shall provide each temporary service and facility ready for use at each location, when first needed to avoid delays in performance of work. Maintain, expand as required, and modify as needed throughout the progress of the work. Do not remove until services or facilities are no longer needed, or are replaced by the authorized use of completed permanent facilities.
- B. Temporary Use of Permanent Facilities: Regardless of previously assigned responsibilities for temporary services and facilities, the Installer of each temporary service or facility shall assume responsibility for its operation, maintenance and protection during use as a construction service or facility prior to the Owner's acceptance and operation of the facility.

- C. Conditions of Use: Operate temporary services and facilities in a safe and efficient manner. Do not overload, and do not permit temporary services and facilities to interfere with the progress of work, or occupancy of existing facility by owner. Do not allow unsanitary conditions, public nuisances or hazardous conditions to develop or persist on the site.
- D. Temporary Utilities: Do not permit freezing of pipes, flooding or intrusion of any water from the elements.
- E. Temporary Construction and Support Facilities: Maintain temporary facilities in a manner to prevent discomfort to users. Take necessary fire prevention measures. Maintain temporary facilities in a sanitary manner so as to avoid health problems.
- F. Security and Protection: Maintain site security and protection facilities in a safe, lawful, publicly acceptable manner. Take measures necessary to prevent site erosion.

1.8 TEMPORARY UTILITIES

- A. Provide all electrical power, lighting, water, and ventilation required for construction purposes.
- B. Existing facilities may be used.
- C. New permanent facilities may be used.
- D. Use trigger-operated nozzles for water hoses, to avoid waste of water.

1.9 DIVISION OF RESPONSIBILITIES

- A. The Contractor is responsible for the following:
 - 1. Installation, operation, maintenance, and removal of each temporary facility usually considered as its own normal construction activity, as well as the costs and use charges associated with each facility.
 - 2. Plug-in electric power cords and extension cords.
 - 3. Supplementary plug-in task lighting, and special lighting necessary exclusively for its own activities.
 - 4. Special power requirements for installation of its own work.
 - 5. Its own tool storage boxes.
 - 6. Hoisting can be coordinated with District, all hoisting of equipment is to be coordinated and provided by contractor, all openings required to install equipment to be reviewed and provided by contractor.
 - 7. Collection of general waste and debris and disposing into containers provided by the Contractor.
 - 8. Secure lockup of its own tools, materials and equipment.
 - 9. Construction aids and miscellaneous services and facilities necessary exclusively for its own construction activities.
- B. The Contractor is responsible and shall pay costs for the following:
 - 1. Temporary toilets, including disposable supplies.
 - 2. Containers for non-hazardous waste and debris.
 - 3. Temporary enclosures of openings.
 - 4. Disposal of wastes containers.
 - 5. Barricades, warning signs, and lights.
 - 6. Site/construction enclosure fence, around dumpsters.
 - 7. Environmental protection.
 - 8. Temporary Fire Protection
 - 9. Temporary dustproof protection when making dust.
- C. Water Service: The Contractor shall provide and pay all costs to install distribution piping of sizes and pressures adequate for construction.

- 1. Maintain hose connections and outlet valves in leak-proof condition. Where finish work below an outlet might be damaged by spillage or leakage, provide a drip pan of suitable size to minimize the possibility of water damage. Drain water promptly from drip pans as it accumulates.
- D. The Electrical Contractor shall maintain all existing systems, including but not limited to, power, lighting, fire alarm, intercom, PA etc., within the existing building operational at all times for Owner occupancy and construction.

1.10 USE CHARGES

- A. General: Cost or use charges for temporary facilities are not chargeable to the Owner or Architect the Owner's Representative. The Architect and Owner will not accept a prime contractor's cost or use charges for temporary services or facilities as a basis of claim for an adjustment in the Contract Sum or the Contract Time.
 - 1. Water Service Use Charges: Water from the Owner's existing water system may be used without metering, and without payment for use charges.
 - 2. Electric Power Service Use Charges: Electric power from the Owner's existing system may be used without payment of use charges.
 - 3. Temporary Utility Services: Where Owner's existing services is inadequate or would disrupt owners use of the existing facility, contractor shall provide utility services for the temporary use at the project site from the utility company, and pay all costs, including use charges.

1.11 TELECOMMUNICATIONS SERVICES

- A. Provide, maintain, and pay for telecommunications services to field office at time of project mobilization.
- B. Telecommunications services shall include:
 - 1. Cellular phone connection for on site superintendent at minimum.
 - 2. Email: Account/address reserved for project use.
 - 3. Facsimile Service: Fax-to-email software on personal computer.

1.12 TEMPORARY SANITARY FACILITIES

- A. Contractor shall provide and maintain required facilities and enclosures. Provide at time of project mobilization.
- B. The Contractor shall maintain daily in clean and sanitary condition.
- C. Sanitary Facilities: Sanitary facilities include temporary toilets, wash facilities and drinking water fixtures. Comply with governing regulations including safety and health codes for the type, number, location, operation and maintenance of fixtures and facilities; provide not less than specified requirements. Install in locations which will best serve the project's needs.
 - 1. Supply and maintain toilet tissue, paper towels, paper cups and other disposable materials as appropriate for each facility, including Owner's Representative's temporary offices. Provide covered waste containers for used material.
 - 2. Install self-contained toilets to the extent permitted by governing regulations.

1.13 BARRIERS

- A. The Contractor shall, provide Barricades, Warning Signs and Lights: Comply with recognized standards and code requirements for erection of substantial, structurally adequate barricades where needed to prevent accidents and losses. Paint with appropriate colors, graphics and warning signs to inform personnel at the site and the public, of the hazard being protected against. Provide lighting where appropriate and needed for recognition of the facility, including flashing red lights where appropriate
 - 1. Sign Materials: For signs and directory boards, provide exterior type, Grade B-B High Density Concrete Form Overlay Plywood conforming to PS-1, of sizes and thickness indicated. Provide exterior grade acrylic-latex-base enamel for painting sign panels and applying graphics.

- B. The Contractor shall, Provide barriers to prevent unauthorized entry to construction areas, to prevent access to areas that could be hazardous to workers or the public, to allow for owner's use of site and to protect existing facilities and adjacent properties from damage from construction operations.
- C. Plywood: For temporary safety barriers, walls and doors and similar direct-contact uses, provide exterior type, 5/8" thick minimum prime and finish painted plywood, over wood stud back-up.

1.14 FENCING

- A. The Contractor shall be responsible for its own fencing as required to secure stored material and waste containers.
- B. Construction: Commercial grade chain link fence.
- C. Provide 6 foot high fence around construction waste containers and the work areas on site. .
- D. Locate where indicated, or if not indicated, enclosed portions of the site determined to be sufficient to accommodate construction operations. Install in a manner that will prevent people, dogs and other animals from easily entering the site, except through entrance gates.
 - 1. Material:
 - a. Steel fencing: Galvanized Chain Link and galvanized gates (non-climbable size).
 - b. Fabric: No. 9 GA galvanized, steel wire mesh, furnish one-piece fabric widths for fencing up to 6' in height indicated in the Contract Documents.
 - c. Framing and Accessories: End, Corner and Pull posts: 2.375" OD steel pipe.
 - d. Line Posts: Space 10'-0" O.C. maximum. 1.90" steel pipe or 1.875" x 1.625 C-sections.
 - e. Fence Rails: Locate at top and bottom of fabric. Post brace assembly manufacturer's standard.
 - f. Wire ties: For tying fabric to line posts use wire ties spaced 12" O.C.
 - g. Height: 6'

1.15 INTERIOR DUST PROTECTION AND CONTROL

- A. Where construction operation create dust provide plastic coverings, 6 mil plastic, covering door openings, office computers, racks, cabinetry, shelving and other items not removed from work area. Tape all edges tight.
 - 1. Seal all UV, supply and return registers.
 - 2. Schedule and coordinated with Greenwich Public School District.
 - 3. Refer to 01 7000 Execution for final cleaning requirements.
 - 4. Maintain ventilation systems and HV systems as long as possible, finish work on same as soon as possible and make HV / HVAC systems operate with the understanding that time is of the essence to provide an air circulation atmosphere for the existing system. Schedule and coordinate with Owner so as not to interfere with Owners occupancy requirements.
- B. Provide temporary partitions as indicated or required to separate work areas from Greenwich Public Schools-occupied areas, to prevent access and penetration of dust and moisture into Greenwich Public Schools-occupied areas, and to prevent damage to existing/new materials and equipment.

1.16 SECURITY

- A. The contractor shall secure and protect facilities and services and shall be the responsible for and pay for all costs in their bid.
- B. Provide security and facilities to protect Work, existing facilities, and Greenwich Public Schools's operations from unauthorized entry, vandalism, or theft.
- C. Temporary Fire Protection: The Contractor shall provide Fire Extinguishers as follows:: Provide type "A" fire extinguishers for temporary offices and similar spaces where there is minimal danger of electrical fires or grease-oil-flammable liquid fires. In other locations provide either type "ABC" dry chemical extinguishers, or a combination of several extinguishers of NFPA recommended types for the exposures in each case

D. The existing building contains a security alarm system maintained and operated by the Owner. Access into the existing building shall not be permitted unless the owner is notified and arrangements made to deactivate the system.

1.17 VEHICULAR ACCESS AND PARKING

- A. The contractor shall Coordinate access and haul routes with governing authorities and Greenwich Public Schools.
- B. The contractor shall Provide and maintain access to fire hydrants free of obstructions.
- C. Provide means of removing mud from vehicle wheels before entering streets.
- D. Provide temporary parking areas to accommodate construction personnel. When site space is not adequate, provide additional off-site parking.

1.18 WASTE REMOVAL

- A. The Contractor shall provide containers, at grade, sufficient for the depositing of nonhazardous/non-toxic waste materials, and shall remove such waste materials from project site as required or directed by the Owner's representative.
 - 1. Comply with requirements in NFPA 241 for removal of combustible waste materials and debris.
 - 2. Contractors shall not utilize the Owner's bins or dumpsters.
- B. The Contractor shall broom clean the site work area at the end of each work day.
 - 1. If the contractor fails to clean areas at the end of each work day the Owner shall perform the cleaning and back charge the contractor accordingly.
- C. The contractor shall be responsible for daily cleaning up of spillage and debris resulting from its operations and from those of its subcontractors; and shall be responsible for complete removal and disposition of hazardous and toxic waste materials.
 - 1. Remove liquid spills promptly.
 - 2. Where dust would impair proper execution of the Work, broom-clean or vacuum the entire work area, as appropriate.
- D. Burying or burning of waste materials on the site will not be permitted. Washing waste materials down sewers or into waterways will not be permitted.
- E. Site: The Contractor shall maintain Project site free of waste materials and debris.
- F. Installed Work: Keep installed work clean. The Contractor shall clean installed surfaces according to written instructions of manufacturer or fabricator of product installed, using only cleaning materials specifically recommended. If specific cleaning materials are not recommended, use cleaning materials that are not hazardous to health or property and that will not damage exposed surfaces.

1.19 MISCELLANEOUS PROVISIONS

A. Dewatering Facilities and Drains: General: For temporary drainage and dewatering facilities and operations not directly associated with performance of work included under individual work sections, comply with dewatering requirements of applicable sections. Where feasible, utilize the same facilities. Maintain site excavations and construction free of water.

1.20 REMOVAL OF UTILITIES, FACILITIES, AND CONTROLS

- A. Remove temporary utilities, equipment, facilities, materials, prior to Date of Substantial Completion inspection.
- B. Clean and repair damage caused by installation or use of temporary work.
- C. Restore existing facilities used during construction to original condition.
- D. Restore new permanent facilities used during construction to specified condition.

PART 2 PRODUCTS - NOT USED PART 3 EXECUTION - NOT USED

END OF SECTION

TRAFFIC AND PEDESTRIAN ACCESS & CONTROL

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of each prime contract, including General Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SECTION INCLUDES

- A. Contractor shall maintain traffic for the duration of the contract and protect the traveling public and pedestrians from all damage to persons and property within the limits of and for the duration of the contract; all in accordance with the plans and specifications.
- B. It is specifically noted that while school is in session, there are children playing at recess, walking to outdoor gym classes, etc. Contractor's trucks must be walked from the project site to the main traffic loop and vice versa, with a separate monitoring individual to insure children's safety. See 01 1000 Summary for delivery black out times.

1.3 METHOD OF MAINTAINING AND PROTECTING TRAFFIC

- A. Contractor shall maintain and protect traffic by so conducting his construction operations that the traveling public and pedestrian safety is subjected to a minimum of hazard and delay. In order to adequately maintain and protect traffic, contractor shall perform the following additional minimum requirements as directed by Owner's Representative:
 - 1. Keep the surface of the traveled way free from mounds, depressions, and obstructions of any type which could present hazards or annoyance to traffic.
 - 2. Keep the surface of all pavements used by the public free and clean of all dirt, debris, stone, timber or other obstructions to provide safe traveled ways.
 - 3. Control dust and keep the traveled way free from materials spilled from hauling and construction equipment.
 - 4. Provide all cones, barricades, signs and warning devices as may be required and/or as ordered by the Owner's Representative to safely carry out the foregoing. All such signs and devices shall be fabricated and placed in accordance with the latest "Federal Manual on Uniform Control Devices". Use of Open Flares Is Prohibited.
 - 5. Prepare and submit for approval sketch/drawing showing proposed location and type of signs, barricades and devices as required in above.
 - 6. Contractor shall cover with steel plates all open trenches at the close of each work day. Such plates to abut each other and be wedged at each end of trench to prevent plates from sliding open.
 - 7. Contractor to post temporary construction signs, including construction traffic signs, safety signs, security signs, and no trespassing signs as required.

1.4 INGRESS AND EGRESS

A. Contractor shall provide and maintain at all times safe and adequate ingress and egress to and from site at existing or at new access points consistent with work, unless otherwise authorized by the Owner's Representative.

1.5 CONTRACTOR'S ATTENTION IS DIRECTED TO

A. If, upon notification by Architect or Owner's Representative, contractor fails to correct any unsatisfactory condition within 24 hours of being so directed, Owner's Representative will immediately proceed with adequate forces to properly maintain the project and the entire cost of such maintenance shall be deducted (back charged) from any moneys due the contractor.

1.6 PAYMENT

A. The lump sum bid price for this item shall include the cost of furnishing all labor, material and equipment including the cost of any and all incidental required by job conditions as ordered by Owner's Representative.

- B. Withholding of Payment
 - 1. No payment will be made under Maintenance and Protection of Traffic for each calendar day during which there are substantial deficiencies in compliance with the specification requirements of any subsection of this section, as determined by the Owner's Representative.
 - 2. If Contractor fails to maintain and protect traffic adequately and safely for a period of 24 hours, the Owner's Representative shall correct the adverse conditions by any means he deems appropriate, and shall deduct the cost of the corrective work from any Monies due the Contractor. The cost of this work shall be in addition to the liquidated damages and nonpayment for Maintenance and Protection of Traffic listed above.
 - 3. However, where major nonconformance with the requirements of this specification is noted by the Owner's Representative and prompt contractor compliance is deemed not to be obtainable, all contract work may be stopped by direct order of the Owner's Representative regardless of whether corrections are made by the Owner's Representative as stated in the paragraph above. **END OF SECTION**

PRODUCT REQUIREMENTS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SECTION INCLUDES

- A. General product requirements.
- B. Re-use of existing products.
- C. Transportation, handling, storage and protection.
- D. Product option requirements.
- E. Substitution limitations and procedures.
- F. Maintenance materials, including extra materials, spare parts, tools, and software.

1.3 RELATED REQUIREMENTS

- A. Section 01 4000 Quality Requirements: Product quality monitoring.
- B. Section 01 6116 Volatile Organic Compound (VOC) Content Restrictions: Requirements for VOC-restricted product categories.
- C. Section 01 7419 Construction Waste Management and Disposal: Waste disposal requirements potentially affecting packaging and substitutions.

1.4 **DEFINITIONS**

- A. Products: Items purchased for incorporating into the Work, whether purchased for Project or taken from previously purchased stock. The term "product" includes the terms "material," "equipment," "system," and terms of similar intent.
- B. Named Products: Items identified by manufacturer's product name, including make or model number or other designation, shown or listed in manufacturer's published product literature, that is current as of date of the Contract Documents.
- C. Comparable Product: Product that is demonstrated and approved through submittal process, or where indicated as a product substitution, to have the indicated qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics that equal or exceed those of specified product.
- D. Manufacturer's Warranty: Preprinted written warranty published by individual manufacturer for a particular product and specifically endorsed by manufacturer to Owner.

1.5 SUBMITTALS Refer to Section 01 3000

- A. Proposed Products List: Submit list of major products proposed for use, with name of manufacturer, trade name, and model number of each product.
 - 1. Submit within 7 days after date of Letter of Award.
- B. Product Data Submittals: Submit manufacturer's standard published data. Mark each copy to identify applicable products, models, options, and other data. Supplement manufacturers' standard data to provide information specific to this Project.
- C. Shop Drawing Submittals: Prepared specifically for this Project; indicate utility, HVAC and electrical characteristics, utility connection requirements, and location of utility outlets for service for functional equipment and appliances.
- D. Sample Submittals: Illustrate functional and aesthetic characteristics of the product, with integral parts and attachment devices. Coordinate sample submittals for interfacing work.

1. For selection from standard finishes, submit samples of the full range of the manufacturer's standard colors, textures, and patterns.

1.6 ASBESTOS

- A. All products, materials, etc. used in conjunction with this Project shall be Asbestos Free.
 - 1. Contractor shall provide a letter to the Owner stating that no asbestos containing material has been used in this project.

PART 2 PRODUCTS

2.1 EXISTING PRODUCTS

- A. Do not use materials and equipment removed from existing premises .
- B. Existing materials and equipment indicated to be removed, but not to be re-used, relocated, reinstalled, delivered to the Greenwich Public Schools, or otherwise indicated as to remain the property of the Greenwich Public Schools, become the property of the Contractor; remove from site.

2.2 NEW PRODUCTS

- A. Provide all new products.
- B. DO NOT USE products having any of the following characteristics:
 - 1. Made outside the United States, its territories, Canada, or Mexico.
 - 2. Made using or containing CFC's or HCFC's.
 - 3. Containing lead, cadmium, asbestos.

2.3 PRODUCT OPTIONS

- A. Products Specified by Reference Standards or by Description Only: Use any product meeting those standards or description.
- B. Products Specified by Naming One or More Manufacturers with a Provision for Substitutions: Submit a request for substitution for any manufacturer not named. Submit on form attached and in accordance with Information to Bidders.

PART 3 EXECUTION

3.1 SUBSTITUTION PROCEDURES

- A. Refer to Instruction to Bidders.
- B. Document each request with complete data substantiating compliance of proposed substitution with Contract Documents.
- C. A request for substitution constitutes a representation that the submitter:
 - 1. Has investigated proposed product and determined that it meets or exceeds the quality level of the specified product.
 - 2. Agrees to provide the same warranty for the substitution as for the specified product.
 - 3. Agrees to coordinate installation and make changes to other Work that may be required for the Work to be complete with no additional cost to Greenwich Public Schools.
 - 4. Waives claims for additional costs or time extension that may subsequently become apparent.
- D. Substitutions will not be considered when they are indicated or implied on shop drawing or product data submittals, without separate written request, or when acceptance will require revision to the Contract Documents.

3.2 TRANSPORTATION AND HANDLING

- A. Package products for shipment in manner to prevent damage; for equipment, package to avoid loss of factory calibration.
- B. If special precautions are required, attach instructions prominently and legibly on outside of packaging.

- C. Coordinate schedule of product delivery to designated prepared areas in order to minimize site storage time and potential damage to stored materials.
- D. Transport and handle products in accordance with manufacturer's instructions.
- E. Transport materials in covered trucks to prevent contamination of product and littering of surrounding areas.
- F. Promptly inspect shipments to ensure that products comply with requirements, quantities are correct, and products are undamaged.
- G. Provide equipment and personnel to handle products by methods to prevent soiling, disfigurement, or damage, and to minimize handling.
- H. Arrange for the return of packing materials, such as wood pallets, where economically feasible.

3.3 STORAGE AND PROTECTION

- A. Designate receiving/storage areas for incoming products so that they are delivered according to installation schedule and placed convenient to work area in order to minimize waste due to excessive materials handling and misapplication.
- B. Store and protect products in accordance with manufacturers' instructions.
- C. Store with seals and labels intact and legible.
- D. Store sensitive products in weather tight, climate controlled, enclosures in an environment favorable to product.
- E. Provide off-site storage and protection when site does not permit on-site storage or protection.
- F. Protect products from damage or deterioration due to construction operations, weather, precipitation, humidity, temperature, sunlight and ultraviolet light, dirt, dust, and other contaminants.
- G. Comply with manufacturer's warranty conditions, if any.
- H. Cover products subject to deterioration with impervious sheet covering. Provide ventilation to prevent condensation and degradation of products.
- I. Prevent contact with material that may cause corrosion, discoloration, or staining.
- J. Provide equipment and personnel to store products by methods to prevent soiling, disfigurement, or damage.
- K. Arrange storage of products to permit access for inspection. Periodically inspect to verify products are undamaged and are maintained in acceptable condition.

| Project: Locker Room Renovations - Ph | | | | |
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| Substitution Request Number: | | | | |
| From: | | | | |
| Date: | | | | |
| A/E Project Number: 2243-19 | | | | |
| Contract For: General Construction | | | | |
| Specification Title: | Description: | | | |
| Section: Page: | | | | |
| Proposed Substitution: | | | | |
| Manufacturer: | Address: | | Phone: | |
| model no.: | | | | |
| Installer: | Address: | | Phone: _ | |
| History:New product years old | 2-5 years old | 5-10 yrs old | More | e than |
| Differences between proposed su | ubstitution and specifie | d product: | | |
| Point-by-point comparative data | attached - REQUIRED |) | | |
| Reason for not providing specific | ed item: | | | |
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GREENWICH PUBLIC SCHOOLS GREENWICH HIGH SCHOOL LOCKER ROOM RENOVATIONS PHASE II PRODUCT REQUIREMENTS

END OF SECTION

VOLATILE ORGANIC COMPOUND (VOC) CONTENT RESTRICTIONS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SECTION INCLUDES

- A. Requirement for installer certification that they did not use any non-compliant products.
- B. VOC restrictions for product categories listed below under "DEFINITIONS."
- C. All products of each category that are installed in the project must comply; Greenwich Public Schools's project goals do not allow for partial compliance.

1.3 RELATED REQUIREMENTS

- A. Section 01 3000 Administrative Requirements: Submittal procedures.
- B. Section 01 4000 Quality Requirements: Procedures for testing and certifications.
- C. Section 01 5721 Indoor Air Quality Controls: Procedures and testing.
- D. Section 01 6000 Product Requirements: Fundamental product requirements, substitutions and product options, delivery, storage, and handling.
- E. Section 07 9200 Joint Sealants: Emissions-compliant sealants.

1.4 **DEFINITIONS**

- A. Indoor-Emissions-Restricted Products: All products in the following product categories, whether specified or not:
 - 1. Interior paints and coatings.
 - 2. Interior adhesives and sealants, including flooring adhesives.
 - 3. Products making up wall and ceiling assemblies.
 - 4. Thermal and acoustical insulation.
- B. VOC-Content-Restricted Products: All products in the following product categories, whether specified or not:
 - 1. Interior paints and coatings.
 - 2. Interior adhesives and sealants, including flooring adhesives.
 - 3. Wet-applied roofing and waterproofing.
- C. Interior of Building: Anywhere inside the exterior weather barrier.
- D. Adhesives: All gunnable, trowelable, liquid-applied, and aerosol adhesives, whether specified or not; including flooring adhesives, resilient base adhesives, and pipe jointing adhesives.
- E. Sealants: All gunnable, trowelable, and liquid-applied joint sealants and sealant primers, whether specified or not; including firestopping sealants and duct joint sealers.

1.5 REFERENCE STANDARDS

- A. 40 CFR 59, Subpart D National Volatile Organic Compound Emission Standards for Architectural Coatings; U.S. Environmental Protection Agency; current edition.
- B. ASTM D3960 Standard Practice for Determining Volatile Organic Compound (VOC) Content of Paints and Related Coatings; 2005 (Reapproved 2013).
- C. CAL (CDPH SM) Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions From Indoor Sources Using Environmental Chambers; California Department of Public Health; v1.1, 2010.

1.6 SUBMITTALS

- A. See Section 01 3000 Administrative Requirements, for submittal procedures.
- B. Product Data: For each VOC-restricted product used in the project, submit evidence of compliance.
- C. Installer Certifications Regarding Prohibited Content: Require each installer of any type of product (not just the products for which VOC restrictions are specified) to certify that either 1) no adhesives, joint sealants, paints, coatings, or composite wood or agrifiber products have been used in the installation of his products, or 2) that such products used comply with these requirements.

1.7 QUALITY ASSURANCE

- A. Indoor Emissions Standard and Test Method: CAL (CDPH SM), using Standard Private Office exposure scenario and the allowable concentrations specified in the method, and range of total VOC's after 14 days.
 - 1. Wet-Applied Products: State amount applied in mass per surface area.
 - 2. Paints and Coatings: Test tinted products, not just tinting bases.
 - 3. Product data submittal showing VOC content is NOT acceptable evidence.
 - 4. Manufacturer's certification without test report by independent agency is NOT acceptable evidence.
- B. VOC Content Test Method: 40 CFR 59, Subpart D (EPA Method 24), or ASTM D3960, unless otherwise indicated.
 - 1. Evidence of Compliance: Acceptable types of evidence are:
 - a. Report of laboratory testing performed in accordance with requirements.
- C. Testing Agency Qualifications: Independent firm specializing in performing testing and inspections of the type specified in this section.

PART 2 PRODUCTS

2.1 MATERIALS

- A. VOC-Content-Restricted Products: VOC content not greater than required by the following:
 - 1. Adhesives, Including Flooring Adhesives: SCAQMD 1168 Rule.
 - 2. Joint Sealants: SCAQMD 1168 Rule.
 - 3. Paints and Coatings: Each color; most stringent of the following:
 - a. 40 CFR 59, Subpart D.
 - b. SCAQMD 1113 Rule.
 - c. CARB (SCM).
 - 4. Wet-Applied Roofing and Waterproofing: Comply with requirements for paints and coatings.

PART 3 EXECUTION

3.1 FIELD QUALITY CONTROL

- A. Greenwich Public Schools reserves the right to reject non-compliant products, whether installed or not, and require their removal and replacement with compliant products at no extra cost to Greenwich Public Schools.
- B. Additional costs to restore indoor air quality due to installation of non-compliant products will be borne by Contractor.

END OF SECTION

EXECUTION

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SECTION INCLUDES

- A. Inspections prior to start of work.
- B. Examination, preparation, and general installation procedures.
- C. Requirements for replacement work, including selective removals.
- D. Pre-installation meetings.
- E. Field engineering and surveying.
- F. General installation of products.
- G. Progress cleaning.
- H. Protection of installed construction.
- I. Correction of the Work.
- J. Surveying for laying out the work.
- K. Cleaning and protection.
- L. Final Cleaning.
- M. Closeout procedures, including Contractor's Correction Punch List, except payment procedures.
- N. General requirements for maintenance service.

1.3 RELATED REQUIREMENTS

- A. Section 01 1000 Summary of Contract: Limitations on working in existing building, continued occupancy, work sequence, identification of salvaged materials., and relocated materials.
- B. Section 01 3000 Administrative Requirements: Submittals procedures, Electronic document submittal service.
- C. Section 01 4000 Quality Requirements: Testing and inspection procedures.
- D. Section 01 5000 Temporary Facilities and Controls: Temporary exterior enclosures.
- E. Section 017132 Selective Removals for removals and cutting and patching.
- F. Section 01 7800 Closeout Submittals: Project record documents, operation and maintenance data, warranties .
- G. Individual Product Specification Sections:
 - 1. Advance notification to other sections of openings required in work of those sections.

1.4 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

1.5 PROJECT CONDITIONS

- A. Dust Control: Execute work by methods to minimize raising dust from construction operations. Provide positive means to prevent air-borne dust from dispersing into atmosphere and over adjacent property.
- B. Noise Control: Provide methods, means, and facilities to minimize noise produced by construction operations.
 - 1. Outdoors: Limit conduct of especially noisy exterior work to hours permitted under the local Noise Ordinance.

C. Pest and Rodent Control: Provide methods, means, and facilities to prevent pests and insects from damaging the work.

1.6 COORDINATION

- A. Coordinate scheduling, submittals, and work of the various sections of the Project Manual to ensure efficient and orderly sequence of installation of interdependent construction elements.
- B. Verify that utility requirements and characteristics of new operating equipment are compatible with building utilities. Coordinate work of various sections having interdependent responsibilities for installing, connecting to, and placing in service, such equipment.
- C. Coordinate space requirements, supports, and installation of mechanical and electrical work that are indicated diagrammatically on Drawings. Follow routing shown for pipes, ducts, and conduit, as closely as practicable; place runs parallel with lines of building. Utilize spaces efficiently to maximize accessibility for other installations, for maintenance, and for repairs.
- D. In finished areas except as otherwise indicated, conceal pipes, ducts, and wiring within the construction. Coordinate locations of fixtures and outlets with finish elements.
- E. Coordinate completion and clean-up of work of separate sections.
- F. After Greenwich Public Schools occupancy of premises, coordinate access to site for correction of defective work and work not in accordance with Contract Documents, to minimize disruption of Greenwich Public Schools's activities.
- G. Alterations: Where applicable, requirements of the contract documents apply to alteration work in the same manner as to new construction. Refer to drawings for specific requirements of alteration work. Primarily, alterations can be described as normal architectural, mechanical and electrical alterations. Contractors shall review phasing and scheduling of the work to understand that certain areas of work must be completed and occupied prior to start of other work. This is essential to the Owner in their ability to maintain the educational programs during construction.

1.7 CODES, PERMITS, FEES, ETC.

A. Refer to Owner Contractor Agreement for additional requirements.

B. The Owner shall file and obtain and pay for the Building Permit.

- C. The contractor(s) and sub- Contractors shall pick-up the Building Permits at Town Hall, Building Department and submitt all required insurances etc. to same to "pull" permits for each trade required.
- D. The Contractor shall furnish and pay for all permits, fees and other installation costs required for the various installations by governing authorities and utility companies; prepare and file drawings and diagrams required; arrange for inspections of any and all parts of the work required by the authorities and furnish all certificates necessary to the Owner and Construction Manager as evidence that the work installed under this Section of the Specifications conforms with all applicable requirements of the Municipal and State Codes, National Board of Fire Underwriters, National Electric Code, as applicable.
- E. Any items of work specified herein and shown on the drawings which conflict with aforementioned rules, regulations and requirements, shall be referred to the Owner and Construction Manager for decision, which decision shall be final and binding.
- F. The building is to be constructed under the following Rules and Regulations of the Building Codes of the State of Connecticut and consist of the following
 - 1. Current Building Code of State of Connecticut

1.8 MANDATORY OSHA CONSTRUCTION SAFETY AND HEALTH TRAINING

A. All laborers, workers and mechanics working on the site are required to be certified as having successfully completed an OSHA construction safety and health course of at least 10 hours prior to performing any work on the project.

PART 2 PRODUCTS

2.1 PATCHING MATERIALS

A. New Materials: As specified in product sections; match existing products and work for patching and extending work.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Prior to start of construction take photographs, videos or similar documentation as evidence of existing project conditions as follows:
 - 1. Exterior views: Spaces adjacent to all work areas.
- B. Verify that existing substrate surfaces are acceptable for subsequent work. Start of work means acceptance of existing conditions.
- C. Examine and verify specific conditions described in individual specification sections.

3.2 PREPARATION

A. Apply manufacturer required or recommended substrate primer, sealer, or conditioner prior to applying any new material or substance in contact or bond, for new walls or opening in-fills and for all painting tasks.

3.3 PREINSTALLATION MEETINGS

- A. When required in individual specification sections, convene a preinstallation meeting at the site prior to commencing work of the section.
- B. Require attendance of parties directly affecting, or affected by, work of the specific section.
- C. Notify Owner and Construction Manager four days in advance of meeting date.
- D. Prepare agenda and preside at meeting:
 - 1. Review conditions of examination, preparation and installation procedures.
 - 2. Review coordination with related work.
- E. Record minutes and distribute copies within two days after meeting to participants, with two copies to Fuller and D'Angelo, P.C., Greenwich Public Schools, participants, and those affected by decisions made.

3.4 GENERAL INSTALLATION REQUIREMENTS

- A. Install products as specified in individual sections, in accordance with manufacturer's instructions and recommendations, and so as to avoid waste due to necessity for replacement.
- B. Make vertical elements plumb and horizontal elements level, unless otherwise indicated.
- C. Make neat transitions between different surfaces, maintaining texture and appearance.

3.5 ALTERATIONS

- A. Drawings showing existing construction and utilities are based on casual field observation only.
 - 1. Verify that construction and utility arrangements are as shown.
 - 2. Report discrepancies to Owner's Representative, Construction Manager, and Architect before disturbing existing installation.
 - 3. Beginning of alterations work constitutes acceptance of existing conditions.
- B. Remove existing work as indicated and as required to accomplish new work.
 - 1. Remove items indicated on drawings.
 - 2. Where new surface finishes are to be applied to existing work, perform removals, patch, and prepare existing surfaces as required to receive new finish; remove existing finish if necessary for successful application of new finish.
- C. Protect existing work to remain.

- 1. Perform cutting to accomplish removals neatly and as specified for cutting new work.
- 2. Repair adjacent construction and finishes damaged during removal work.
- 3. Patch as specified for patching new work.
- D. Adapt existing work to fit new work: Make as neat and smooth transition as possible.
 - 1. When existing finished surfaces are cut so that a smooth transition with new work is not possible, terminate existing surface along a straight line at a natural line of division and make recommendation to Fuller and D'Angelo, P.C..
- E. Patching: Where the existing surface is not indicated to be refinished, patch to match the surface finish that existed prior to cutting. Where the surface is indicated to be refinished, patch so that the substrate is ready for the new finish.
- F. Remove debris and abandoned items from alterations areas and dispose of off-site; do not burn or bury.
- G. Do not begin new construction in alterations areas before removals are complete.
- H. Comply with all other applicable requirements of this section.

3.6 CUTTING AND PATCHING

- A. See Alterations article above for additional requirements.
- B. Perform whatever cutting and patching is necessary to:
 - 1. Complete the work.
 - 2. Fit products together to integrate with other work.
 - 3. Provide openings for penetration of, electrical, and other services.
 - 4. Match work that has been cut to adjacent work.
 - 5. Repair areas adjacent to cuts to required condition.
 - 6. Repair new work damaged by subsequent work.
 - 7. Remove samples of installed work for testing when requested.
 - 8. Remove and replace defective and non-conforming work.
- C. Execute work by methods that avoid damage to other work and that will provide appropriate surfaces to receive patching and finishing. In existing work, minimize damage and restore to original condition.
- D. Restore work with new products in accordance with requirements of Contract Documents.
- E. Patching:
 - 1. Finish patched surfaces to match finish that existed prior to patching. On continuous surfaces, refinish to nearest intersection or natural break. For an assembly, refinish entire unit.
 - 2. Match color, texture, and appearance.
 - 3. Repair patched surfaces that are damaged, lifted, discolored, or showing other imperfections due to patching work. If defects are due to condition of substrate, repair substrate prior to repairing finish.
- F. Make neat transitions. Patch work to match adjacent work in texture and appearance. Where new work abuts or aligns with existing, perform a smooth and even transition.

3.7 MISCELLANEOUS PROVISIONS:

A. Except as otherwise indicated comply with applicable requirements of Division- 23 sections for mechanical provisions within units of general (Divisions 2-14) work. Except as otherwise indicated, comply with applicable requirements of Division-26 sections for electrical provisions within units of general (Divisions 2-14) work.

3.8 FIRE PREVENTION AND CONTROL Refer to Section 01 3553

3.9 WATCHMAN

A. The Owner will not provide watchman. The Contractor will be held responsible for loss or injury to persons or property or work where his work is involved and shall provide such watchman and take such precautionary measures as he may deem necessary to protect his own interests.

3.10 SECURITY SYSTEM

A. The existing building contains a security alarm system maintained and operated by the Owner. Access into the existing building shall not be permitted unless the owner is notified and arrangements made to deactivate the system.

3.11 PROGRESS CLEANING

- A. Maintain areas free of waste materials, debris, and rubbish. Maintain site in a clean and orderly condition.
- B. Remove debris and rubbish from pipe chases, plenums, attics, crawl spaces, and other closed or remote spaces, prior to enclosing the space.
- C. Broom and vacuum clean interior areas prior to start of surface finishing, and continue cleaning to eliminate dust.
- D. Collect and remove waste materials, debris, and trash/rubbish from site periodically and dispose off-site; do not burn or bury.
- E. The Contractor is responsible for their own daily debris removal into containers provided by the Contractor. Working areas are to be broom swept on a daily basis by the Contractor.
- F. The Contractor is responsible to provide dust protection for their construction-related activities.

3.12 PROTECTION OF INSTALLED WORK

- A. Protect installed work from damage by construction operations.
- B. Provide special protection where specified in individual specification sections.
- C. Provide temporary and removable protection for installed products. Control activity in immediate work area to prevent damage.

3.13 ADJUSTING

- A. Adjust operating products and equipment to ensure smooth and unhindered operation.
- B. Balance all systems
- C. Test and adjust BMS systems

3.14 FINAL CLEANING

- A. Final cleaning shall be the responsibility of the Contractor and all costs for final cleaning shall be included in the Base Bid. Final cleaning responsibility shall be limited to all new additions and areas where renovations occur.
- B. Execute final cleaning prior to final project assessment.
- C. Remove waste, surplus materials, trash/rubbish, and construction facilities from the site; dispose of in legal manner; do not burn or bury.
- D. Remove labels that are not permanent.
- E. Leave Project clean and ready for occupancy.
- F. Comply with safety standards for cleaning. Do not burn waste materials. Do not bury debris or excess materials on Owner's property. Do not discharge volatile, harmful, or dangerous materials into drainage systems. Remove waste materials from Project site and dispose of lawfully.

3.15 CLOSEOUT PROCEDURES Refer to Section 01 7800

3.16 MAINTENANCE

A. Provide service and maintenance of components indicated in specification sections.

CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 WASTE MANAGEMENT REQUIREMENTS

- A. Greenwich Public Schools requires that this project generate the least amount of trash and waste possible.
- B. Employ processes that ensure the generation of as little waste as possible due to error, poor planning, breakage, mishandling, contamination, or other factors.
- C. Minimize trash/waste disposal in landfills; reuse, salvage, or recycle as much waste as economically feasible.
- D. Required Recycling, Salvage, and Reuse: The following may not be disposed of in landfills or by incineration:
 - 1. Aluminum and plastic beverage containers.
 - 2. Corrugated cardboard.
 - 3. Wood pallets.
 - 4. Concrete: May be crushed and used as riprap, aggregate, sub-base material, or fill.
 - 5. Metals, including packaging banding, metal studs, sheet metal, structural steel, piping, reinforcing bars, door frames, and other items made of steel, iron, galvanized steel, stainless steel, aluminum, copper, zinc, lead, brass, and bronze.
 - 6. Paint.
 - 7. Acoustical ceiling tile and panels.
- E. Contractor shall submit periodic Waste Disposal Reports; all landfill disposal, recycling, salvage, and reuse must be reported regardless of to whom the cost or savings accrues; use the same units of measure on all reports.
- F. The following sources may be useful in developing the Waste Management Plan:
 - 1. State Recycling Department. .
- G. Methods of trash/waste disposal that are not acceptable are:
 - 1. Burying on the project site.
 - 2. Dumping or burying on other property, public or private.
 - 3. Other illegal dumping or burying.
- H. Regulatory Requirements: Contractor is responsible for knowing and complying with regulatory requirements, including but not limited to Federal, state and local requirements, pertaining to legal disposal of all construction and demolition waste materials.

1.3 RELATED REQUIREMENTS

- A. Section 01 3000 Administrative Requirements: Additional requirements for project meetings, reports, submittal procedures, and project documentation.
- B. Section 01 5000 Temporary Facilities and Controls: Additional requirements related to trash/waste collection and removal facilities and services.
- C. Section 01 6000 Product Requirements: Waste prevention requirements related to delivery, storage, and handling.
- D. Section 01 7000 Execution: Trash/waste prevention procedures related to demolition, cutting and patching, installation, protection, and cleaning.

1.4 **DEFINITIONS**

A. Clean: Untreated and unpainted; not contaminated with oils, solvents, caulk, or the like.

- B. Construction and Demolition Waste: Solid wastes typically including building materials, packaging, trash, debris, and rubble resulting from construction, remodeling, repair and demolition operations.
- C. Hazardous: Exhibiting the characteristics of hazardous substances, i.e., ignitibility, corrosivity, toxicity or reactivity.
- D. Nonhazardous: Exhibiting none of the characteristics of hazardous substances, i.e., ignitibility, corrosivity, toxicity, or reactivity.
- E. Nontoxic: Neither immediately poisonous to humans nor poisonous after a long period of exposure.
- F. Recyclable: The ability of a product or material to be recovered at the end of its life cycle and remanufactured into a new product for reuse by others.
- G. Recycle: To remove a waste material from the project site to another site for remanufacture into a new product for reuse by others.
- H. Recycling: The process of sorting, cleansing, treating and reconstituting solid waste and other discarded materials for the purpose of using the altered form. Recycling does not include burning, incinerating, or thermally destroying waste.
- I. Return: To give back reusable items or unused products to vendors for credit.
- J. Reuse: To reuse a construction waste material in some manner on the project site.
- K. Salvage: To remove a waste material from the project site to another site for resale or reuse by others.
- L. Sediment: Soil and other debris that has been eroded and transported by storm or well production run-off water.
- M. Source Separation: The act of keeping different types of waste materials separate beginning from the first time they become waste.
- N. Toxic: Poisonous to humans either immediately or after a long period of exposure.
- O. Trash: Any product or material unable to be reused, returned, recycled, or salvaged.
- P. Waste: Extra material or material that has reached the end of its useful life in its intended use. Waste includes salvageable, returnable, recyclable, and reusable material.

1.5 SUBMITTALS

4.

- A. See Section 01 3000 Administrative Requirements, for submittal procedures.
- B. Waste Disposal Reports: Submit at specified intervals, with details of quantities of trash and waste, means of disposal or reuse, and costs; show both totals to date and since last report.
 - 1. Submit updated Report with each Application for Progress Payment; failure to submit Report will delay payment.
 - 2. Submit Report on a form acceptable to Greenwich Public Schools.
 - 3. Landfill Disposal: Include the following information:
 - a. Identification of material.
 - b. Amount, in tons or cubic yards, of trash/waste material from the project disposed of in landfills.
 - c. State the identity of landfills, total amount of tipping fees paid to landfill, and total disposal cost.
 - d. Include manifests, weight tickets, receipts, and invoices as evidence of quantity and cost.
 - Incinerator Disposal: Include the following information:
 - a. Identification of material.
 - b. Amount, in tons or cubic yards, of trash/waste material from the project delivered to incinerators.
 - c. State the identity of incinerators, total amount of fees paid to incinerator, and total disposal cost.

- d. Include manifests, weight tickets, receipts, and invoices as evidence of quantity and cost.
- 5. Recycled and Salvaged Materials: Include the following information for each:
 - a. Identification of material, including those retrieved by installer for use on other projects.
 - b. Amount, in tons or cubic yards, date removed from the project site, and receiving party.
 - c. Transportation cost, amount paid or received for the material, and the net total cost or savings of salvage or recycling each material.
 - d. Include manifests, weight tickets, receipts, and invoices as evidence of quantity and cost.
 - e. Certification by receiving party that materials will not be disposed of in landfills or by incineration.
- 6. Other Disposal Methods: Include information similar to that described above, as appropriate to disposal method.

PART 2 PRODUCTS NOT USED

PART 3 EXECUTION

3.1 WASTE MANAGEMENT PROCEDURES

- A. See Section 01 3000 for additional requirements for project meetings, reports, submittal procedures, and project documentation.
- B. See Section 01 5000 for additional requirements related to trash/waste collection and removal facilities and services.
- C. See Section 01 6000 for waste prevention requirements related to delivery, storage, and handling.
- D. See Section 01 7000 for trash/waste prevention procedures related to removals cutting and patching, installation, protection, and cleaning.

3.2 WASTE MANAGEMENT PLAN IMPLEMENTATION

- A. Manager: Designate an on-site person or persons responsible for instructing workers and overseeing and documenting results of the Waste Management Plan.
- B. Communication: Distribute copies of the Waste Management Plan to job site foreman, each subcontractor, Greenwich Public Schools, and Fuller and D'Angelo, P.C..
- C. Instruction: Provide on-site instruction of appropriate separation, handling, and recycling, salvage, reuse, and return methods to be used by all parties at the appropriate stages of the project.
- D. Meetings: Discuss trash/waste management goals and issues at:
 - 1. Pre-construction meeting.
 - 2. Regular job-site meetings.
- E. Facilities: Provide specific facilities for separation and storage of materials for recycling, salvage, reuse, return, and trash disposal, for use by all contractors and installers.
 - 1. Provide containers as required.
 - 2. Provide adequate space for pick-up and delivery and convenience to subcontractors.
 - 3. Keep recycling and trash/waste bin areas neat and clean and clearly marked in order to avoid contamination of materials.
- F. Recycling: Separate, store, protect, and handle at the site identified recyclable waste products in order to prevent contamination of materials and to maximize recyclability of identified materials. Arrange for timely pickups from the site or deliveries to recycling facility in order to prevent contamination of recyclable materials.

END OF SECTION

CLOSEOUT SUBMITTALS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of each prime Contract, including General Conditions and other Division-1 Specification sections, apply to work of this section.

1.2 SECTION INCLUDES

- A. Project Record Documents.
- B. Maintenance Data.
- C. Warranties and Bonds.

1.3 RELATED REQUIREMENTS

- A. Agreement.
- B. Section 01 3000 Administrative Requirements: Submittals procedures, shop drawings, product data, and samples.
- C. Individual Product Sections: Specific requirements for operation and/or maintenance data.
- D. Individual Product Sections: Warranties required for specific products or Work.

1.4 SUBSTANTIAL COMPLETION

- A. Refer to the Agreement for additional requirements.
- B. Preliminary Procedures: Before requesting inspection for determining date of Substantial Completion:
 - 1. Prepare a list of items to be completed and corrected, the value of items on the list, and reasons why the Work is not complete.
 - 2. Advise Owner, Architect, and Construction Manager of pending insurance changeover requirements.
 - 3. Obtain and submit releases permitting Owner's Representaive, Architect, and Construction Manager unrestricted use of the Work and access to services and utilities. Include occupancy permits, operating certificates, and similar releases.
- C. Prior to issuance of the Certificate of Substantial Completion, submit, in writing, a request to the Owner, Owner's Representaive, and Architect a request to perform site inspection for the purpose of preparing a "punch list".
- D. On receipt of request Owner's Representative, Architect, and Construction Manager will prepare a punch list. Certificate of Substantial Completion after completion of all punch list items or will notify Contractor of items, either punch list list or additional items identified by Architect, that must be completed or corrected before certificate will be issued
- E. Certificate of Substantial Completion will be issued after completion of all punch list items. Owner's Representative, Architect, and Construction Manager will notify Contractor of items, either punch list or additional items identified by Architect, that must be completed or corrected before certificate will be issued. After completion of "punch list" items submit the following:
 - 1. Application for Payment showing 100 percent completion for portion of the Work claimed as substantially completed the following:
 - 2. Warranties (guarantees).
 - 3. Maintenance Manuals and instructions.
 - 4. Indoor Quality Report
 - 5. Final cleaning.
 - 6. List of incomplete Work, recognized as exceptions to Architect's "punch list"...
 - 7. Architect's punch list certifying all punch list items have been completed and signed off by the Owner's Representative, Construction Manager, and Contractor.

- 8. Removal of temporary facilities and services.
- 9. Removal of surplus materials, rubbish and similar elements.
- F. Request re inspection when the Work identified in previous inspections as incomplete is completed or corrected, after one reinspection further architectural charges will be back-charged to the contractor on a T+M basis.
 - 1. If necessary, re inspection will be repeated and the contractor shall pay for all additional inspections.

1.5 FINAL COMPLETION

- A. Refer to the Agreement for additional requirements.
- B. Preliminary Procedures: Before requesting final inspection for determining date of Final Completion, complete the following:
 - 1. Inspection: Submit a written request for final inspection for acceptance. On receipt of request, Owner's Representative, Architect, and Construction Manager will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will not process a final Certificate for Payment until after the inspection or will notify Contractor of construction that must be completed or corrected before certificate will be issued.
- C. Following Final Inspection acceptance of work submit the following:
 - 1. Submit Owners Affidavit of Final Payment.
 - 2. Submit a final Application for Payment.
 - 3. Submit certified copy of Architect's Substantial Completion punch list items endorsed and dated Contractor and Owner's Representative certifying each item has been completed or otherwise resolved for acceptance.
 - 4. Release of liens from contractor and all entitles of contractor.
 - 5. Consent of Surety to Final Payment.
 - 6. Final Liquidated Damages settlement statement, if applicable.
 - 7. Contractor's Affidavit of Release of Liens (AIA G706A).
 - 8. Contractors Affidavit of Payment of Debts and Claims (AIA G706)
 - 9. Certification of Payment of Prevailing Wage Rates.
 - 10. Contractor's certified statement that no asbestos containing material was incorporated into the project.
 - 11. HVAC and Plumbing sub contractors must provide test results upon completion from a State of Connecticut accredited testing lab certifying that all pipe insulation and joints on this project contain no asbestos.
 - a. This certification shall be based on a sampling of 10% of all linear feet of pipe insulation (unless manufacturer's certificate is submitted).
 - 12. All items per checklist at end of this section (no retainage reductions will be allowed until all closeout paperwork is received).

1.6 SUBMITTALS

- A. Contractor shall submit all documentation identified in this section within thirty (30) days from the time the Contractor submits the list of items to be corrected, as referred to in the Agreement in addition to other rights of the Owner set forth elsewhere in the Contract Documents, to include but not limited to withholding of final payment. If the documentation has not been submitted within thirty (30) day period, the Owner will obtain such through whatever means necessary. The Contractor shall solely be responsible for all expenses incurred by the Owner, provided the Owner has advised the Contractor of this action thirty 30 days prior to the culmination date and again, seven 7 days prior to the culmination date by written notice
- B. Project Record Documents: Submit documents to Fuller and D'Angelo, P.C. with claim for final Application for Payment.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.1 PROJECT RECORD DOCUMENTS

- A. Maintain on site one set of the following record documents; record actual revisions to the Work:
 - 1. Drawings.
 - 2. Specifications.
 - 3. Addenda.
 - 4. Change Orders and other modifications to the Contract.
 - 5. Reviewed shop drawings, product data, and samples.
 - 6. Manufacturer's instruction for assembly, installation, and adjusting.
- B. Ensure entries are complete and accurate, enabling future reference by Greenwich Public Schools.
- C. Store record documents separate from documents used for construction.
- D. Record information concurrent with construction progress.
- E. Specifications: Legibly mark and record at each product section description of actual products installed, including the following:
 - 1. Changes made by Addenda and modifications.
- F. Record Drawings and Shop Drawings: Legibly mark each item to record actual construction including:
 - 1. Field changes of dimension and detail.
 - 2. Details not on original Contract drawings.

3.2 RECORD DRAWINGS

- A. Record Prints: Maintain one set of blue- or black-line white prints of the Contract Drawings and approved Shop Drawings at the project site.
- B. Preparation: Mark Record Prints to show the actual installation where installation varies from that shown originally. Require individual or entity who obtained record data, whether individual or entity is Installer, subcontractor, or similar entity, to prepare the marked-up Record Prints.
 - 1. Accurately, neatly and clearly record information in an understandable drawing technique.
- C. Content: Types of items requiring marking include, but are not limited to, the following:
 - 1. Dimensional changes to Drawings.
 - 2. Locations and depths of underground utilities.
 - 3. Changes made by Change Order or Construction Change Directive.
 - 4. Details not on the original Contract Drawings.
- D. Mark the Contract Drawings or Shop Drawings, whichever is most capable of showing actual physical conditions, completely and accurately. If Shop Drawings are marked, show cross-reference on the Contract Drawings.
- E. Note Construction Change Directive numbers, alternate numbers, Change Order numbers, and similar identification, where applicable.
- F. Provide final record drawings on CD in PDF format.

3.3 FORMAT

- A. Identify and date each Record Drawing; include the designation "PROJECT RECORD DRAWING" in a prominent location. Contractor shall certify and sign. Provide one B+W set on full size set.
- B. Identify Record Drawing as follows:
 - 1. Project name.
 - a. Date.
 - b. Designation "PROJECT RECORD DRAWINGS."

- c. Name of Architect and Owner's Representative.
- d. Name of Contractor.
- e. Contractor shall certify and sign each drawing

3.4 MAINTENANCE DATA FOR MATERIALS AND FINISHES

- A. For Each Product, Applied Material, and Finish:
- B. Instructions for Care and Maintenance: Manufacturer's recommendations for cleaning agents and methods, precautions against detrimental cleaning agents and methods, and recommended schedule for cleaning and maintenance.

3.5 ASSEMBLY OF OPERATION AND MAINTENANCE MANUALS

- A. Assemble operation and maintenance data into durable manuals for Greenwich Public Schools's personnel use, with data arranged in the same sequence as, and identified by, the specification sections.
- B. Where systems involve more than one specification section, provide separate tabbed divider for each system.
- C. Prepare instructions and data by personnel experienced in maintenance and operation of described products.
- D. Prepare data in the form of an instructional manual.
- E. Binders: Commercial quality, 8-1/2 by 11 inch three D side ring binders with durable plastic covers; 2 inch maximum ring size. When multiple binders are used, correlate data into related consistent groupings.
- F. Cover: Identify each binder with typed or printed title OPERATION AND MAINTENANCE INSTRUCTIONS; identify title of Project; identify subject matter of contents.
- G. Project Directory: Title and address of Project; names, addresses, and telephone numbers of Fuller and D'Angelo, P.C., Consultants, Contractorand subcontractors, with names of responsible parties.
- H. Tables of Contents: List every item separated by a divider, using the same identification as on the divider tab; where multiple volumes are required, include all volumes Tables of Contents in each volume, with the current volume clearly identified.
- I. Dividers: Provide tabbed dividers for each separate product and system; identify the contents on the divider tab; immediately following the divider tab include a description of product and major component parts of equipment.
- J. Text: Manufacturer's printed data, or typewritten data on 24 pound paper.
- K. Drawings: Provide with reinforced punched binder tab. Bind in with text; fold larger drawings to size of text pages.
- L. Arrange content by systems under section numbers and sequence of Table of Contents of this Project Manual.

3.6 WARRANTIES

- A. Obtain warranties executed in duplicate by responsible Subcontractors, suppliers, and manufacturers, within 10 days after completion of the applicable item of work. Except for items put into use with Greenwich Public Schools's permission, leave date of beginning of time of warranty until the Date of Substantial completion is determined.
- B. Verify that documents are in proper form, contain full information, and are notarized.
- C. Co-execute submittals when required.
- D. Retain warranties until time specified for submittal.

CHECKLIST FOR PROJECT CLOSEOUT

AND PROCESSING OF FINAL PAYMENT

JOB TITLE: - Greenwich Public Schools Locker Room Renovations - Phase II Greenwich High School

BOARD OF EDUCATION BID NUMBER; 2243-19

CLOSE-OUT SUBMITTALS: (As Applicable)

[] WAGE & SUPPLEMENTS VERIFICATION FORM (COPY ATTACHED).

THREE (3) 3-RING BINDER BROCHURES OF OPERATION AND MAINTENANCE MANUALS FOR ALL EQUIPMENT INSTALLED ON THE PROJECT INCLUDING THE FOLLOWING:

- [] TYPED OR PRINTED INSTRUCTIONS COVERING THE CARE AND OPERATIONS OF EQUIPMENT AND SYSTEMS FURNISHED AND INSTALLED.
- [] MANUFACTURERS INSTRUCTION BOOKS, DIAGRAMS, SPARE PARTS LISTS COVERING ALL EQUIPMENT.
- [] INSTRUCTION OF OWNER'S REPRESENTATIVE IN CARE AND MAINTENANCE OF NEW EQUIPMENT.
- [] ALL APPROVED SHOP DRAWINGS.
- [] CERTIFICATES OF COMPLIANCE AND INSPECTION. (WHERE APPLICABLE ELECTRIC, ELEVATOR, ETC.)
- [] SPARE PARTS AND MAINTENANCE MATERIALS. (RECEIPT SIGNED BY FIELD SUPERINTENDENT)
- [] EVIDENCE OF COMPLIANCE WITH REQUIREMENTS OF GOVERNING AUTHORITIES (CERTIFICATES OF INSPECTION ELECTRICAL).
- [] CERTIFICATES OF INSURANCE FOR PRODUCTS AND COMPLETED OPERATIONS.
- [] NOTARIZED STATEMENT THAT ONLY NON-ASBESTOS MATERIALS WERE INSTALLED ON THIS PROJECT.
- [] FULLY EXECUTED CERTIFICATE OF SUBSTANTIAL COMPLETION: AIA G704.
- [] CONTRACTOR'S WRITTEN TWO-YEAR WARRANTY AND EXTENDED WARRANTIES (IF ANY REQUIRED).
- [] PROJECT RECORD DOCUMENTS: SECTION 01 7800.
- [] AS-BUILT DRAWINGS.

EVIDENCE OF PAYMENT AND RELAEASE OF LIEN

- [] CONTRACTOR'S AFFIDAVIT OF PAYMENT OF DEBTS AND CLAIMS: AIA G706.
- [] CONTRACTOR'S AFFIDAVIT OF RELEASE OF LIENS AIA G706A PRIME CONTRACTORS AND SUBCONTRACTORS.
- [] CONSENT OF SURETY TO FINAL PAYMENT AIA G707.

REFER TO SECTION 017800 PAR 1.4 AND 1.5 FOR ADDITIONAL REQUIREMENTS. FINAL PAYMENT WILL NOT BE PROCESSED UNTIL ALL ITEMS INDICATED ARE RECEIVED IN ACCORDANCE WITH SECTION 01 7800 - CLOSEOUT SUBMITTALS.

GREENWICH PUBLIC SCHOOLS GREENWICH HIGH SCHOOL LOCKER ROOM RENOVATIONS PHASE II CLOSEOUT SUBMITTALS

Greenwich Public Schools

Contractor Wage and Supplement Certification

I _____ am an officer of (Prime Contracto

(Prime Contractor

and am duly authorized to make this affidavit for the Public Contract for the Ossining Union Free School District.

That I fully comprehend the terms and provisions of section 220-1 of the Labor Law.

That I have been issued a copy of the schedule of Wages and Supplements, as specified in the project manual.

That I agree to pay the applicable Prevailing Wage and will pay or provide the supplements specified.

Contractor Signature President

| Print Name | | |
|------------------|-------------------|--|
| ACKNOWLEDG | MENT: | |
| STATE OF NEW | YORK | |
| COUNTY OF | :SS.: | |
| On this | day of | , 20before me personally came to me known and known to me to be the person described in and |
| who executed the | foregoing instrum | ent and acknowledged that he executed the same. |

Notary Public

County

GREENWICH PUBLIC SCHOOLS GREENWICH HIGH SCHOOL LOCKER ROOM RENOVATIONS PHASE II CLOSEOUT SUBMITTALS

Greenwich Public Schools

Subcontractor Wage and Supplement Certification

That I am an officer of ______ and am duly authorized to make

this affidavit on behalf of the Subcontract to _____

(Prime Contractor) on Public Contract for the Greenwich Public School District.

That I fully comprehend the terms and provisions of section 220-1 of the Labor Law.

That I have been issued a copy of the schedule of Wages and Supplements, as specified in the project manual.

That I agree to pay the applicable Prevailing Wage and will pay or provide the supplements specified.

| Subcontract | tor | | | Signature |
|-----------------|-----------------|-----------------|------|---|
| Print Name | | | | |
| Presid | dent | | | |
| ACKNOWLED | DGMENT: | | | |
| STATE OF 1 | NEW YORK | | | |
| COUNTY O |)F | :SS.: | | |
| On this | day of | | , 20 | before me personally came |
| who executed t | he foregoing in | | | d known to me to be the person described in and dged that he executed the same. |
| who executed th | ne foregoing m | sti uniciti and | | ugeu that he executeu the same. |

Notary Public

County

END OF SECTION

GENERAL COMMISSIONING REQUIREMENTS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Commissioning is intended to achieve the following specific objectives; this section specifies the Contractor's responsibilities for commissioning:
 - 1. Verify that the work is installed in accordance with the Contract Documents and the manufacturer's recommendations and instructions, and that it receives adequate operational checkout prior to startup: Startup reports and Prefunctional Checklists executed by Contractor are utilized to achieve this.
 - 2. Verify and document that functional performance is in accordance with the Contract Documents: Functional Tests executed by Contractor and witnessed by the Commissioning Authority are utilized to achieve this.
 - 3. Verify that operation and maintenance manuals submitted to Greenwich Public Schools are complete: Detailed operation and maintenance (O&M) data submittals by Contractor are utilized to achieve this.
 - 4. Verify that the Greenwich Public Schools's operating personnel are adequately trained: Formal training conducted by Contractor is utilized to achieve this.
- B. Commissioning, including Functional Tests, O&M documentation review, and training, is to occur after startup and initial checkout and be completed before Substantial Completion
- C. The Commissioning Authority is employed by Greenwich Public Schools.
- D. The Commissioning Authority in no way relieves the Contractor of their responsibility in their complete performance of their contract.

1.3 SCOPE OF COMMISSIONING

- A. The following are to be commissioned:
- B. HVAC System, including:
 - 1. Major and minor equipment items.
 - 2. Piping systems and equipment.
 - 3. Ductwork and accessories.
 - 4. Terminal units.
 - 5. Control system.
 - 6. Vibration control devices.
 - 7. Variable frequency drives.
- C. Electrical Systems:

D.

- 1. Power quality.
- 2. Emergency power systems.
- Electronic Safety and Security:
 - 1. Fire and smoke alarms.
- E. Other equipment and systems explicitly identified elsewhere in Contract Documents as requiring commissioning.

1.4 RELATED REQUIREMENTS

A. Section 01 5721 - Indoor Air Quality Controls: Precautions and procedures; smoking room testing; building flush-out.

- B. Section 01 7000 Execution: General startup requirements.
- C. Section 01 7800 Closeout Submittals: Scope and procedures for operation and maintenance manuals and project record documents.
- D. Section 01 7900 Demonstration and Training: Scope and procedures for Greenwich Public Schools personnel training.

1.5 SUBMITTALS

- A. See Section 01 3000 Administrative Requirements, for submittal procedures; except:
 - 1. Make all submittals specified in this section, and elsewhere where indicated for commissioning purposes, directly to the Owner and Construction Manager Commissioning Authority, unless they require review by Fuller and D'Angelo, P.C.; in that case, submit to Fuller and D'Angelo, P.C. first.
 - 2. Make commissioning submittals on time schedule specified by Construction Manager.
 - 3. Submittals indicated as "Draft" are intended for the use of the Owner and Construction Manager in preparation of Prefunctional Checklists or Functional Test requirements; submit in editable electronic format, Microsoft Word 2010 preferred.
 - 4. As soon as possible after submittals made to Fuller and D'Angelo, P.C. are approved, submit copy of approved submittal to the Owner and Construction Manager.
- B. Manufacturers' Instructions: Submit copies of all manufacturer-provided instructions that are shipped with the equipment as soon as the equipment is delivered.
- C. Product Data: If submittals to Fuller and D'Angelo, P.C. do not include the following, submit copies as soon as possible:
 - 1. Manufacturer's product data, cut sheets, and shop drawings.
 - 2. Manufacturer's installation instructions.
 - 3. Startup, operating, and troubleshooting procedures.
 - 4. Fan and pump curves.
 - 5. Factory test reports.
 - 6. Warranty information, including details of Greenwich Public Schools's responsibilities in regard to keeping warranties in force.
- D. Startup Plans and Reports.
- E. Completed Prefunctional Checklists.

PART 2 PRODUCTS

2.1 TEST EQUIPMENT

- A. Provide all standard testing equipment required to perform startup and initial checkout and required Functional Testing; unless otherwise noted such testing equipment will NOT become the property of Greenwich Public Schools.
- B. Calibration Tolerances: Provide testing equipment of sufficient quality and accuracy to test and/or measure system performance with the tolerances specified. If not otherwise noted, the following minimum requirements apply:
 - 1. Temperature Sensors and Digital Thermometers: Certified calibration within past year to accuracy of 0.5 degree F and resolution of plus/minus 0.1 degree F.
 - 2. Pressure Sensors: Accuracy of plus/minus 2.0 percent of the value range being measured (not full range of meter), calibrated within the last year.
 - 3. Calibration: According to the manufacturer's recommended intervals and when dropped or damaged; affix calibration tags or keep certificates readily available for inspection.
- C. Equipment-Specific Tools: Where special testing equipment, tools and instruments are specific to a piece of equipment, are only available from the vendor, and are required in order to accomplish startup or Functional Testing, provide such equipment, tools, and instruments as part of the work at no extra cost to

Greenwich Public Schools; such equipment, tools, and instruments are to become the property of Greenwich Public Schools.

- D. Dataloggers: Independent equipment and software for monitoring flows, currents, status, pressures, etc. of equipment.
 - 1. Dataloggers required to for Functional Tests will be provided by the Commissioning Authority and will not become the property of Greenwich Public Schools.

PART 3 EXECUTION

3.1 COMMISSIONING PLAN

- A. Commissioning Plan: The commissioning schedule, procedures, and coordination requirements for all parties in the commissioning process.
- B. Commissioning Schedule:
 - 1. Submit anticipated dates of startup of each item of equipment and system to Commissioning Authority within 60 days after award of Contract.
 - 2. Re-submit anticipated startup dates monthly, but not less than 4 weeks prior to startup.
 - 3. Prefunctional Checklists and Functional Tests are to be performed in sequence from components, to subsystems, to systems.
 - 4. Provide sufficient notice to Commissioning Authority for delivery of relevant Checklists and Functional Test procedures, to avoid delay.

3.2 DOCUMENTATION IDENTIFICATION SYSTEM

- A. Give each submitted form or report a unique identification; use the following scheme.
- B. Type of Document: Use the following prefixes:
 - 1. Startup Plan: SP-.
 - 2. Startup Report: SR-.
 - 3. Prefunctional Checklist: PC-.
 - 4. Functional Test Procedure: FTP-.
 - 5. Functional Test Report: FTR-.
- C. System Type: Use the first 6 digits from CSI/CSC MasterFormat, that are applicable to the system; for example:
 - 1. 23 0000: HVAC system as a whole.
 - 2. 23 2000: HVAC Piping and Pumps.
 - 3. 23 3000: HVAC Air Distribution.
- D. Component Number: Assign numbers sequentially, using 1, 2, or 3 digits as required to accommodate the number of units in the system.
- E. Test, Revision, or Submittal Number: Number each successive iteration sequentially, starting with 1.
- F. Example: PC-2320-001.2 would be the Prefunctional Checklist for equipment item 1 in the HVAC piping system, probably a pump; this is the second, revised submittal of this checklist.

3.3 STARTUP PLANS AND REPORTS

- A. Startup Plans: For each item of equipment and system for which the manufacturer provides a startup plan, submit the plan not less than 8 weeks prior to startup.
- B. Startup Reports: For each item of equipment and system for which the manufacturer provides a startup checklist (or startup plan or field checkout sheet), document compliance by submitting the completed startup checklist prior to startup, signed and dated by responsible entity.
- C. Submit directly to the Commissioning Authority.

3.4 PREFUNCTIONAL CHECKLISTS

- A. A Prefunctional Checklist is required to be filled out for each item of equipment or other assembly specified to be commissioned.
 - 1. No sampling of identical or near-identical items is allowed.
 - 2. These checklists do not replace manufacturers' recommended startup checklists, regardless of apparent redundancy.
 - 3. Prefunctional Checklist forms will not be complete until after award of the contract; the following types of information will be gathered via the completed Checklist forms:
 - a. Certification by installing contractor that the unit is properly installed, started up, and operating and ready for Functional Testing.
 - b. Confirmation of receipt of each shop drawing and commissioning submittal specified, itemized by unit.
 - c. Manufacturer, model number, and relevant capacity information; list information "as specified," "as submitted," and "as installed."
 - d. Serial number of installed unit.
 - e. List of inspections to be conducted to document proper installation prior to startup and Functional Testing; these will be primarily static inspections and procedures; for equipment and systems may include normal manufacturer's start-up checklist items and minor testing.
 - f. Sensor and actuator calibration information.
- B. Commissioning Authority is responsible for furnishing the Prefunctional Checklists to Contractor.
 - 1. Initial Drafts: Contractor is responsible for initial draft of Prefunctional Checklist where so indicated in the Contract Documents.
 - 2. Provide all additional information requested by Commissioning Authority to aid in preparation of checklists, such as shop drawing submittals, manufacturers' startup checklists, and O&M data.
 - 3. Commissioning Authority may add any relevant items deemed necessary regardless of whether they are explicitly mentioned in the Contract Documents or not.
 - 4. When asked to review the proposed Checklists, do so in a timely manner.
- C. Commissioning Authority Witnessing: Required for:
 - 1. Each piece of primary equipment, unless sampling of multiple similar units is allowed by the commissioning plan.
 - 2. A sampling of non-primary equipment, as allowed by the commissioning plan.
- D. Deficiencies: Correct deficiencies and re-inspect or re-test, as applicable, at no extra cost to Greenwich Public Schools.
 - 1. If difficulty in correction would delay progress, report deficiency to the Commissioning Authority immediately.

3.5 FUNCTIONAL TESTS

- A. A Functional Test is required for each item of equipment, system, or other assembly specified to be commissioned, unless sampling of multiple identical or near-identical units is allowed by the final test procedures.
- B. Contractor is responsible for execution of required Functional Tests, after completion of Prefunctional Checklist and before closeout.
- C. Commissioning Authority is responsible for witnessing and reporting results of Functional Tests, including preparation and completion of forms for that purpose.
- D. Contractor is responsible for correction of deficiencies and re-testing at no extra cost to Greenwich Public Schools; if a deficiency is not corrected and re-tested immediately, the Commissioning Authority will document the deficiency and the Contractor's stated intentions regarding correction.
 - 1. Deficiencies are any condition in the installation or function of a component, piece of equipment or system that is not in compliance with the Contract Documents or does not perform properly.

- 2. When the deficiency has been corrected, the Contractor completes the form certifying that the item is ready to be re-tested and returns the form to the Commissioning Authority; the Commissioning Authority will reschedule the test and the Contractor shall re-test.
- 3. Identical or Near-Identical Items: If 10 percent, or three, whichever is greater, of identical or near-identical items fail to perform due to material or manufacturing defect, all items will be considered defective; provide a proposal for correction within 2 weeks after notification of defect, including provision for testing sample installations prior to replacement of all items.
- 4. Contractor shall bear the cost of Greenwich Public Schools and Commissioning Authority personnel time witnessing re-testing.
- 5. Contractor shall bear the cost of Greenwich Public Schools and Commissioning Authority personnel time witnessing re-testing if the test failed due to failure to execute the relevant Prefunctional Checklist correctly; if the test failed for reasons that would not have been identified in the Prefunctional Checklist process, Contractor shall bear the cost of the second and subsequent re-tests.
- E. Functional Test Procedures:
 - 1. Some test procedures are included in the Contract Documents; where Functional Test procedures are not included in the Contract Documents, test procedures will be determined by the Commissioning Authority with input by and coordination with Contractor.
 - 2. Examples of Functional Testing:
 - a. Test the dynamic function and operation of equipment and systems (rather than just components) using manual (direct observation) or monitoring methods under full operation (e.g., the chiller pump is tested interactively with the chiller functions to see if the pump ramps up and down to maintain the differential pressure setpoint).
 - b. Systems are tested under various modes, such as during low cooling or heating loads, high loads, component failures, unoccupied, varying outside air temperatures, fire alarm, power failure, etc.
 - c. Systems are run through all the HVAC control system's sequences of operation and components are verified to be responding as the sequence's state.
 - d. Traditional air or water test and balancing (TAB) is not Functional Testing; spot checking of TAB by demonstration to the Commissioning Authority is Functional Testing.
- F. Deferred Functional Tests: Some tests may need to be performed later, after substantial completion, due to partial occupancy, equipment, seasonal requirements, design or other site conditions; performance of these tests remains the Contractor's responsibility regardless of timing.

3.6 SENSOR AND ACTUATOR CALIBRATION

- A. Calibrate all field-installed temperature, relative humidity, carbon monoxide, carbon dioxide, and pressure sensors and gages, and all actuators (dampers and valves) on this piece of equipment shall be calibrated. Sensors installed in the unit at the factory with calibration certification provided need not be field calibrated.
- B. Calibrate using the methods described below; alternate methods may be used, if approved by Commissioning Authority and Owner beforehand. See PART 2 for test instrument requirements. Record methods used on the relevant Prefunctional Checklist or other suitable forms, documenting initial, intermediate and final results.
- C. All Sensors:
 - 1. Verify that sensor location is appropriate and away from potential causes of erratic operation.
 - 2. Verify that sensors with shielded cable are grounded only at one end.
 - 3. For sensor pairs that are used to determine a temperature or pressure difference, for temperature make sure they are reading within 0.2 degree F of each other, and for pressure, within tolerance equal to 2 percent of the reading, of each other.
 - 4. Tolerances for critical applications may be tighter.

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- D. Sensors Without Transmitters Standard Application:
 - 1. Make a reading with a calibrated test instrument within 6 inches of the site sensor.
 - 2. Verify that the sensor reading, via the permanent thermostat, gage or building automation system, is within the tolerances in the table below of the instrument-measured value.
 - 3. If not, install offset, calibrate or replace sensor.
- E. Sensors With Transmitters Standard Application.
 - 1. Disconnect sensor.
 - 2. Connect a signal generator in place of sensor.
 - 3. Connect ammeter in series between transmitter and building automation system control panel.
 - 4. Using manufacturer's resistance-temperature data, simulate minimum desired temperature.
 - 5. Adjust transmitter potentiometer zero until 4 mA is read by the ammeter.
 - 6. Repeat for the maximum temperature matching 20 mA to the potentiometer span or maximum and verify at the building automation system.
 - 7. Record all values and recalibrate controller as necessary to conform with specified control ramps, reset schedules, proportional relationship, reset relationship and P/I reaction.
 - 8. Reconnect sensor.
 - 9. Make a reading with a calibrated test instrument within 6 inches of the site sensor.
 - 10. Verify that the sensor reading, via the permanent thermostat, gage or building automation system, is within the tolerances in the table below of the instrument-measured value.
 - 11. If not, replace sensor and repeat.
 - 12. For pressure sensors, perform a similar process with a suitable signal generator.
- F. Sensor Tolerances for Standard Applications: Plus/minus the following maximums:
 - 1. Watthour, Voltage, Amperage: 1 percent of design.
 - 2. Pressure, Air, Water, Gas: 3 percent of design.
 - 3. Air Temperatures (Outside Air, Space Air, Duct Air): 0.4 degrees F.
 - 4. Relative Humidity: 4 percent of design.
 - 5. Barometric Pressure: 0.1 inch of Hg.
 - 6. Flow Rate, Air: 10 percent of design.
 - 7. Flow Rate, Water: 4 percent of design.
 - 8. AHU Wet Bulb and Dew Point: 2.0 degrees F.
- G. Critical Applications: For some applications more rigorous calibration techniques may be required for selected sensors. Describe any such methods used on an attached sheet.
- H. Valve/Damper Stroke Setup and Check:
 - 1. For all valve/damper actuator positions checked, verify the actual position against the control system readout.
 - 2. Set pump/fan to normal operating mode.
 - 3. Command valve/damper closed; visually verify that valve/damper is closed and adjust output zero signal as required.
 - 4. Command valve/damper to open; verify position is full open and adjust output signal as required.
 - 5. Command valve/damper to a few intermediate positions.
 - 6. If actual valve/damper position does not reasonably correspond, replace actuator or add pilot positioner (for pneumatics).
- I. Isolation Valve or System Valve Leak Check: For valves not associated with coils.
 - 1. With full pressure in the system, command valve closed.
 - 2. Use an ultra-sonic flow meter to detect flow or leakage.

3.7 TEST PROCEDURES - GENERAL

- A. Provide skilled technicians to execute starting of equipment and to execute the Functional Tests. Ensure that they are available and present during the agreed upon schedules and for sufficient duration to complete the necessary tests, adjustments and problem-solving.
- B. Provide all necessary materials and system modifications required to produce the flows, pressures, temperatures, and conditions necessary to execute the test according to the specified conditions. At completion of the test, return all affected equipment and systems to their pre-test condition.
- C. Sampling: Where Functional Testing of fewer than the total number of multiple identical or near-identical items is explicitly permitted, perform sampling as follows:
 - 1. Identical Units: Defined as units with same application and sequence of operation; only minor size or capacity difference.
 - 2. Sampling is not allowed for:
 - a. Major equipment.
 - b. Life-safety-critical equipment.
 - c. Prefunctional Checklist execution.
 - 3. XX = the percent of the group of identical equipment to be included in each sample; defined for specific type of equipment.
 - 4. YY = the percent of the sample that if failed will require another sample to be tested; defined for specific type of equipment.
 - 5. Randomly test at least XX percent of each group of identical equipment, but not less than three units. This constitutes the "first sample."
 - 6. If YY percent of the units in the first sample fail, test another XX percent of the remaining identical units.
 - 7. If YY percent of the units in the second sample fail, test all remaining identical units.
 - 8. If frequent failures occur, resulting in more troubleshooting than testing, the Commissioning Authority may stop the testing and require Contractor to perform and document a checkout of the remaining units prior to continuing testing.
- D. Manual Testing: Use hand-held instruments, immediate control system readouts, or direct observation to verify performance (contrasted to analyzing monitored data taken over time to make the "observation").
- E. Simulating Conditions: Artificially create the necessary condition for the purpose of testing the response of a system; for example apply hot air to a space sensor using a hair dryer to see the response in a VAV box.
- F. Simulating Signals: Disconnect the sensor and use a signal generator to send an amperage, resistance or pressure to the transducer and control system to simulate the sensor value.
- G. Over-Writing Values: Change the sensor value known to the control system in the control system to see the response of the system; for example, change the outside air temperature value from 50 degrees F to 75 degrees F to verify economizer operation.
- H. Indirect Indicators: Remote indicators of a response or condition, such as a reading from a control system screen reporting a damper to be 100 percent closed, are considered indirect indicators.
- I. Monitoring: Record parameters (flow, current, status, pressure, etc.) of equipment operation using dataloggers or the trending capabilities of the relevant control systems; where monitoring of specific points is called for in Functional Test Procedures:
 - 1. All points that are monitored by the relevant control system shall be trended by Contractor; at the Commissioning Authority's request, Contractor shall trend up to 20 percent more points than specified at no extra charge.
 - 2. Other points will be monitored by the Commissioning Authority using dataloggers.
 - 3. At the option of the Commissioning Authority, some control system monitoring may be replaced with datalogger monitoring.

- 4. Provide hard copies of monitored data in columnar format with time down left column and at least 5 columns of point values on same page.
- 5. Graphical output is desirable and is required for all output if the system can produce it.
- 6. Monitoring may be used to augment manual testing.

3.8 OPERATION AND MAINTENANCE MANUALS

- A. See Section 01 7800 Closeout Submittals for additional requirements.
- B. Add design intent documentation furnished by Fuller and D'Angelo, P.C. to manuals prior to submission to Greenwich Public Schools.
- C. Submit manuals related to items that were commissioned to Commissioning Authority for review; make changes recommended by Commissioning Authority.
- D. Commissioning Authority will add commissioning records to manuals after submission to Greenwich Public Schools.

END OF SECTION

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 other Division 1 Specification Sections, apply to this Section.

1.2 SECTION INCLUDES

- A. Removals.
- B. Floors and slabs on grade.
- C. Reinforcing for new slabs to existing slabs.
- D. Concrete reinforcement.
- E. Joint devices associated with concrete work.
- F. Finishes.
- G. Mix design.
- H. Placement procedure.

1.3 RELATED REQUIREMENTS

- A. Section 09 6725 Epoxy Resin Flooring.
- B. REFERENCE STANDARDS
 - 1. ACI 117 Standard Specifications for Tolerances for Concrete Construction and Materials; 2010.
 - 2. ACI 301 Specifications for Structural Concrete; 2010 (Errata 2012).
 - 3. ACI 304R Guide for Measuring, Mixing, Transporting, and Placing Concrete; 2000.
 - 4. ACI 308R Guide to Curing Concrete; 2001 (Reapproved 2008).
 - 5. ASTM A615/A615M Standard Specification for Deformed and Plain Carbon Steel Bars for Concrete Reinforcement; 2015.
 - 6. ASTM A775/A775M Standard Specification for Epoxy-Coated Steel Reinforcing Bars; 2007b (Reapproved 2014).
 - 7. ASTM A884/A884M Standard Specification for Epoxy-Coated Steel Wire and Welded Wire Reinforcement; 2014.
 - 8. ASTM C1602/C1602M Standard Specification for Mixing Water Used in the Production of Hydraulic Cement Concrete; 2012.
 - 9. ASTM C33/C33M Standard Specification for Concrete Aggregates; 2013.
 - 10. ASTM C94/C94M Standard Specification for Ready-Mixed Concrete; 2015.
 - 11. ASTM C171 Standard Specification for Sheet Materials for Curing Concrete; 2007.
 - 12. ASTM C685/C685M Standard Specification for Concrete Made by Volumetric Batching and Continuous Mixing; 2014.
 - 13. ASTM C1059/C1059M Standard Specification for Latex Agents for Bonding Fresh to Hardened Concrete; 2013.
- C. ASTM D2103 Standard Specification for Polyethylene Film and Sheeting; 2015.
 - 1. ASTM D3963/D3963M Standard Specification for Fabrication and Jobsite Handling of Epoxy-Coated Reinforcing Steel Bars; 2001 (Reapproved 2007).
- D. SUBMITTALS
 - 1. See Section 01 3000 Administrative Requirements, for submittal procedures.
 - 2. Product Data: Submit manufacturers' data on manufactured products showing compliance with specified requirements and installation instructions.
 - 3. For curing compounds, provide data on method of removal in the event of incompatibility with floor covering adhesives.

- 4. Mix Design: Submit proposed concrete mix design.
 - a. Indicate proposed mix design complies with requirements of ACI 301, Section 4 Concrete Mixtures.
- 5. Test Reports: Submit report for each test or series of tests specified.

1.4 QUALITY ASSURANCE

- A. Perform work of this section in accordance with ACI 301 and ACI 318.
- B. Follow recommendations of ACI 305R when concreting during hot weather.
- C. Source Limitations: Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant, obtain aggregate from one source, and obtain admixtures through one source from a single manufacturer.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Steel Reinforcement: Deliver, store, and handle steel reinforcement to prevent bending and damage.

1.6 PROJECT CONDITIONS

A. Coordinate with the work of all other sections and separate contracts.

PART 2 PRODUCTS

2.1 FORMWORK

A. Formwork Design and Construction: Comply with guidelines of ACI 347R to provide formwork that will produce concrete complying with tolerances of ACI 117.

2.2 REINFORCEMENT MATERIALS

- A. Comply with requirements of Section 03 2000.
- B. Reinforcing Steel: ASTM A615/A615M, Grade 60 (60,000 psi).
 - 1. Type: Deformed billet-steel bars. For reinforcing and in between new and exsiting slabs.
 - 2. Finish: Epoxy coated in accordance with ASTM A775/A775M, unless otherwise indicated.
- C. Steel Welded Wire Reinforcement (WWR): Class A epoxy coated, deformed type, ASTM A884/A884M.
 - 1. Form: Flat Sheets.
 - 2. Mesh Size: 6 x 6.
 - 3. Wire Gage: W 6 x W 6.
- D. Reinforcement Accessories:
 - 1. Tie Wire: Annealed, minimum 16 gage, 0.0508 inch.
 - 2. Chairs, Bolsters, Bar Supports, Spacers: Sized and shaped for adequate support of reinforcement during concrete placement.

2.3 CONCRETE MATERIALS

- A. Cement: ASTM C150/C150M, Type I Normal Portland type.
- B. Fine and Coarse Aggregates: ASTM C33/C33M.
- C. Water: ASTM C1602/C1602M; clean, potable, and not detrimental to concrete.

2.4 ACCESSORY MATERIALS

- A. Vapor Retarder: ASTM E 1745, Class A, three-ply, nylon- or polyester-cord-reinforced, high-density polyethylene sheet; laminated to a nonwoven geotextile fabric, 30 mils (0.76 mm) thick.
 - 1. Available Product: Subject to compliance with requirements, a product that may be incorporated into the Work includes, but is not limited to:
 - 2. "Griffolyn T-65G" by Reef Industries Inc

2.5 BONDING AND JOINTING PRODUCTS

A. Latex Bonding Agent: Non-redispersable acrylic latex, complying with ASTM C1059/C1059M, Type II.

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1. Manufacturers:

- a. Kaufman Products Inc; SureBond: www.kaufmanproducts.net/#sle.
- b. SpecChem, LLC; Strong Bond Acrylic Bonder: www.specchemllc.com/#sle.
- c. W. R. Meadows, Inc; ACRY-LOK-: www.wrmeadows.com/#sle.
- d. Substitutions: See Section 01 2500 Substitution Procedures.

2.6 CURING MATERIALS

- A. Moisture-Retaining Sheet: ASTM C171.
 - 1. Polyethylene film, clear, minimum nominal thickness of 4 mil, 0.004 inch.
- B. Water: Potable, not detrimental to concrete.

2.7 REPAIR MATERIALS

- A. Repair Underlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/8 inch (3.2 mm) and that can be feathered at edges to match adjacent floor elevations.
 - 1. Cement Binder: ASTM C 150, portland cement or hydraulic or blended hydraulic cement as defined in ASTM C 219.
 - 2. Primer: Product of underlayment manufacturer recommended for substrate, conditions, and application.
 - 3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch (3 to 6 mm) or coarse sand as recommended by underlayment manufacturer.
 - 4. Compressive Strength: Not less than 4100 psi (29 MPa) at 28 days when tested according to ASTM C 109/C 109M.
- B. Proportioning Normal Weight Concrete: Comply with ACI 211.1 recommendations.

2.8 CONCRETE MIX DESIGN

- A. Concrete Strength: 4,000 psi, Establish required average strength for concrete on the basis of field experience, as specified in ACI 301.
 - 1. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch (3 to 6 mm) or coarse sand as recommended by underlayment manufacturer.
 - 2. Compressive Strength: Not less than 4000 psi (29 MPa) at 28 days when tested according to ASTM C 109/C 109M.
- B. Normal Weight Concrete:
 - 1. Water-Cement Ratio: Maximum 0.45.
 - 2. Total Air Content: 6 percent, determined in accordance with ASTM C173/C173M.
 - 3. Maximum Slump: 4 inches.
 - 4. Maximum Aggregate Size: 3/4 inch.

2.9 MIXING

- A. On Project Site: Mix in drum type batch mixer, complying with ASTM C685/C685M. Mix each batch not less than 1-1/2 minutes and not more than 5 minutes.
- B. Adding Water: If concrete arrives on-site with slump less than suitable for placement, do not add water that exceeds the maximum water-cement ratio or exceeds the maximum permissible slump.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify lines, levels, and dimensions before proceeding with work of this section.

3.2 PREPARATION

- A. Formwork: Comply with requirements of ACI 301. Design and fabricate forms to support all applied loads until concrete is cured, and for easy removal without damage to concrete.
- B. Coordinate placement of embedded items with erection of concrete and placement of accessories.

- C. Where new concrete is to be bonded to previously placed concrete, prepare existing surface by cleaning and applying bonding agent in according to bonding agent manufacturer's instructions.
 - 1. Use latex bonding agent only for non-load-bearing applications.
- D. In locations where new concrete is doweled to existing work, drill holes in existing concrete, insert steel dowels and pack solid with non-shrink grout.
- E. Interior Slabs on Grade: Install vapor retarder under interior slabs on grade. Lap joints minimum 6 inches. Seal joints, seams and penetrations watertight with manufacturer's recommended products and follow manufacturer's written instructions. Repair damaged vapor retarder before covering.
 - 1. Vapor Retarder Over Granular Fill: Install compactible granular fill before placing vapor retarder as indicated on drawings. Do not use sand.

3.3 INSTALLING REINFORCEMENT AND OTHER EMBEDDED ITEMS

- A. Fabricate and handle epoxy-coated reinforcing in accordance with ASTM D3963/D3963M.
- B. Comply with requirements of ACI 301. Clean reinforcement of loose rust and mill scale, and accurately position, support, and secure in place to achieve not less than minimum concrete coverage required for protection.
- C. Install welded wire reinforcement in maximum possible lengths, and offset end laps in both directions. Splice laps with tie wire.

3.4 PLACING CONCRETE

- A. Place concrete in accordance with ACI 304R.
- B. Place concrete for floor slabs in accordance with ACI 302.1R.
- C. Ensure reinforcement and formed construction joint devices will not be disturbed during concrete placement.
- D. Place concrete continuously without construction (cold) joints wherever possible; where construction joints are necessary, before next placement prepare joint surface by removing laitance and exposing the sand and sound surface mortar, by sandblasting or high-pressure water jetting.
- E. Finish floors level and flat, unless otherwise indicated, within the tolerances specified below.
- F. Finish floors level with adjacent existing concrete floors
- G. Prep for finish flooring as required.

3.5 SLAB JOINTING

- A. Locate joints as indicated on drawings.
- B. Anchor joint fillers and devices to prevent movement during concrete placement.

3.6 SEPARATE FLOOR TOPPINGS

- A. Prior to placing floor topping, roughen substrate concrete surface and remove deleterious material. Broom and vacuum clean.
- B. Place required dividers, edge strips, reinforcing, and other items to be cast in.
- C. Apply bonding agent to substrate in accordance with manufacturer's instructions.
- D. Place concrete floor toppings to required lines and levels.

3.7 MISCELLANEOUS CONCRETE ITEMS

A. Filling In: Fill in holes and openings left in concrete structures and existing concrete locker bases, 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.

3.8 CONCRETE FINISHING

A. Repair surface defects, immediately after removing formwork.

- B. Unexposed Form Finish: Rub down or chip off fins or other raised areas 1/4 inch or more in height.
- C. Concrete Slabs: Finish to requirements of ACI 302.1R, and as follows:
 - 1. Surfaces to Receive Thin Floor Coverings: "Steel trowel" as described in ACI 302.1R; thin floor coverings include resilient flooring, thin set ceramic tile, and Epoxy flooring.

3.9 CURING AND PROTECTION

- A. Comply with requirements of ACI 308R. Immediately after placement, protect concrete from premature drying, excessively hot or cold temperatures, and mechanical injury.
- B. Maintain concrete with minimal moisture loss at relatively constant temperature for period necessary for hydration of cement and hardening of concrete.
- C. Surfaces Not in Contact with Forms:
 - 1. Final Curing: Begin after initial curing but before surface is dry.
 - a. Moisture-Retaining Sheet: Lap strips not less than 3 inches and seal with waterproof tape or adhesive; secure at edges.

3.10 FIELD QUALITY CONTROL

- A. An independent testing agency may perform field quality control tests, as specified in Section 01 4000 Quality Requirements.
- B. Submit proposed mix design of each class of concrete to inspection and testing firm for review prior to commencement of concrete operations.
- C. Tests of concrete and concrete materials may be performed at any time to ensure compliance with specified requirements.
- D. Compressive Strength Tests: ASTM C39/C39M, for each test, mold and cure three concrete test cylinders. Obtain test samples for every 100 cubic yards or less of each class of concrete placed.

3.11 DEFECTIVE CONCRETE

- A. Repair or replacement of defective concrete will be determined by the Fuller and D'Angelo, P.C.. The cost of additional testing shall be borne by Contractor when defective concrete is identified.
- B. Do not patch, fill, touch-up, repair, or replace exposed concrete except upon express direction of Fuller and D'Angelo, P.C. for each individual area.

3.12 PROTECTION

A. Do not permit traffic over unprotected concrete floor surface until fully cured.

END OF SECTION

SINGLE-WYTHE UNIT MASONRY

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SECTION INCLUDES

- A. Concrete masonry units.
- B. Reinforcement, anchorage, and accessories.
- C. Flashings.

1.3 RELATED REQUIREMENTS

- A. Section 07 9200 Joint Sealants: Sealing control and expansion joints.
- B. Section 09 2116 Gypsum Board Assemblies:
- C. Section 09 3000 Tiling:

1.4 REFERENCE STANDARDS

- A. ASTM A153/A153M Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2009.
- B. ASTM A615/A615M Standard Specification for Deformed and Plain Carbon Steel Bars for Concrete Reinforcement; 2015.
- C. ASTM C129 Standard Specification for Nonloadbearing Concrete Masonry Units; 2011.
- D. BIA Technical Notes No. 7 Water Penetration Resistance Design and Detailing; 2017.
- E. TMS 402/602 Building Code Requirements and Specification for Masonry Structures; 2016.

1.5 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Convene one week before starting work of this section.

1.6 SUBMITTALS

- A. See Section 01 3000 Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data for masonry and fabricated wire reinforcement.

1.7 QUALITY ASSURANCE

A. Comply with provisions of ACI 530/530.1/ERTA, except where exceeded by requirements of Contract Documents.

1.8 MOCK-UP

- A. Construct a masonry wall as a mock-up panel sized 8 feet long by 6 feet high; include mortar and accessories in mock-up.
- B. Locate where directed.
- C. Mock-up may remain as part of the Work.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Deliver, handle, and store masonry units by means that will prevent mechanical damage and contamination by other materials.

PART 2 PRODUCTS

2.1 MASONRY MATERIALS

A. Brick:

- 1. Brick shall be clay or shale, ASTM C216, Type FBS, solid. Brick shall be tested for efflorescence in accordance with ASTM Test Methods C67 and the rating shall be "Not Effloresce".
 - a. Use 100% solid brick over exterior relieving angles/lintels or other brick projections on exterior face of building. (Use of solid brick with cores is acceptable if cores are filled solid with mortar and the cores are not visible to view.
- B. Concrete Block: Comply with referenced standards and as follows:
 - 1. Size: Standard units with nominal face dimensions of 16 x 8 inches and nominal depths as indicated on the drawings for specific locations or as required to match existing wall thickness.
 - 2. Special Shapes: Provide non-standard blocks configured for corners, end walls., and other detailed conditions.
 - 3. Provide mortar and grout for block wall instalations, type N
 - 4. Non-Loadbearing Units: ASTM C129.
 - a. Hollow block, as indicated.
 - b. Normal weight.

2.2 REINFORCEMENT AND ANCHORAGE

- A. Reinforcing Steel: ASTM A615/A615M, Grade 40 (40,000 psi) yield strength, deformed billet bars; uncoated.
- B. Joint Reinforcement: Use ladder type joint reinforcement where vertical reinforcement is involved and truss type elsewhere, unless otherwise indicated.
- C. Single Wythe Joint Reinforcement: Truss type; ASTM A1064/A1064M steel wire, mill galvanized to ASTM A641/A641M, Class 3; 0.1483 inch side rods with 0.1483 inch cross rods; width as required to provide not more than 1 inch and not less than 1/2 inch of mortar coverage on each exposure.
- D. Strap Anchors: Bent steel shapes configured as required for specific situations, 1-1/4 in width, 0.105 in thick, lengths as required to provide not more than 1 inch and not less than 1/2 inch of mortar coverage from masonry face, corrugated for embedment in masonry joint, hot dip galvanized to ASTM A 153/A 153M, Class B.
- E. Partition Anchors: Partition anchors to provide lateral shear at upper limit of masonry wall with neoprene pad and anchor.
 - 1. PTA-420 Series by Hohmann & Barnard
- F. Flexible Anchors: 2-piece anchors that permit differential movement between masonry and building frame, sized to provide not more than 1 inch and not less than 1/2 inch of mortar coverage from masonry face.

2.3 ACCESSORIES

- A. Flashing Weep Vent System: Polypropylene pan and bridge unit with polyester mesh drainage mats and bug guards; wall system size: As required.
- B. Cleaning Solution: Non-acidic, not harmful to masonry work or adjacent materials.
- C. Various Steel Lintels as required at openings.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that field conditions are acceptable and are ready to receive masonry.

3.2 PREPARATION

A. Direct and coordinate placement of metal anchors supplied for installation under other sections.

3.3 COURSING

A. Establish lines, levels, and coursing indicated. Protect from displacement.

- B. Maintain masonry courses to uniform dimension. Form vertical and horizontal joints of uniform thickness.
- C. Match existing adjacent coursing and bond layout.
- D. Concrete Masonry Units:
 - 1. Bond: Running.
 - 2. Coursing: One unit and one mortar joint to equal 8 inches.
 - 3. Mortar Joints: Concave.
- E. Brick Units:
 - 1. Bond: Match existing.
 - 2. Coursing: Three units and three mortar joints to equal 8 inches.
 - 3. Mortar Joints: Concave.

3.4 PLACING AND BONDING

- A. Lay hollow masonry units with face shell bedding on head and bed joints.
- B. Buttering corners of joints or excessive furrowing of mortar joints is not permitted.
- C. Remove excess mortar as work progresses.
- D. Interlock intersections and external corners.
- E. Do not shift or tap masonry units after mortar has achieved initial set. Where adjustment must be made, remove mortar and replace.
- F. Perform job site cutting of masonry units with proper tools to provide straight, clean, unchipped edges. Prevent broken masonry unit corners or edges.

3.5 REINFORCEMENT AND ANCHORAGE

- A. Install horizontal joint reinforcement 16 inches on center.
- B. Place continuous joint reinforcement in first and second joint below top of walls.
- C. Lap joint reinforcement ends minimum 6 inches.
- D. Fasten anchors to structural framing and embed in masonry joints as masonry is laid. Space anchors at maximum of 24 inches horizontally and 16 inches vertically.

3.6 MASONRY FLASHINGS

- A. Whether or not specifically indicated, install masonry flashing to divert water to exterior at all locations where downward flow of water will be interrupted.
 - 1. Extend flashings full width at such interruptions and at least 6 inches, minimum, into adjacent masonry or turn up at least 1 inch, minimum, to form watertight pan at non-masonry construction.
 - 2. Remove or cover protrusions or sharp edges that could puncture flashings.
 - 3. Seal lapped ends and penetrations of flashing before covering with mortar.

3.7 LINTELS

- A. Install loose steel lintels over openings as indicated on drawings.
- B. Maintain minimum 4 inch bearing on each side of opening.

3.8 GROUTED COMPONENTS

- A. Support and secure reinforcing bars from displacement. Maintain position within 1/2 inch of dimensioned position.
- B. Place and consolidate grout fill without displacing reinforcing.

3.9 BUILT-IN WORK

A. As work progresses, install built-in metal door frames and other items to be built into the work and furnished under other sections.

B. Install built-in items plumb, level, and true to line.

3.10 TOLERANCES

- A. Maximum Variation From Unit to Adjacent Unit: 1/16 inch.
- B. Maximum Variation from Plane of Wall: 1/4 inch in 10 ft and 1/2 inch in 20 ft or more.
- C. Maximum Variation from Plumb: 1/4 inch per story non-cumulative; 1/2 inch in two stories or more.

3.11 CUTTING AND FITTING

A. Cut and fit for joining adjacent units. Coordinate with other sections of work to provide correct size, shape, and location.

3.12 CLEANING

- A. Remove excess mortar and mortar smears as work progresses.
- B. Replace defective mortar. Match adjacent work.
- C. Clean soiled surfaces with cleaning solution.
- D. Use non-metallic tools in cleaning operations.

3.13 **PROTECTION**

A. Without damaging completed work, provide protective boards at exposed external corners that are subject to damage by construction activities.

END OF SECTION

ROUGH CARPENTRY

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SECTION INCLUDES

- A. Wood blocking for toilet accessories, casework, lockers, etc.
- B. Miscellaneous wood nailers, furring, and grounds.
- C. Plywood.

1.3 RELATED REQUIREMENTS

- A. Section 01 6116 Volatile Organic Compound (VOC) Content Restrictions.
- B. Section 10 5126 Plastic Lockers.
- C. Section 10 2800 Toilet And Bath Accessories.
- D. Section 12 2940 Roller Shades.
- E. Section 12 3200 Plastic Laminated Casework.

1.4 REFERENCE STANDARDS

- A. APA PRP-108 Performance Standards and Qualification Policy for Structural-Use Panels (Form E445); 2001.
- B. AWPA U1 Use Category System: User Specification for Treated Wood; 2012.
- C. PS 20 American Softwood Lumber Standard; 2010.
- D. WCLIB (GR) Standard Grading Rules for West Coast Lumber No. 17; 2004, and supplements.
- E. WWPA G-5 Western Lumber Grading Rules; 2011.

1.5 SUBMITTALS

- A. See Section 01 3000 Administrative Requirements, for submittal procedures.
- B. Product Data: Provide technical data on each type of lumber and fastener.
- C. Material Safety Data Sheets.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications:
 - 1. A firm (Installer) with not less than 5 years experience installing comparable carpentry work, employing personnel skilled in the work specified.
 - 2. Pre-Application Conference: Attend the pre-roofing conference to discuss how the carpentry work will be performed and coordinated with other related work
 - 3. Lumber: Comply with PS 20 and approved grading rules and inspection agencies.
 - a. Acceptable Lumber Inspection Agencies: Any agency with rules approved by American Lumber Standards Committee.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. General: Cover wood products to protect against moisture. Support stacked products to prevent deformation and to allow air circulation.
- B. Do not overload the structure when storing material on the roof

1.8 WARRANTY

- A. See Section 01 7800 Closeout Submittals, for additional warranty requirements.
- B. Provide five year manufacturer warranty for roofing subcontractor.

1.9 WARRANTY

- A. See Section 01 7800 Closeout Submittals for additional warranty requirements.
- B. Correct defective Work within a two (2) year period after Date of Substantial Completion.

PART 2 PRODUCTS

2.1 GENERAL REQUIREMENTS

- A. Dimension Lumber: Comply with PS 20 and requirements of specified grading agencies.
 1. Species: Douglas Fir, Structural Grade unless otherwise indicated.
- B. Lumber fabricated from old growth timber is not permitted.

2.2 DIMENSION LUMBER

- A. Grading Agency: Western Wood Products Association; WWPA G-5.
- B. Sizes: Nominal sizes as indicated on drawings, S4S.
- C. Moisture Content: Kiln-dry or MC15.Provide fire retardant material in all concealed spaces..

2.3 CONSTRUCTION PANELS

A. Plywood: Exterior grade APA rated Type CDX underlayment plywood.

2.4 ACCESSORIES

- A. Fasteners and Anchors:
 - 1. Stainless steel.
 - 2. Use screws wherever possible, minimum size diameter #12. If nails are used they shall be annular ring shank type. Do not use dry wall screws to secure wood blocking assemblies.
 - 3. Use stainless steel threaded adhesive anchors for fastening wood blocking to masonry.
 - a. Hilti "HIT-HY 200A" or approved equal for solid masonry locations.
 - b. Hilti "HIT-HI" 70" or approved equal with composite mesh sleeves, for hollow masonry locations.
 - 4. Metal and Finish: Stainless steel for all applications and locations.
 - 5. Anchors: Toggle bolt type for anchorage to hollow masonry.

2.5 FACTORY WOOD TREATMENT

- A. Preservative Treatment:
 - 1. Manufacturers:
 - a. Osmose, Inc: www.osmose.com.
 - b. Substitutions: 01 2500 Substitutions Procedures.
- B. Preservative Pressure Treatment of Lumber Above Grade: AWPA U1, Use Category UC3B, Commodity Specification A using waterborne preservative.
 - 1. Kiln dry lumber after treatment to maximum moisture content of 19 percent.
 - 2. Treat lumber in contact with masonry or concrete.
 - 3. Treat lumber in other locations as indicated.

PART 3 EXECUTION

3.1 **PREPARATION**

A. Coordinate installation of rough carpentry members specified in other sections.

3.2 INSTALLATION - GENERAL

- A. Coordinate the installation of carpentry items with the installation of the roofing system, roof insulation, metal, membrane flashings, windows.
- B. Coordinate the installation of carpentry items with the installation toilet accessories and other similar items.

- C. Set carpentry work plumb and true, except provide slope at the top surfaces of horizontal members as indicated.
- D. Space fasteners to achieve adequate holding power, generally as follows:
 - 1. Anchor bolts embedded in concrete, drilled anchors into concrete or masonry, minimum embedment 1" and minimum edge distance 2", screws into a steel deck or structural steel member, or screws into wood framing: 12 inches on center.
 - 2. Install two rows of fasteners on blocking wider than 6 inches.
 - 3. Fit carpentry work neatly scribed and cut to fit within 1/8 inch of adjoining materials. Position furring, nailers, blocking, shims and similar supports for the proper attachment of subsequent work
- E. Where treated wood is used on interior, provide temporary ventilation during and immediately after installation sufficient to remove indoor air contaminants.

3.3 FRAMING INSTALLATION - TEMP WALLS

- A. Set structural members level, plumb, and true to line. Discard pieces with defects that would lower required strength.
- B. Make provisions for temporary construction loads, and provide temporary bracing sufficient to maintain structure in true alignment and safe condition until completion of erection and installation of permanent bracing.
- C. Install structural members full length without splices.
- D. Comply with member sizes, spacing, and configurations indicated, and fastener size and spacing indicated, but not less than required by applicable codes.
- E. Construct double joist headers at floor and ceiling openings and under wall stud partitions that are parallel to floor joists; use metal joist hangers unless otherwise detailed.
- F. Frame wall openings with two or more studs at each jamb; support headers on cripple studs for temp doors.

3.4 BLOCKING, NAILERS, AND SUPPORTS

- A. Provide framing and blocking members as indicated or as required to support finishes, fixtures, specialty items, and trim.
- B. In metal stud walls, provide continuous blocking around door and window openings for anchorage of frames, securely attached to stud framing.
- C. Where ceiling-mounting is indicated, provide blocking and supplementary supports above ceiling, unless other method of support is explicitly indicated.
- D. Provide the following specific non-structural framing and blocking:
 - 1. Cabinets and shelf supports.
 - 2. Grab bars.
 - 3. Towel and bath accessories.
 - 4. Wall-mounted door stops.
 - 5. Chalkboards and marker boards.
 - 6. Toilet and ShowerAccessories.

3.5 INSTALLATION OF CONSTRUCTION PANELS

- A. Communications and Electrical Room Mounting Boards: Secure with screws to studs with edges over firm bearing; space fasteners at maximum 24 inches on center on all edges and into studs in field of board.
 - 1. At fire-rated walls, install board over wall board indicated as part of the fire-rated assembly.
 - 2. Where boards are indicated as full floor-to-ceiling height, install with long edge of board parallel to studs.
 - 3. Install adjacent boards without gaps.

3.6 FIELD QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements, for additional requirements.

3.7 CLEANING, PROTECTION AND WATERTIGHTNESS

- A. Conduct an inspection of the interior and exterior of the building and grounds, and submit a written report of any pre-existing leakage or damage, prior to performing any work.
- B. The Architect will conduct a similar inspection at the completion of the work, and the Contractor will be back-charged for all leakage or damage which was not documented in the Contractor's report, or repaired to the Owners satisfaction at the Contractor's expense.
- C. Provide any equipment, material and labor necessary to protect the site, the building, its contents and occupants, pedestrians, and surrounding landscaped and paved areas from damage due to the construction work or from inclement weather during construction.
- D. Do not perform work during inclement weather. Protect incomplete work and the building from damage by inclement weather which may occur unexpectedly. Make all work areas watertight at the end of each day's work.
- E. Frequently clean up all refuse, rubbish, scrap materials and debris so the work site presents a neat, orderly and workmanlike appearance.
- F. Carefully sweep areas of work to remove all residual debris upon the completion of all work. After cleaning the roof, thoroughly clean all drain sumps and drain lines, leader heads and leaders. Do not allow debris to enter the drain lines, leaders or underground drain lines END OF SECTION

nd of section

FIRESTOPPING

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SECTION INCLUDES

- A. Firestopping systems.
- B. Firestopping of all joints and penetrations in fire resistance rated and smoke resistant assemblies, whether indicated on drawings or not, and other openings indicated.

1.3 RELATED REQUIREMENTS

- A. Section 01 6116 Volatile Organic Compound (VOC) Content Restrictions.
- B. Section 01 7000 Execution: Cutting and patching.

1.4 REFERENCE STANDARDS

- A. ASTM E119 Standard Test Methods for Fire Tests of Building Construction and Materials; 2015.
- B. ASTM E814 Standard Test Method for Fire Tests of Through-Penetration Fire Stops; 2013a.
- C. FM (AG) FM Approval Guide; current edition.
- D. UL 1479 Standard for Fire Tests of Penetration Firestops; Current Edition, Including All Revisions.
- E. UL (FRD) Fire Resistance Directory; current edition.
- F. UL 2079 Standard Test Method of Fire Resistant Joints

1.5 SUBMITTALS

- A. Schedule of Firestopping: List each type of penetration, fire rating of the penetrated assembly, and firestopping test or design number.
- B. Product Data: Provide data on product characteristics, performance ratings, and limitations.

1.6 QUALITY ASSURANCE

- A. Fire Testing: Provide firestopping assemblies of designs that provide the specified fire ratings when tested in accordance with methods indicated.
 - 1. Listing in the current-year classification or certification books of UL, FM, or ITS (Warnock Hersey) will be considered as constituting an acceptable test report.
- B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

1.7 FIELD CONDITIONS

A. Comply with firestopping manufacturer's recommendations for temperature and conditions during and after installation; maintain minimum temperature before, during, and for three days after installation of materials.

PART 2 PRODUCTS

2.1 FIRESTOPPING - GENERAL REQUIREMENTS

- A. Mold and Mildew Resistance: Provide firestoppping materials with mold and mildew resistance rating of zero(0) in accordance with ASTM G21.
- B. Primers, Sleeves, Forms, Insulation, Packing, Stuffing, and Accessories: Type required for tested assembly design.
- C. Fire Ratings: Refer to drawings for required wall ratings.

2.2 FIRESTOPPING ASSEMBLY REQUIREMENTS

A. Through Penetration Firestopping: Use any system that has been tested according to ASTM E814 to have fire resistance F Rating equal to required fire rating of penetrated assembly.

2.3 FIRESTOPPING FOR FLOOR-TO-FLOOR, WALL-TO-FLOOR, AND WALL-TO-WALL JOINTS

- A. Concrete and Concrete Masonry Walls and Floors:
 - 1. Floor to Floor Joints:
 - a. 2 Hour Construction: UL System FF-D-1013; Hilti CFS-SP WB Firestop Joint Spray and CP 672.
 - 2. Top of Wall Joints at Concrete/Concrete Masonry Wall to Concrete Floor:
 - a. 2 Hour Construction: UL System HW-D-0312; Specified Technologies Inc. SIL silicone sealant.
 - 3. Concrete/Concrete Masonry Wall to Wall Joint Systems That Have Not Been Tested For Movement Capabilities (Static):
 - 4. Concrete/Concrete Masonry Wall to Wall Joints:
 - a. 2 Hour Construction: UL System WW-D-0017; Hilti CFS-SP WB Firestop Joint Spray and CP 672.
- B. Gypsum Board Walls:
 - 1. Wall to Wall Joints:
 - a. 2 Hour Construction: UL System WW-D-0067; Hilti CP 606 Flexible Firestop Sealant.
 - b. 1 Hour Construction: UL System WW-D-0067; Hilti CP 606 Flexible Firestop Sealant.
 - 2. Top of Wall Joints at Underside of Steel Beam and Concrete Over Metal Deck Floor with Sprayed On Fireproofing:
 - a. 2 Hour Construction: UL System HW-D-0259; Hilti CFS-SP WB Firestop Joint Spray and CP 672.
 - b. 1 Hour Construction: UL System HW-D-0259; Hilti CFS-SP WB Firestop Joint Spray and CP 672.
 - 3. Top of Wall Joints at Concrete Over Metal Deck:
 - a. 1 Hour Construction: UL System HW-D-0099; Specified Technologies Inc. SpeedFlex Joint Profile System.

2.4 FIRESTOPPING PENETRATIONS THROUGH CONCRETE AND CONCRETE MASONRY CONSTRUCTION

- A. Penetrations Through Floors or Walls By:
 - 1. Multiple Penetrations in Large Openings:
 - a. 2 Hour Construction: UL System C-AJ-8143; Hilti FS-ONE MAX Intumescent Firestop Sealant.
 - 2. Uninsulated Metallic Pipe, Conduit, and Tubing:
 - a. 2 Hour Construction: UL System C-AJ-1425; Hilti CFS-S SIL GG Firestop Silicone Sealant Gun-Grade.
 - 3. Electrical Cables Not In Conduit:
 - a. 2 Hour Construction: UL System C-AJ-3216; Hilti CFS-PL Firestop Plug.
 - 4. Insulated Pipes:
 - a. 2 Hour Construction: UL System C-AJ-5091; Hilti FS-ONE IMAX intumescent Firestop Sealant.
 - 5. HVAC Ducts, Uninsulated:
 - a. 2 Hour Construction: UL System C-AJ-7111; Hilti FS-ONE MAX Intumescent Firestop Sealant.
- B. Penetrations Through Walls By:

- 1. Uninsulated Metallic Pipe, Conduit, and Tubing:
 - a. 2 Hour Construction: UL System W-J-1067; Hilti FS-ONE MAX Intumescent Firestop Sealant.
 - b. 1 Hour Construction: UL System W-J-1067; Hilti FS-ONE MAX Intumescent Firestop Sealant.
- 2. Electrical Cables Not In Conduit:
 - a. 2 Hour Construction: UL System C-AJ-3095; Hilti FS-ONE MAX Intumescent Firestop Sealant.
- 3. Insulated Pipes:
 - a. 2 Hour Construction: UL System C-AJ-5090; Hilti FS-ONE MAX Intumescent Firestop Sealant.
 - b. 1 Hour Construction: UL System C-AJ-5090; Hilti FS-ONE MAX Intumescent Firestop Sealant.
- 4. HVAC Ducts, Uninsulated:
 - a. 2 Hour Construction: UL System W-J-7109; Hilti FS-ONE MAX Intumescent Firestop Sealant or CP 606 Flexible Firestop Sealant.

2.5 FIRESTOPPING PENETRATIONS THROUGH GYPSUM BOARD WALLS

- A. Penetrations By:
 - 1. Multiple Penetrations in Large Openings:
 - a. 2 Hour Construction: UL System W-L-1389; Hilti FS-ONE Intumescent Firestop Sealant.
 - b. 1 Hour Construction: UL System W-L-1389; Hilti FS-ONE Intumescent Firestop Sealant.
 - 2. Uninsulated Metallic Pipe, Conduit, and Tubing:
 - a. 2 Hour Construction: UL System W-L-1054; Hilti FS-ONE MAX Intumescent Firestop Sealant.
 - b. 1 Hour Construction: UL System W-L-1054; Hilti FS-ONE MAX Intumescent Firestop Sealant.
 - 3. Uninsulated Non-Metallic Pipe, Conduit, and Tubing:
 - a. 2 Hour Construction: UL System W-L-2078; Hilti CP 643N/644 Firestop Collar.
 - b. 1 Hour Construction: UL System W-L-2078; Hilti CP 643N/644 Firestop Collar.
 - 4. Insulated Pipes:
 - a. 2 Hour Construction: UL System W-L-5028; Hilti FS-ONE MAX Intumescent Firestop Sealant.
 - b. 1 Hour Construction: UL System W-L-5028; Hilti FS-ONE MAX Intumescent Firestop Sealant.
 - 5. HVAC Ducts, Insulated:
 - a. 2 Hour Construction: UL System W-L-7156; Hilti FS-ONE MAX Intumescent Firestop Sealant.
 - b. 1 Hour Construction: UL System W-L-7156; Hilti FS-ONE MAX Intumescent Firestop Sealant.

2.6 MATERIALS

- A. Firestopping Sealants: Provide only products having lower volatile organic compound (VOC) content than required by South Coast Air Quality Management District Rule No.1168.
- B. Elastomeric Silicone Firestopping: Single component silicone elastomeric compound and compatible silicone sealant; conforming to the following:
 - 1. Manufacturers:
 - a. 3M Fire Protection Products; Product CP-25WB: www.3m.com/firestop.
 - b. 3M Fire Barrier Silicone Sealant 2000+
 - c. HILTI FS-ONE MAX ; www.us.hilti.com

- d. Substitutions: See Section 01 6000 Product Requirements.
- C. Fiber Firestopping: Mineral fiber insulation used in conjunction with elastomeric surface sealer forming airtight bond to opening; conforming to the following:
 - 1. Density: 4 lb/cu ft.
 - 2. Manufacturers:
 - a. Thermafiber, Inc: www.thermafiber.com.
 - b. Substitutions: See Section 01 6000 Product Requirements.
- D. Primers, Sleeves, Forms, Insulation, Packing, Stuffing, and Accessories: Type required for tested assembly design.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify openings are ready to receive the work of this section.

3.2 PREPARATION

- A. Clean substrate surfaces of dirt, dust, grease, oil, loose material, or other matter that could adversely affect bond of firestopping material.
- B. Remove incompatible materials that could adversely affect bond.
- C. Install backing materials to arrest liquid material leakage.

3.3 INSTALLATION

- A. Install materials in manner described in fire test report and in accordance with manufacturer's instructions, completely closing openings.
- B. Do not cover installed firestopping until inspected by authorities having jurisdiction.
- C. Install labeling required by code.

3.4 FIELD QUALITY CONTROL

- A. Independent Testing Agency: Inspection agency employed and paid by Greenwich Public Schools, will examine penetration firestopping in accordance with ASTM E2174, 93Standard Practice for On-Site Inspection of Installed Fire Stops and ASTM E2393, 93Standard Practice for On-Site Inspection of Installed Fire Stop Joint Systems.
- B. Repair or replace penetration firestopping and joints at locations where inspection results indicate firestopping or joints do not meet specified requirements.

3.5 CLEANING

A. Clean adjacent surfaces of firestopping materials.

3.6 **PROTECTION**

A. Protect adjacent surfaces from damage by material installation.

END OF SECTION

JOINT SEALANTS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SECTION INCLUDES

- A. Nonsag gunnable joint sealants.
- B. Self-leveling pourable joint sealants.
- C. Joint backings and accessories.

1.3 RELATED REQUIREMENTS

- A. Section 01 6116 Volatile Organic Compound (VOC) Content Restrictions: Additional requirements for sealants and primers.
- B. Section 07 8400 Firestopping: Firestopping sealants.
- C. Section 08 1113 Hollow Metal Doors and Frames.
- D. Section 08 1116 Aluminum Doors and Aluminum Frames.
- E. Section 08 7100 Door Hardware: Setting exterior door thresholds in sealant.
- F. Section 09 2116 Gypsum Board Assemblies: Sealing acoustical and sound-rated walls and ceilings.
- G. Section 09 3000 Tiling: Sealant between tile and plumbing fixtures and at junctions with other materials and changes in plane.
- H. 09 6725 Epoxy Resin Flooring: For sealants in epoxy resin floors.

1.4 REFERENCE STANDARDS

- A. ASTM C661 Standard Test Method for Indentation Hardness of Elastomeric-Type Sealants by Means of a Durometer; 2006 (Reapproved 2011).
- B. ASTM C919 Standard Practice for Use of Sealants in Acoustical Applications; 2012.
- C. ASTM C920 Standard Specification for Elastomeric Joint Sealants; 2014.
- D. ASTM C1087 Standard Test Method for Determining Compatibility of Liquid-Applied Sealants with Accessories Used in Structural Glazing Systems; 2000 (Reapproved 2011).
- E. ASTM C1193 Standard Guide for Use of Joint Sealants; 2013.
- F. ASTM C1330 Standard Specification for Cylindrical Sealant Backing for Use with Cold Liquid-Applied Sealants; 2002 (Reapproved 2013).

1.5 SUBMITTALS

- A. See Section 01 3000 Administrative Requirements, for submittal procedures.
- B. Product Data for Sealants: Submit manufacturer's technical data sheets for each product to be used, that includes the following.
 - 1. Physical characteristics, including movement capability, VOC content, hardness, cure time, and color availability.
 - 2. List of backing materials approved for use with the specific product.
 - 3. Substrates that product is known to satisfactorily adhere to and with which it is compatible.
 - 4. Substrates the product should not be used on.
 - 5. Substrates for which use of primer is required.
 - 6. Sample product warranty.
 - 7. Certification by manufacturer indicating that product complies with specification requirements.

- C. Product Data for Accessory Products: Submit manufacturer's technical data sheet for each product to be used, including physical characteristics, installation instructions, and recommended tools.
- D. Color Cards for Selection: Where sealant color is not specified, submit manufacturer's color cards showing standard colors available for selection.

1.6 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum five (5) years documented experience.
- B. Installer Qualifications: Company specializing in performing the work of this section and with at least three years of documented experience.
- C. Field Quality Control Plan:
 - 1. Visual inspection of entire length of sealant joints.

1.7 MOCK-UP

- A. Mockups: Before installing joint sealants, apply elastomeric sealants as follows to verify selections made under sample submittals and to demonstrate aesthetic effects and qualities of materials and execution:
 - 1. Joints in mockups of assemblies specified in other Sections that are indicated to receive elastomeric joint sealants, which are specified by reference to this Section.
- B. Construct mock-up with specified sealant types and with other components noted.
- C. Locate where directed.
- D. Mock-up may remain as part of the Work.

1.8 WARRANTY

- A. See Section 01 7800 Closeout Submittals, for additional warranty requirements.
- B. Correct defective work within a five year period after Date of Substantial Completion.
- C. Warranty: Include coverage for installed sealants and accessories that fail to achieve watertight seal, exhibit loss of adhesion or cohesion, or do not cure.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Non-Sag Sealants: Permits application in joints on vertical surfaces without sagging or slumping.
 - 1. Dow Corning Corporation: www.dowcorning.com/construction/#sle.
 - 2. Sika Corporation: www.usa-sika.com.
 - 3. W.R. Meadows, Inc: www.wrmeadows.com/sle.
- B. Self-Leveling Sealants: Pourable or self-leveling sealant that has sufficient flow to form a smooth, level surface when applied in a horizontal joint.
 - 1. Sika Corporation: www.usa-sika.com/#sle.
 - 2. W.R. Meadows, Inc: www.wrmeadows.com/#sle.

2.2 JOINT SEALANT APPLICATIONS

- A. Scope:
 - 1. Exterior Joints: Seal open joints, whether or not the joint is indicated on drawings, unless specifically indicated not to be sealed. Exterior joints to be sealed include, but are not limited to, the following items.
 - a. Joints between door, window, and other frames and adjacent construction.
 - b. Other joints indicated.
 - 2. Interior Joints: Do not seal interior joints unless specifically indicated to be sealed. Interior joints to be sealed include, but are not limited to, the following items.
 - a. Joints between door, window, and other frames and adjacent construction.

- b. Other joints indicated below.
- 3. Do not seal the following types of joints.
 - a. Joints indicated to be treated with manufactured expansion joint cover or some other type of sealing device.
 - b. Joints where sealant is specified to be provided by manufacturer of product to be sealed.
 - c. Joints where installation of sealant is specified in another section.
 - d. Joints between suspended panel ceilings/grid and walls.
- B. Vertical Exterior Joints: Use non-sag non-staining silicone sealant, unless otherwise indicated.
- C. Interior Vertical Joints: Use non-sag non-staining silicone sealant, unless otherwise indicated.
 - 1. Joints between Fixtures in Wet Areas and Floors, Walls, and Ceilings: Mildew-resistant silicone sealant; white.
- D. Interior Wet Areas: Bathrooms and restrooms; fixtures in wet areas include plumbing fixtures, countertops, cabinets, and other similar items.

2.3 JOINT SEALANTS - GENERAL

A. Sealants and Primers: Provide products with levels of volatile organic compound (VOC) content as indicated in Section 01 6116.

2.4 NONSAG JOINT SEALANTS

- A. Mildew-Resistant Silicone Sealant: ASTM C920, Grade NS, Uses M and A; single component, mildew resistant; not expected to withstand continuous water immersion or traffic.
 - 1. Color: White.
 - 2. Applications: Use for:
 - a. Use for all perimeter joints of toilet fixtures, cabinets, casework, countertops and similar locations..
 - 3. Manufacturers:
 - a. 786 Mildew Resistant; Dow Corning.
 - b. Pecora Corporation; 898 Silicone Sanitary Sealant: www.pecora.com.
 - c. Sika Corporation; Sikasil GP: www.usa-sika.com/#sle.
 - d. Sanitary 1700; GE Silicones..
 - 4. Substitutions: 01 2500 Substitution Procedures
- B. Polyurethane Sealant: ASTM C920, Grade NS, Uses M and A; single component; not expected to withstand continuous water immersion or traffic.
 - 1. Movement Capability: Plus and minus 25 percent, minimum.
 - 2. Color: To be selected by Fuller and D'Angelo, P.C. from manufacturer's standard range.
 - 3. Service Temperature Range: Minus 40 to 180 degrees F.
 - 4. Manufacturers:
 - a. Pecora Corporation; Dynatrol I;: www.pecora.com.
 - b. Sika Corporation; Sikaflex-1a: www.usa-sika.com.
 - 5. Applications: Use for:
 - a. All exterior and interior vertical joints.
 - 6. Substitutions: 01 2500 Substitution Procedures
- C. Type Acoustical Sealant: Acrylic Emulsion Latex: Water-based; ASTM C834, single component, non-staining, non-bleeding, non-hardening, non-sagging; not intended for exterior use.
 - 1. Color: To be selected by Fuller and D'Angelo, P.C. from manufacturer's standard range.
 - 2. Grade: ASTM C834; Grade Minus 18 Degrees C.
 - 3. Manufacturers:
 - a. Pecora Corporation; AC-20 FTR Acoustical and Insulation Sealant: www.pecora.com.

- 4. Applications: Use for:
 - a. Use for all interior joints of where acoustical sealant indicated.
- 5. Substitutions: 01 2500 Substitution Procedures

2.5 SELF-LEVELING SEALANTS

- A. Self-Leveling Silicone Sealant: ASTM C920, Grade P, Uses M and A; single or multicomponent, explicitly approved by manufacturer for traffic exposure when recessed below traffic surface; not expected to withstand continuous water immersion.
 - 1. Movement Capability: Plus 100 percent, minus 50 percent, minimum.
 - 2. Hardness Range: 0 to 15, Shore A, when tested in accordance with ASTM C661.
 - 3. Color: To be selected by Fuller and D'Angelo, P.C. from manufacturer's standard range.
 - 4. Service Temperature Range: Minus 40 to 180 degrees F.
 - 5. Manufacturers:
 - a. Sika Corporation; Sikaflex 1c SL: www.usa-sika.com/#sle.
 - b. Use for all horizontal exterior joints and Interior joints in wet areas..
 - c. Substitutions: 01 2500 Substitution Procedures

2.6 ACCESSORIES

- A. Backer Rod: Cylindrical cellular foam rod with surface that sealant will not adhere to, compatible with specific sealant used, and recommended by backing and sealant manufacturers for specific application.
 - 1. Type for Joints Not Subject to Pedestrian or Vehicular Traffic: ASTM C1330; Type O Open Cell Polyurethane.
 - 2. Type for Joints Subject to Pedestrian or Vehicular Traffic: ASTM C1330; Type C Closed Cell Polyethylene.
 - 3. Open Cell: 40 to 50 percent larger in diameter than joint width. (Not to be used in flat or horizontal joints)
 - 4. Closed Cell and Bi-Cellular: 25 to 33 percent larger in diameter than joint width. (Use for flat and hoizontal joints)
- B. Backing Tape: Self-adhesive polyethylene tape with surface that sealant will not adhere to and recommended by tape and sealant manufacturers for specific application.
- C. Masking Tape: Self-adhesive, nonabsorbent, non-staining, removable without adhesive residue, and compatible with surfaces adjacent to joints and sealants.
- D. Primers: Type recommended by sealant manufacturer to suit application; non-staining.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify that joints are ready to receive work.
- B. Verify that backing materials are compatible with sealants.
- C. Verify that backer rods are of the correct size.

3.2 PREPARATION

- A. Remove loose materials and foreign matter that could impair adhesion of sealant.
- B. Clean joints, and prime as necessary, in accordance with manufacturer's instructions.
- C. Perform preparation in accordance with manufacturer's instructions and ASTM C1193.
- D. Mask elements and surfaces adjacent to joints from damage and disfigurement due to sealant work; be aware that sealant drips and smears may not be completely removable.

3.3 INSTALLATION

A. Perform work in accordance with sealant manufacturer's requirements for preparation of surfaces and material installation instructions.

- B. Perform installation in accordance with ASTM C1193.
- C. Measure joint dimensions and size joint backers to achieve width-to-depth ratio, neck dimension, and surface bond area as recommended by manufacturer, except where specific dimensions are indicated.
- D. Install bond breaker backing tape where backer rod cannot be used.
- E. Install sealant free of air pockets, foreign embedded matter, ridges, and sags, and without getting sealant on adjacent surfaces.
- F. Do not install sealant when ambient temperature is outside manufacturer's recommended temperature range, or will be outside that range during the entire curing period, unless manufacturer's approval is obtained and instructions are followed.
- G. Nonsag Sealants: Tool surface concave, unless otherwise indicated; remove masking tape immediately after tooling sealant surface.
- H. Self-leveling joints: Recess joint depth as recommended by the sealant manufacturer.

3.4 FIELD QUALITY CONTROL

- A. Perform field quality control inspection/testing as specified in PART 1 under QUALITY ASSURANCE article.
- B. Remove and replace failed portions of sealants using same materials and procedures as indicated for original installation.

END OF SECTION

HOLLOW METAL DOORS AND FRAMES

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SECTION INCLUDES

- A. Non-fire-rated hollow metal doors and frames.
- B. Hollow metal borrowed lites glazing frames.
- C. Patching existing metal frames.

1.3 RELATED REQUIREMENTS

- A. Section 08 1613 Fiberglass Doors and Aluminum Frames.
- B. Section 08 7100 Door Hardware.
- C. Section 09 9123 Interior Painting: Field painting.

1.4 ABBREVIATIONS AND ACRONYMS

- A. ANSI: American National Standards Institute.
- B. NAAMM: National Association of Architectural Metal Manufacturers.
- C. SDI: Steel Door Institute.

1.5 REFERENCE STANDARDS

- A. ADA Standards Americans with Disabilities Act (ADA) Standards for Accessible Design; 2010.
- B. ANSI/ICC A117.1 American National Standard for Accessible and Usable Buildings and Facilities; International Code Council; 2009.
- C. ANSI/SDI A250.4 Test Procedure and Acceptance Criteria for Physical Endurance for Steel Doors, Frames and Frame Anchors; 2011.
- D. ANSI/SDI A250.6 Recommended Practice for Hardware Reinforcing on Standard Steel Doors and Frames; 2003 (R2009).
- E. ANSI/SDI A250.8 Specifications for Standard Steel Doors and Frames (SDI-100); 2014.
- F. ANSI/SDI A250.10 Test Procedure and Acceptance Criteria for Prime Painted Steel Surfaces for Steel Doors and Frames; 2011.
- G. ASTM A653/A653M Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2015.
- H. ASTM E413 Classification for Rating Sound Insulation; 2010.
- I. BHMA A156.115 American National Standard for Hardware Preparation in Steel Doors and Steel Frames; 2014.
- J. ICC A117.1 Accessible and Usable Buildings and Facilities; 2009.
- K. NAAMM HMMA 830 Hardware Selection for Hollow Metal Doors and Frames; 2002.
- L. NAAMM HMMA 831 Hardware Locations for Hollow Metal Doors and Frames; 2011.
- M. NAAMM HMMA 840 Guide Specifications for Installation and Storage of Hollow Metal Doors and Frames; 2007.
- N. NAAMM HMMA 860 Guide Specifications for Hollow Metal Doors and Frames; 2013.
- O. NAAMM HMMA 861 Guide Specifications for Commercial Hollow Metal Doors and Frames; 2006.
- P. NFPA 80 Standard for Fire Doors and Other Opening Protectives; 2016.
- Q. NFPA 252 Standard Methods of Fire Tests of Door Assemblies; 2012.

- R. SDI 117 Manufacturing Tolerances for Standard Steel Doors and Frames; 2013.
- S. UL 10B Standard for Fire Tests of Door Assemblies; Current Edition, Including All Revisions.

1.6 SUBMITTALS

- A. See Section 01 3000 Administrative Requirements, for submittal procedures.
- B. Product Data: Materials and details of design and construction, hardware locations, reinforcement type and locations, anchorage and fastening methods, and finishes .
- C. Shop Drawings: Details of each opening, showing elevations, glazing, frame profiles, and any indicated finish requirements.
- D. Installation Instructions: Manufacturer's published instructions, including any special installation instructions relating to this project.
- E. Manufacturer's Qualification Statement.

1.7 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than five (5) years documented experience.
- B. Installer Qualifications: Company specializing in performing work of the type specified and with at least three years of documented experience.
- C. Maintain at project site copies of reference standards relating to installation of products specified.
- D. Installed Fire Rated Door Assembly: Conform to NFPA 80 for fire rated class as scheduled.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Comply with NAAMM HMMA 840 or ANSI/SDI A250.8 (SDI-100) in accordance with specified requirements.
- B. Protect with resilient packaging; avoid humidity build-up under coverings; prevent corrosion and adverse effects on factory applied painted finish.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Basis of design: Hollow Metal Doors and Frames:
 - 1. Steelcraft, an Allegion brand 1819 N. Pennsylvania St. Carmel, IN 46032; Toll Free Tel: 877-578-1247 ,; Product L-Series : www.allegion.com/us.
 - 2. Substitutions: See Section 01 2500 Substitution Procedures.

2.2 PERFORMANCE REQUIREMENTS

- A. Requirements for Hollow Metal Doors and Frames:
 - 1. Accessibility: Comply with ICC A117.1 and ADA Standards.
 - 2. Door Edge Profile: Manufacturers standard for application indicated.
 - 3. Typical Door Face Sheets: Flush and Flush. Refer to Door Schedule for additional information.
 - 4. Glazed Lights: Non-removable stops on non-secure side; sizes and configurations as indicated on drawings. Style: Flush.
 - Hardware Preparations, Selections and Locations: Comply with NAAMM HMMA 830 and NAAMM HMMA 831 or BHMA A156.115 and ANSI/SDI A250.8 (SDI-100) in accordance with specified requirements.
 - a. Provide 14 gauge channel reinforcing for all door closers.
 - b. Provide preparation for all electrical hardware where required.
 - 6. Galvanizing including toilets, janitor closets, and etc: All components hot-dipped zinc-iron alloy-coated (galvannealed), manufacturer's standard coating thickness.
 - a. Finish: Factory primed, for field finishing

B. Combined Requirements: If a particular door and frame unit is indicated to comply with more than one type of requirement, comply with the specified requirements for each type; for instance, an exterior door that is also indicated as being sound-rated must comply with the requirements specified for exterior doors and for sound-rated doors; where two requirements conflict, comply with the most stringent.

2.3 STEEL DOORS NON EMBOSSED

- A. Door Finish: Factory primed and field finished. Smooth
- B. Interior Doors, Non-Fire Rated and Fire Rated:
 - 1. Grade: ANSI A250.8 (14 gauge) Level 4, physical performance Level A, Model 2, seamless, continuous welded.
 - a. Physical Performance Level A, 1,000,000 cycles; in accordance with ANSI/SDI A250.4.
 - b. Model 2 Seamless.
 - c. Top and Bottom Capped
 - d. Door Face Metal Thickness: 14 gage, 0.067 inch, minimum.
 - e. Zinc Coating: A60/ZF180 galvannealed coating; ASTM A653/A653M.
 - 2. Core Material: Vertical steel stiffeners, 22ga. 6" max. spacing welded to face sheets 5" o.c.
 - 3. Door Thickness: 1-3/4 inch, nominal.
 - 4. Door Face Sheets: Flush.
 - 5. Core: Honeycomb
 - 6. Door Finish: Factory primed and field finished. Primer

2.4 HOLLOW METAL FRAMES

- A. Comply with standards and/or custom guidelines as indicated for corresponding door in accordance with applicable door frame requirements.
- B. Frame Finish: Factory primed and field finished.
- C. Repair Frames as indicated on drawings, cut and reweld new frame material and finish to match exsiting surfaces. Prime and paint.
- D. Interior Door Frames, Non-Fire Rated: Full profile/continuously welded type.
 1. Frame Metal Thickness: 16 gage, 0.053 inch, minimum.

2.5 FINISHES

A. Primer: Rust-inhibiting, complying with ANSI/SDI A250.10, door manufacturer's standard.

2.6 ACCESSORIES

- A. Mechanical Fasteners for Concealed Metal-to-Metal Connections: Self-drilling, self-tapping, steel with electroplated zinc finish.
- B. Grout for Frames: Portland cement grout with maximum 4 inch slump for hand troweling; thinner pumpable grout is prohibited.
- C. Silencers: Resilient rubber, fitted into drilled hole; provide three on strike side of single door, three on center mullion of pairs, and two on head of pairs without center mullions.
- D. Temporary Frame Spreaders: Provide for factory- or shop-assembled frames.
- E. Frame Anchors: Minimum of six wall anchors and two base anchors.
 - 1. T anchors for masonry.
- F. Existing Frame Repairs:
 - 1. Repair dents, patch rust holes, fill in chips etc.
 - 2. Body Filler With Hardener.
 - 3. Color: Light Gray.
 - 4. Manufacturer: 3M Product "Bondo Body Filler 265".

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify existing conditions before starting work.
- B. Verify that opening sizes and tolerances are acceptable.
- C. Verify that finished walls are in plane to ensure proper door alignment.

3.2 PREPARATION

- A. Coat inside of frames to be installed in masonry or to be grouted, with bituminous coating, prior to installation.
- B. Patch existing frames as required to remove rust, dents, chips and fill holes.
 - 1. Apply body filler i accordance to manufacturer's instruction.
 - 2. Sand surfaces smooth.

3.3 INSTALLATION

- A. Install doors in accordance with manufacturer's instructions and related requirements of specified door and frame standards or custom guidelines indicated.
- B. Coordinate frame anchor placement with wall construction.
- C. Grout frames in masonry construction, using hand trowel methods; brace frames so that pressure of grout before setting will not deform frames.
- D. Install door hardware as specified in Section 08 7100.

3.4 TOLERANCES

- A. Clearances Between Door and Frame: Comply with related requirements of specified frame standards or custom guidelines indicated in accordance with SDI 117 or NAAMM HMMA 861.
- B. Maximum Diagonal Distortion: 1/16 inch measured with straight edge, corner to corner.

3.5 ADJUSTING

A. Adjust for smooth and balanced door movement.

END OF SECTION

FIBERGLASS DOORS AND ALUMINUM FRAMES

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SECTION INCLUDES

- A. Fiberglass reinforced polyester ((FRP) doors.
- B. Fiberglass reinforced polyester (FRP) fire-rated doors.
- C. Patching existing metal frames.
- D. Snap trim.
- E. Factory installed Finish Hardware
- F. Accessories.

1.3 RELATED REQUIREMENTS

- A. Section 08 1213 Hollow Metal Frames: Metal frames.
- B. Section08 7100 Door Hardware.

1.4 REFERENCE STANDARDS

- A. ASTM B 209 Aluminum and Aluminum-Alloy Sheet and Plate.
- B. ASTM B 221 Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.
- C. ASTM D 543 Evaluating the Resistance of Plastics to Chemical Reagents
- D. ASTM D 570 Water Absorption of Plastics
- E. ASTM D 638 Tensile Properties of Plastics
- F. ASTM D 790 Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials
- G. ASTM D 1621 Compressive Properties of Rigid Cellular Plastics
- H. ASTM D 1623 Tensile and Tensile Adhesion Properties of Rigid Cellular Plastics
- I. ASTM D 2126 Response of Rigid Cellular Plastics to Thermal and Humid Aging
- J. ASTM D 2583 Indentation Hardness of Rigid Plastics by Means of a Barcol Impressor
- K. ASTM D 5420 Impact Resistance of Flat Rigid Plastic Specimens by Means of a Falling Weight.
- L. ASTM D 6670-01 Standard Practice for Full-Scale Chamber Determination of Volatile Organic Emissions from Indoor Materials/Products
- M. ASTM E84 Standard Test Method for Surface Burning Characteristics of Building Materials; 2015a.
- N. ASTM E2112 Standard Practice for Installation of Exterior Windows, Doors and Skylights; 2007.
- O. ASTM E 90 Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions.
- P. UL 10C Standard for Positive Pressure Fire Tests of Door Assemblies; Current Edition, Including All Revisions.
- Q. ASTM E 330 Structural Performance of Exterior Windows, Curtain Walls, and Doors by Uniform Static Air Pressure Difference.
- R. ASTM E 331 Test Method for Water Penetration of Exterior Windows, Curtain Walls and Doors by Uniform Static Air Pressure Difference.
- S. ASTM F 476 Security of Swinging Door Assemblies.
- T. NWWDA T.M. 7-90 Cycle Slam Test Method

- U. SFBC PA 201 Impact Test Procedures.
- V. SFBC PA 203 Criteria for Testing Products Subject to Cyclic Wind Pressure Loading.
- W. SFBC 3603.2 (b)(5) Forced Entry Resistance Test.
- X. NFPA 252 Fire Tests of Door Assemblies.
- Y. UBC Standard 7-2 Fire Tests of Door Assemblies.
- Z. UL 10C Positive Pressure Fire Tests of Door Assemblies

1.5 ADMINISTRATIVE REQUIREMENTS

A. Coordination: Obtain hardware templates from hardware manufacturer prior to starting fabrication.

1.6 SUBMITTALS

- A. See Section 01 3000 Administrative Requirements, for submittal procedures.
- B. Product Data: Provide manufacturer's standard details, installation instructions, hardware and anchor recommendations.
- C. Test Reports: Show compliance with specified criteria.
- D. Shop Drawings: Show layout and profiles; include assembly methods. Shop drawings to be prepared by door manufacturer.
 - 1. Indicate product components, including hardware reinforcement locations and preparations, accessories, finish colors, patterns, and textures.
 - 2. Indicate wall conditions, door and frame elevations, at 1/2" scale, half-sized detail sections, materials, gages, finishes, location of door hardware by dimension, and details of openings; use same reference numbers indicated on Drawings to identify details and openings. expansion provisions, and other components not included in the manufacturer's standard data. Include glazing details
- E. Selection Samples: Submit two complete sets of color chips, illustrating manufacturer's available finishes, colors, and textures.
 - 1. Where normal color and texture variations are expected, include two or more units in each sample to show the range of such variations.
- F. Architect reserves the right to require samples of typical fabricated section, showing joints, exposed fastenings (if any), quality of workmanship, hardware and accessory items, before fabrication of the work proceeds.
- G. Door Corner Sample: Submit corner cross sections, 10 inch by 10 inch in size, illustrating construction, finish, color, and texture.
- H. Manufacturer's Qualification Statement.
- I. Maintenance Data: Include instructions for repair of minor scratches and damage.
- J. Warranty: Submit manufacturer warranty and ensure that forms have been completed in Greenwich Public Schools's name and registered with manufacturer; include detailed terms of warranty.

1.7 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing products of the type specified in this section, with not less than ten years of documented experience.
 - 1. Door and frame components from same manufacturer.
 - 2. Evidence of a compliant documented quality management system.
- B. Standards: Comply with the requirements and recommendations in applicable specifications and standards by NAAMM, AAMA, and AA, including the terminology definitions, and specifically including the "Entrance Manual" by NAAMM, except to the extent more stringent requirements are indicated.
- C. All materials, equipment and operation supplied shall conform to all Code requirements including Accessibility for the Handicapped.

- D. Installer Qualifications: Company specializing in installing products of the type specified in this section with not less than five (5) years of documented experience, and approved by the manufacturer.
- E. The manufacturer shall provide a factory trained technician to visit this project and instruct the installers in the proper installation of the door and frame assemblies.

1.8 FIELD MEASUREMENT:

A. Verify field measurements prior to fabrication of doors and frames to insure proper fitting of assemblies. Successful bidders are expected to field verify all dimensions, sizes, quantities and the material required to complete this project. Failure to do so will not relieve the successful contractor from the necessity of furnishing any and all materials that my be required, without any additional costs to the Owner.

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Mark doors with location of installation, door type, color, and weight.
- B. Deliver materials in manufacturer's original, unopened, undamaged containers with identification labels intact. Materials shall be inspected for damage, and the manufacturer shall be advised immediately of any discrepancies. Unsatisfactory materials are not to be used
- C. Handling: Protect materials and finish from damage during handling and installation.
- D. Store materials in original corrugated packaging, under cover, protected from exposure to harmful weather conditions and from direct contact with water.
 - 1. Doors shall be "floated" within cartons, with no portion of the door having contact with the outer shell of the container.
 - 2. Store at temperature and humidity conditions recommended by manufacturer.
 - 3. Do not use non-vented plastic or canvas shelters.
 - 4. Immediately remove wet wrappers.
 - 5. Store in position recommended by manufacturer, elevated minimum 4 inch above grade, with minimum 1/4 inch space between doors.

1.10 FIELD CONDITIONS

- A. Field measure all existing door openings prior to fabrication.
- B. Identify all existing fire rated doors prior to fabrication.

1.11 WARRANTY

- A. See Section 01 7800 Closeout Submittals, for additional warranty requirements.
- B. Special Project Warranty:
 - 1. Provide a written warranty signed by Manufacturer, Installer and Contractor, agreeing to replace, at no cost to the Owner, any doors or frames that fail in materials or workmanship, within the time period of acceptance, as indicated below. Failure of materials or workmanship includes excessive deflection, faulty operation of entrances, deterioration of finish, or construction, in excess of normal weathering, and defects in hardware, weather stripping, and other components of the work. In addition the manufacturer further certifies that they have factory installed all hardware and such hardware is also guaranteed not to come loose during the guarantee period.
 - 2. Warranty Time Period: Ten Years from substantial completion.
 - 3. In addition, a limited lifetime (while the door is in its specified application in its original installation) warranty covering: failure due to corrosion on FRP components.

PART 2 PRODUCTS

2.1 MANUFACTURERS

Basis of Design: Special-Lite, Inc., PO Box 6, Decatur, Michigan 49045. Toll Free (800) 821-6531.
 Phone (269) 423-7068. Fax (800) 423-7610. Web Site www.special-lite.com. E-Mail info@special-lite.com.

2.2 EXISTING HOLLOW METAL DOOR FRAMES

- A. Existing Frames: All existing frames in rated opening, without UL labels shall be certified as conforming to rating indicated on drawings.
- B. Frame Repairs:
 - 1. Repair dents, patch rust holes, fill in chips etc.
 - 2. Body Filler With Hardener.
 - 3. Color: Light Gray.
 - 4. Manufacturer: 3M Product "Bondo Body Filler 265".

2.3 FIBERGLASS REINFORCED POLYESTER (FRP) DOORS: (Non Rated)

A. Performance:

1.

- Face Sheet.
 - a. Interior Face Only Class A 0.120" thick, Sandstone texture, through color FRP sheet.
 - a) Flexural Strength, ASTM-D790: 14 x 103 psi.
 - b) Flexural Modulus, ASTM-D790: 0.4 x 106 psi.
 - c) Tensile Strength, ASTM-D638: 7 x 103 psi.
 - d) Tensile Modulus, ASTM-D638: 0.8 x 106 psi.
 - e) Barcol Hardness, ASTM-D2583: 45.
 - f) Izod Impact, ASTM-D256: 4.0 ft-lb/in notched.
 - g) Water Absorption, ASTM-D570: 0.16%/24hrs at 77°F.
 - h) Surface Burning, ASTM-E84: Flame Spread ? 25, Smoke Developed ? 450.
 - i) Taber Abrasion Resistance, Taber Test: 0.036% Max Wt. Loss, cs-17 wheels, 1000g. Wt., 25 cycles.
- 2. Stiles & Rails.
 - Fastener Withdrawal, ASTM-D1761: 894 lbs.
- B. Door Opening Size.

a.

- As indicated on door schedule.
- C. Construction.

1.

- 1. Door Thickness.
 - a. 1-3/4".
- 2. Stiles & Rails.
 - a. Pultruded fiberglass with integral channels for securing corner reinforcing clip.
- 3. Corners.
 - a. Mitered.
 - b. Secured with pultruded fiberglass corner clip chemically welded to stiles and rails.
 - c. Mechanical fasteners to secure corner joints not acceptable.
- 4. Core.
 - a. PP Polypropylene Honeycomb.
 - a) 5.0 pcf density.
 - b) High strength to weight ratio.
 - c) Corrosion, fungi, rot, chemical and moisture resistant.
 - d) Sound and vibration dampening.
 - e) Energy absorbing and recyclable.
- D. Face Sheet.
 - 1. Interior
 - a. 0.120" thick, sandstone texture, through color with integral surface seal film FRP sheet.
 - b. Class C standard.

- c. Class A. consult manufacturer.
- 2. Attachment of face sheet.
 - a. Face sheets adhered to stiles, rails, and core using hot melt adhesive evenly coated across all surfaces to produce strong bond and prevent moisture absorption.

E. Cutouts.

- 1. Manufacture doors with cutouts for .
- F. Hardware.
 - 1. Pre-machine doors in accordance with templates from specified hardware manufacturers.
 - 2. Surface mounted closures will be reinforced for but not prepped or installed at factory.
 - 3. Refer to Section 08 7100 Door Hardware.
- G. Reinforcements.
 - 1. Solid high-density polyurethane shapes chemically welded to stiles, rails and/ or core.
 - 2. No metallic reinforcements will be allowed.

H. Finishes:

- 1. Door: a.
 - FRP Face Sheets
 - a) Through color.
 - (a) Color.As selected from manufacturers standard colors.

I. Model.

1. Special-Lite AF-220 Sandstone Texture Composite Fiberglass Door.

2.4 FIBERGLASS REINFORCED POLYESTER (FRP) DOORS: (Fire Rated)

- A. Performance:
 - 1. Face Sheet.

a.

Optional Interior Face Class A 0.120" thick, Sandstone texture, through color FRP sheet.

- a) Flexural Strength, ASTM-D790: 14 x 103 psi.
- b) Flexural Modulus, ASTM-D790: 0.4 x 106 psi.
- c) Tensile Strength, ASTM-D638: 7 x 103 psi.
- d) Tensile Modulus, ASTM-D638: 0.8 x 106 psi.
- e) Barcol Hardness, ASTM-D2583: 45.
- f) Izod Impact, ASTM-D256: 4.0 ft-lb/in notched.
- g) Water Absorption, ASTM-D570: 0.16%/24hrs at 77°F.
- h) Surface Burning, ASTM-E84: Flame Spread ? 25, Smoke Developed ? 450.
- i) Taber Abrasion Resistance, Taber Test: 0.036% Max Wt. Loss, cs-17 wheels, 1000g. Wt., 25 cycles.

B. Description:

- 1. Rated: 45 min maximum duration.
- 2. Door Opening Size.
 - a. As iinidicated on drawings.Click or tap here to enter text.
- 3. Construction.
 - a. Door Thickness.
 - a) 1-7/8" at door edge.
 - b. Stiles.
 - a) Single Swing.
 - (a) Hinge and lock stile, 2" minimum tectonite.
 - b) Standard Pairs.
 - (a) Hinge stile, 2" minimum tectonite.

- (b) Meeting edge, 3" minimum tectonite.
- c. Rails.
 - a) Top rail, 6" minimum tectonite.
 - b) Bottom rail, 4" minimum for single swing, 4-1/2" minimum for pairs tectonite.
- d. Core.
 - a) WSCP-412 proprietary mineral core.
 - b) 1-1/2" nominal thickness.
 - c) 18 pcf minimum density.
- e. Face Sheet.
 - a) Interior
 - (a) 0.120" thick, Sandstone texture, through color FRP sheet.
 - (b) Class A available consult manufacturer.
- f. Edge Channels.
 - a) 0.062" thick, 3/4" leg, stainless steel edge channel.
 - b) Applied to entire perimeter of the door.
 - c) Sealed by 3M CP 25WB + Fire Barrier caulk applied to the inside edges of all the steel edge channels.
- g. Cutouts.
 - a) Manufacture doors with cutouts .
- h. Hardware.
 - a) Pre-machine doors in accordance with templates from specified hardware manufacturers.
 - b) Surface mounted closures will be reinforced for but not prepped or installed at factory.
 - c) Refer to Section 08 7100 Door Hardware.
- 4. Field apply factory supplied gaskets and seals, full width intumescent and smoke seal required at top of door, smoke seals required on both jambs.

C. Finishes:

- 1. Door.
 - a. FRP Face Sheets
 - a) Through color.
 - (a) Color. As selected from manufacturers standard colors.

2.5 FINISH HARDWARE:

- A. Provide and factory install finish hardware for each door leaf as specified in Division 8 "Finish Hardware".
- B. SL-82 Class I Aluminum Recessed Pull Handles. Color selected by Architect.
- C. Receive Hardware supplied in accordance with this Section, and coordinate with additional Hardware requirements of Section 08 7100. Report discrepancies (in writing) to the Architect immediately.
- D. Reinforce, cut, drill and tap doors and frames as required to receive Hardware, except do not drill and tap for surface mounted closers and holders, which will be applied at the jobsite. Comply with Hardware manufacturer's instructions and template requirements. Use concealed fasteners wherever possible.
- E. Install all Hardware, except surface mounted closers and holders, at the fabrication plant. Remove only Hardware as required for final finishing or delivery to jobsite. Package and identify such Hardware and ship with doors and frames for installation at the project site.
- F. Painting: All existing surfaces to remain exposed, and all disturbed areas shall be painted to match existing surfaces.
- G. Hinge and hardware fasteners Stainless steel Type 304

2.6 FABRICATION:

- A. Sizes and Profiles: The required sizes for door and frame units, and profiles requirements are shown on the drawings.
- B. The details shown are based upon standard details by one or more manufacturers. It is intended that similar details by other manufacturers will be accepted, provided they comply with size requirements, and with minimum/maximum profile requirements as shown.
- C. Co-ordination of Fabrication: Check the actual frame or door openings in the construction work by accurate field measurements before fabrication, and show recorded measurements on final shop drawings. Coordinate fabrication schedule with construction progress, as directed by Contractor, and avoid delays of the work.
- D. Complete the cutting, fitting, forming, drilling and grinding of all metal work prior to the cleaning, finishing, treatment and application for coatings. Remove burrs from cut edges, and ease edges and corners to a radius of approximately 1/64".
- E. No Welding of joints will be accepted.
- F. Conceal fasteners, wherever possible, except as otherwise noted.
- G. Maintain continuity of line and accurate relation of planes and angles. Provide secure attachments and support at mechanical joints, with hairline fit at contacting members.
- H. Reinforce the work as necessary for performance requirements, and for support to the structure. Separate dissimilar metals with bituminous paint or preformed separators which will prevent corrosion. Separate metal surfaces at moving joints with non-metallic separators to prevent "freeze-up" of joints.

2.7 ACCESSORIES

A. Snap Trim as required. Match door and frame finish.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify actual dimensions of openings by field measurements before door fabrication; show recorded measurements on shop drawings.
- B. Do not begin installation until substrates have been properly prepared.

3.2 PREPARATION

- A. Remove existing doors and frames, and dispose of all removed materials in accordance with local authorities having jurisdiction.
- B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.
- C. Patch existing hollow metal frames as required to remove rust, dents, chips and fill holes.
 - 1. Apply body filler in accordance to manufacturer's instruction.
 - 2. Sand surfaces smooth.
- D. Clean and prepare substrate in accordance with manufacturer's directions.
- E. Protect adjacent work and finish surfaces from damage during installation.

3.3 INSTALLATION

- A. Install in accordance with manufacturer's instructions; do not penetrate frames with anchors.
- B. Install fire-rated assemblies in accordance with NFPA 80.
- C. Install exterior doors in accordance with ASTM E2112.
- D. Set units plumb, level, and true-to-line, without warping or racking doors or frames, and with specified clearances; anchor securely in place.

- E. Set thresholds in continuous bed of sealant.
- F. Install perimeter sealant in accordance with requirements specified in Section 07 9005.
 - 1. Fill all exterior spaces and joint between windows and doors solid with foam in accordance with manufacture's instructions.
 - 2. Cut back to permit application of joint sealant.
- G. Separate aluminum and other metal surfaces from sources of corrosion of electrolytic action at points of contact with other materials.
- H. Repair or replace damaged installed products.

3.4 ADJUSTING

- A. Lubricate, test, and adjust doors to operate easily, free from warp, twist or distortion, and to fit watertight for entire perimeter.
- B. Adjust hardware for smooth and quiet operation.
- C. Adjust doors to fit snugly and close without sticking or binding.

3.5 CLEANING

- A. Clean installed products in accordance with manufacturer's instructions prior to owner's acceptance.
- B. Do not use harsh cleaning materials or methods that would damage finish.

3.6 **PROTECTION**

- A. Protect installed products from damage until Date of Substantial Completion.
- B. Protect installed doors to ensure that, except for normal weathering, doors will be without damage or deterioration at time of substantial completion.
- C. Provide protective treatment and other precautions required through the remainder of the construction period, to ensure that the doors and frames will be without damage or deterioration (other than normal weathering) at the time of acceptance.

END OF SECTION

ACCESS DOORS AND PANELS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SECTION INCLUDES

A. Access door and frame units, non-fire-rated, in wall and ceiling.

1.3 RELATED REQUIREMENTS

- A. Section 09 9123 Interior Painting: Field paint finish.
- B. Divisions 22, 23 and 26: Mechanical/ Electrical components requiring access.

1.4 REFERENCE STANDARDS

- A. ADA Standards Americans with Disabilities Act (ADA) Standards for Accessible Design; 2010.
- B. ASTM A240/A240M Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications; 2015b.
- C. ASTM A1011/A1011M Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength; 2014.

1.5 SUBMITTALS

- A. See Section 01 3000 Administrative Requirements, for submittal procedures.
- B. Product Data: Provide sizes, types, finishes, hardware, scheduled locations, and details of adjoining work.
- C. Manufacturer's Installation Instructions: Indicate installation requirements and rough-in dimensions.
- D. Project Record Documents: Record actual locations of each access unit.

1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

PART 2 PRODUCTS

2.1 ACCESS DOOR AND PANEL APPLICATIONS

- A. Wall-Mounted Units:
 - 1. Location: Where required.
 - 2. Material: Steel, hot-dipped zinc or zinc-aluminum-alloy coated.
 - 3. all
 - 4. Size: 12 inch by 12 inch. minimum or as required to provide adequate access.
 - 5. Door/Panel: Hinged, standard duty, with tool-operated spring or cam lock and no handle.
 - 6. Wall Mounting Criteria: Provide surface-mounted face frame and door surface flush with frame surface.
 - 7. Gypsum Board Mounting Criteria: Provide drywall bead frame with door surface flush with wall surface.
 - 8. Masonry Mounting Criteria: Provide surface-mounted frame with door surface flush with frame surface.
- B. Wall-Mounted Units in Wet Areas:
 - 1. Size: 12 inch by 12 inch.
- C. Ceiling-Mounted Units:
 - 1. Location: As indicated on drawings.

- 2. Material: Steel, hot-dipped zinc, or zinc-aluminum-alloy coated.
- 3. Material: Stainless steel in wet areas.
- 4. Size : 12 inch by 12 inch. minimum or as required to provide adequate access.
- 5. Door/Panel: Hinged, standard duty, with tool-operated spring or cam lock and no handle.

2.2 MANUFACTURERS

- A. Wall and Ceiling Access Doors:
 - 1. Milcor by Commercial Products Group of Hart & Cooley, Inc: www.milcorinc.com.
 - 2. Substitutions: See Section 01 2500 Substitution Procedures.

2.3 WALL AND CEILING UNITS

- A. Access Doors: Factory fabricated door and frame units, fully assembled units with corner joints welded, filled, and ground flush; square and without rack or warp; coordinate requirements with assemblies that units are to be installed in.
 - 1. Style: Exposed frame with door surface flush with frame surface.
 - 2. Door Style: Single thickness with rolled or turned in edges.
 - 3. Frames: 16 gage, 0.0598 inch, minimum thickness.
 - 4. Single Steel Sheet Door Panels: 1/16 inch, minimum thickness.
- B. Door and Frame Units: Formed stainless steel.
 - 1. Frames and flanges: 0.058 inch steel.
 - 2. Hardware:
 - a. Hinges for Non-Fire-Rated Units: Concealed, constant force closure spring type.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that rough openings are correctly sized and located.

3.2 INSTALLATION

- A. Provide access doors for all dampers, valves, cleanest, junction boxes, pull boxes or similar items located above finished ceilings or ceiling breaks or extensions, behind finished walls or below finished floors. The access doors shall be steel, hinged types as required for type of construction.
 - 1. Where feasible locate all dampers, valves, cleanest, junction boxes, pull boxes or similar items above acoustical tile ceiling.
- B. In new walls, floor, ceiling, etc., access doors are to be installed by the General Construction Contractor and furnished by each Contractor whose work requires access.
- C. Access door required in existing walls, floors, ceilings, etc., shall be furnished and installed by the contractor requiring access.
- D. Provide access doors for all dampers, valves, cleanest, junction boxes, pull boxes or similar items located above finished ceilings or ceiling breaks or extensions, behind finished walls or below finished floors. The access doors shall be steel or stainless steel, hinged types as required for type of construction.
 - 1. Where feasible locate all dampers, valves, cleanest, junction boxes, pull boxes or similar items above acoustical tile ceiling.
- E. Install units in accordance with manufacturer's instructions.
- F. Install frames plumb and level in openings. Secure rigidly in place.
- G. Position units to provide convenient access to the concealed work requiring access.

END OF SECTION

DOOR HARDWARE

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SECTION INCLUDES

- A. Work of this Section includes all labor, materials, equipment and services necessary to furnish all the finish hardware as shown on the drawings and specified herein, including but not limited to the following:
 - 1. Hardware for aluminum and hollow metal doors.
 - 2. Field verification, preparation and modification of existing doors and frames to receive new door hardware
- B. Exclusions: Unless specifically listed in hardware sets, hardware is not specified in this section for:
 - 1. Cabinets (casework), including locks in cabinets

1.3 RELATED REQUIREMENTS

- A. Section 01 2300 Alternates for alternates affecting this section.
- B. Section 06 1000 Rough Carpentry.
- C. Section 07 9200 Joint Sealants for sealant requirements applicable to threshold installation specified in this section.
- D. Section 08 1113 Hollow Metal Doors and Frames.
- E. Section 08 1116 Aluminum Doors and Frames.
- F. Section 09 9123 Interior Painting.

1.4 REFERENCE STANDARDS

- A. American National Standards Institute ANSI 156.18 Materials and Finishes.
- B. ANSI/ICC A117.1 American National Standard for Accessible and Usable Buildings and Facilities; International Code Council; 2009.
- C. BHMA Builders Hardware Manufacturers Association.
- D. DHI Door and Hardware Institute.
 - 1. Sequence and Format for the Hardware Schedule
 - 2. Recommended Locations for Builders Hardware
 - 3. Key Systems and Nomenclature
- E. NFPA National Fire Protection Association.
- F. UL Underwriters Laboratories.
 - 1. UL 10B Fire Test of Door Assemblies
 - 2. UL 10C Positive Pressure Test of Fire Door Assemblies
 - 3. UL 1784 Air Leakage Tests of Door Assemblies
 - 4. UL 305 Panic Hardware
- G. New York State Building Code.
- H. ICC/IBC International Building Code
- I. SDI Steel Door Institute.
- J. ANSI/BHMA Certified Product Standards A156 Series
- K. BHMA A156.31 American National Standard for Electric Strikes and Frame Mounted Actuators; 2013.
- L. NFPA 80 Standard for Fire Doors and Other Opening Protectives; 2016.

M. NFPA 101 - Life Safety Code; 2015.

1.5 SUBMITTALS

- A. See Section 01 3000 Administrative Requirements, for submittal procedures.
- B. General:
 - 1. Submit in accordance with Conditions of Contract and Division 01 requirements.
 - 2. Highlight, encircle, or otherwise specifically identify on submittals deviations from Contract Documents, issues of incompatibility or other issues which may detrimentally affect the Work.
 - 3. Prior to forwarding submittal, comply with procedures for verifying existing door and frame compatibility for new hardware, as specified in PART 3, "EXAMINATION" article, herein
- C. Product Data: Manufacturer's catalog literature for each type of hardware, installation instructions, maintenance of operating parts and finish, and other information necessary to show compliance with requirements, marked to clearly show products to be furnished for this project.
- D. Keying Schedule: Submit for approval of Greenwich Public Schools.
- E. Samples: Provide the following prior to preparation of hardware schedule;
 - 1. Submit one (1) sample of hinge, latchset, lockset, and closer illustrating style, color, and finish.
 - 2. Samples will be incorporated into the Work.
- F. Manufacturer's Installation Instructions: Indicate special procedures, perimeter conditions requiring special attention.
- G. Maintenance Data: Include data on operating hardware, lubrication requirements, and inspection procedures related to preventative maintenance.
- H. Templates: After final approval of hardware schedule, provide templates for doors, frames and other work specified to be factory prepared for door hardware installation
- I. Keys: Deliver with identifying tags to Greenwich Public Schools by security shipment direct from hardware supplier.
- J. Informational Submittals:
 - 1. Qualification Data: For Supplier, Installer and Architectural Hardware Consultant.
 - 2. Product Certificates for electrified door hardware, signed by manufacturer:
 - a. Certify that door hardware approved for use on types and sizes of labeled fire-rated doors complies with listed fire-rated door assemblies.
- K. Certificates of Compliance:
 - 1. Certificates of compliance for fire-rated hardware and installation instructions if requested by Architect or Authority Having Jurisdiction.
 - 2. Installer Training Meeting Certification: Letter of compliance, signed by Contractor, attesting to completion of installer training meeting specified in "QUALITY ASSURANCE" article, herein.
 - 3. Electrified Hardware Coordination Conference Certification: Letter of compliance, signed by Contractor, attesting to completion of electrified hardware coordination conference, specified in "QUALITY ASSURANCE" article, herein.
- L. Product Test Reports: For compliance with accessibility requirements, based on evaluation of comprehensive tests performed by manufacturer and witnessed by qualified testing agency, for door hardware on doors located in accessible routes.
- M. Warranty: Special warranty specified in this Section
- N. Operations and Maintenance Data: Provide in accordance with Section 01 7800 Closeout Submittals and include:
 - 1. Complete information on care, maintenance, and adjustment; data on repair and replacement parts, and information on preservation of finishes.
 - 2. Catalog pages for each product.

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- 3. Name, address, and phone number of local representative for each manufacturer.
- 4. Parts list for each product.
- 5. Final approved hardware schedule, edited to reflect conditions as-installed.
- 6. Final keying schedule
- 7. Copies of floor plans with keying nomenclature
- 8. As-installed wiring diagrams for each opening connected to power, both low voltage and 110 volts.
- O. Copy of warranties including appropriate reference numbers for manufacturers to identify project
- P. Warranty: Submit manufacturer's warranty and ensure that forms have been completed in Greenwich Public Schools's name and registered with manufacturer.

1.6 QUALITY ASSURANCE

- A. Hardware: shall be suitable and adapted for its required use and shall fit its designated location. Should any hardware as shown, specified or required fail to meet the intended requirements or require modification to suit or fit the designated location, determine the correction or modification necessary and notify the Architect in ample time to avoid delay in the manufacture and delivery of hardware.
- B. Product Substitutions: Comply with product requirements stated in Section 01 2500 Substitution Procedures and as specified herein.
 - 1. Where products indicate "acceptable manufacturers" or "acceptable manufacturers and products", provide product from specified manufacturers, subject to compliance with specified requirements and "Single Source Responsibility" requirements stated herein
- C. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum 10 years of documented experience.
- D. Hardware Supplier Qualifications: Company specializing in supplying commercial door hardware with 10 years of experience. The Hardware Supplier shall have been regularly engaged in the sale and distribution of Finish Hardware for projects of comparable scope and size. The Hardware Supplier shall have an AHC of the Door and Hardware Institute on staff who will be responsible for overseeing the scheduling, detailing, ordering, and coordinating of Finish Hardware, and shall be available for consultation with the Owner, Architect, and Contractor, at no additional cost to the Owner, during progress of construction. The Hardware Supplier shall be a direct factory authorized distributor for all Finish Hardware items being furnished in accordance with this Specification.
 - 1. Warehousing Facilities: In Project's vicinity.
 - 2. Scheduling Responsibility: Preparation of door hardware and keying schedules.
 - 3. Engineering Responsibility: Preparation of data for electrified door hardware, including Shop Drawings, based on testing and engineering analysis of manufacturer's standard units in assemblies similar to those indicated for this Project.
 - 4. Coordination Responsibility: Coordinate installation of electronic security hardware with Architect and electrical engineers and provide installation and technical data to Architect and other related subcontractors.
 - a. Upon completion of electronic security hardware installation, inspect and verify that all components are working properly
- E. Installer Qualifications: Qualified tradesmen, skilled in application of commercial grade hardware with record of successful in-service performance for installing door hardware similar in quantity, type, and quality to that indicated for this Project
- F. Architectural Hardware Consultant Qualifications: A person who is experienced in providing consulting services for door hardware installations that are comparable in material, design, and extent to that indicated for this Project and who can meet the following qualification requirements:
 - 1. For door hardware, DHI-certified, Architectural Hardware Consultant (AHC).
 - 2. Can provide installation and technical data to the Architect and other related subcontractors.
 - 3. Can inspect and verify components are in working order upon completion of installation.

- 4. Capable of producing wiring diagrams.
- 5. Capable of coordinating installation of the electrified hardware with the Architect and electrical engineers.
- G. Single Source Responsibility: Obtain each type of door hardware from a single manufacturer.
 - 1. Provide electrified door hardware from same manufacturer as mechanical door hardware, unless otherwise indicated.
 - 2. Manufacturers that perform electrical modifications and that are listed by a testing and inspecting agency acceptable to authorities having jurisdiction are acceptable.
- H. Means of Egress Doors: Latches do not require more than 15 lbf (67 N) to release the latch. Locks do not require use of a key, tool, or special knowledge for operation.
- I. Accessibility Requirements: For door hardware on doors in an accessible route, comply with governing accessibility regulations cited in "REFERENCES" article, herein.
 - 1. Provide operating devices that do not require tight grasping, pinching, or twisting of the wrist and that operate with a force of not more than 5 lbf (22.2 N).
 - 2. Comply with the following maximum opening-force requirements:
 - a. Interior, Non-Fire-Rated Hinged Doors: 5 lbf (22.2 N) applied perpendicular to door.
 - b. Sliding or Folding Doors: 5 lbf (22.2 N) applied parallel to door at latch.
 - c. Fire Doors: Minimum opening force allowable by authorities having jurisdiction.
 - 3. Bevel raised thresholds with a slope of not more than 1:2. Provide thresholds not more than 1/2 inch (13 mm) high [and] [3/4 inch (19 mm) high for exterior sliding doors].
 - 4. Adjust door closer sweep periods so that, from an open position of 70 degrees, the door will take at least 3 seconds to move to a point 3 inches (75 mm) from the latch, measured to the leading edge of the door.
- J. Keying Conference: Conduct conference at Project site to comply with requirements in Division 01.
 - 1. Attendees: Owner, Contractor, Architect, Installer, Supplier's Architectural Hardware Consultant.
 - 2. Incorporate keying conference decisions into final keying schedule after reviewing door hardware keying system including, but not limited to, the following:
 - a. Function of building, flow of traffic, purpose of each area, degree of security required, and plans for future expansion.
 - b. Preliminary key system schematic diagram.
 - c. Requirements for key control system.
 - d. Requirements for access control.
 - e. Address for delivery of keys.
- K. Pre-installation Conference: Conduct conference at Project site.
 - 1. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
 - 2. Inspect and discuss preparatory work performed by other trades.
 - 3. Inspect and discuss electrical roughing-in for electrified door hardware.
 - 4. Review sequence of operation for each type of electrified door hardware.
 - 5. Review required testing, inspecting, and certifying procedures.
- L. Coordination Conferences:
 - 1. Installation Coordination Conference: Prior to hardware installation, schedule and hold a meeting for the purpose of reviewing any questions or concerns related to the proper installation and adjustment of door hardware.
 - a. Attendees: doors hardware supplier, door hardware installer, Contractor.
 - b. After the meeting, provide letter of compliance to the Architect, indicating when the meeting was held and who was in attendance.

- M. After installation has been completed, the hardware supplier and manufacturers representative for locksets, door closers, exit devices, and overhead stops shall check the project and verify compliance with installation instructions, adjustment of all hardware items, and proper application according to the approved hardware schedule. Hardware supplier shall submit a list of all hardware that has not been installed correctly.
- N. The Contractor shall retain, at their cost, a Architectural Hardware Consultant, duly certified by the Hardware Industry and approved by the Architect, prior to Substantial Completion, to inspect installation and certify that hardware and installation has been furnished and installed in accordance with manufacturer's instructions and as specified and is improper working order. Submit written report. This Consultant shall be separate and independent of the Consultant required in paragraph 3.3.B.

1.7 KEY SCHEDULE

- A. After Keying Conference, provide keying schedule listing levels of keying as well as explanation of key system's function, key symbols used and door numbers controlled.
- B. Use ANSI/BHMA A156.28 "Recommended Practices for Keying Systems" as guideline for nomenclature, definitions, and approach for selecting optimal keying system.
- C. Provide 3 copies of keying schedule for review prepared and detailed in accordance with referenced DHI publication. Include schematic keying diagram and index each key to unique door designations.
- D. Index keying schedule by door number, keyset, hardware heading number, cross keying instructions, and special key stamping instructions.
- E. Provide one complete bitting list of key cuts and one key system schematic illustrating system usage and expansion.
 - 1. Forward bitting list, key cuts and key system schematic directly to Owner, by means as directed by Owner.
- F. Prepare key schedule by or under supervision of supplier, detailing Owner's final keying instructions for locks.

1.8 PROJECT CONDITIONS

- A. Field Service: The hardware supplier shall assign a competent representative, acceptable to the Architect, to be at the job site each time a major shipment of finish hardware is received. Such representative shall assist in "checking in" these shipments and shall secure a receipt covering the contents of each shipment. In addition, such representative shall be available for immediate call to the job site when, in the opinion of the Architect, his presence is necessary.
- B. Templates: Promptly following approval of the Hardware Schedule by the Architect, furnish and deliver template information, to the fabricators, of items to which finish hardware is to be applied.
 - 1. Such deliveries shall be made in ample time to avoid delays in such work of said fabricators. Provide drawings, schedules and detailed information to other trades as necessary for them to accommodate and prepare their work to receive the finish hardware.
- C. Cooperation and Coordination: Prior to the installation of any finish hardware, all parties and trades having responsibility to any of all of the openings for the job, shall meet in a pre-construction meeting, for instruction on the proper installation of finish hardware with the manufacturer's representative.
 - 1. Cooperate and coordinate work with that of other trades supplying materials or performing work in contact with, connecting to, underlying, or overlaying the work of this Section.
 - 2. Provide complete data of requirements for work of this Section to those other trades whose work is affected by or dependent upon the work of this Section.
 - 3. Furnish all items to be built into other work in ample time to avoid delaying the progress of such work.
 - 4. Examine all drawings covering the work of this Section and refer to all other drawings, including mechanical and electrical drawings, which may affect the work of this Section or require coordination by this trade.

- D. Maintain manufacturer-recommended environmental conditions throughout storage and installation periods.
- E. Provide secure lock-up for door hardware delivered to Project, but not yet installed. Control handling and installation of hardware items so that completion of Work will not be delayed by hardware losses both before and after installation
- F. Existing Conditions: Verify all existing conditions in the field to ensure compatibility with hardware specified in the Hardware Sets herein. Any discrepancies between the existing field conditions and hardware specified shall be brought to the attention of the Architect immediately. Hardware Supplier shall not order any hardware until all discrepancies are rectified and the Architect grants written approval.

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Package hardware items individually; label and identify each package with door opening code to match hardware schedule.
- B. Inventory door hardware on receipt and provide secure lock-up for hardware delivered to Project site.
- C. Tag each item or package separately with identification coordinated with the final door hardware schedule, and include installation instructions, templates, and necessary fasteners with each item or package.
 - 1. Each article of hardware shall be individually packaged in manufacturer's original packaging.
 - 2. Deliver each article of hardware in manufacturer's original packaging
- D. Protection and Damage:
 - 1. Promptly replace products damaged during shipping with exactly the same products.
 - 2. Handle hardware in manner to avoid damage, marring, or scratching. Correct, replace or repair products damaged during the course of the Work.
 - 3. Protect products against malfunction due to paint, solvent, cleanser, or any chemical agent.
- E. Deliver keys to manufacturer of key control system for subsequent delivery to Owner.
- F. Deliver keys to Owner by registered mail or overnight package service

1.10 COORDINATION

- A. Coordinate layout and installation of floor-recessed door hardware with floor construction. Cast anchoring inserts into concrete. Concrete, reinforcement, and formwork requirements are specified in Division 03.
- B. Installation Templates: Distribute for doors, frames, and other work specified to be factory prepared. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing door hardware to comply with indicated requirements.
- C. Security: Coordinate installation of door hardware, keying, and access control with Owner's security consultant.
- D. Existing Openings: Where hardware components are scheduled for application to existing construction or where modifications to existing door hardware are required, field verify existing conditions and coordinate installation of door hardware to suit opening conditions and to provide proper door operation.
- E. Direct shipments not permitted, unless approved by the Contractor.

1.11 WARRANTY

- A. See Section 01 7800 Closeout Submittals, for additional warranty requirements.
- B. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of door hardware that fail in materials or workmanship within specified warranty period.
 - 1. Warranty Period: Years from date of Substantial Completion, for durations indicated.
 - a. Closers:
 - a) Mechanical: 25 years.

- b. Exit Devices:
 - a) Mechanical: 5 years.
- c. Locksets:
 - a) Mechanical: 10 years.
- d. Continuous Hinges: Lifetime warranty
- e. Key Blanks: Lifetime
- 2. Warranty does not cover damage or faulty operation due to improper installation, improper use or abuse.

1.12 MAINTENANCE

- A. Maintenance Tools:
 - 1. Furnish One (1) complete set of special tools required for maintenance and adjustment of hardware, including changing of cylinders.

PART 2 PRODUCTS

2.1 SCHEDULED DOOR HARDWARE

- A. General: Provide door hardware for each door to comply with requirements in Door Hardware Sets and each referenced section that products are to be supplied under.
- B. Designations: Requirements for quantity, item, size, finish or color, grade, function, and other distinctive qualities of each type of door hardware are indicated in the Door Hardware Sets at the end of Part 3. Products are identified by using door hardware designations, as follows:
 - 1. Named Manufacturer's Products: Product designation and manufacturer are listed for each door hardware type required for the purpose of establishing requirements. Manufacturers' names are abbreviated in the Door Hardware Schedule.
- C. Substitutions: Requests for substitution and product approval for inclusive mechanical and electromechanical door hardware in compliance with the specifications must be submitted in writing and in accordance with the procedures and time frames outlined in 01 2500 Substitution Procedures. Approval of requests is at the discretion of the architect, owner, and their designated consultants

2.2 HANGING DEVICES

- A. Continuous Geared Hinges: ANSI/BHMA A156.26 Grade 1-600 certified continuous geared hinge. with minimum 0.120-inch thick extruded 6060 T6 aluminum alloy hinge leaves and a minimum overall width of 4 inches. Hinges are non-handed, reversible and fabricated to template screw locations. Factory trim hinges to suit door height and prepare for electrical cut-outs.
 - 1. Basis of Design:
 - a. Pemko Products; ASSA ABLOY Architectural Door Accessories (PE).

2.3 DOOR OPERATING TRIM

- A. Flush Bolts and Surface Bolts: ANSI/BHMA A156.3 and A156.16, Grade 1, certified.
 - 1. Flush bolts to be furnished with top rod of sufficient length to allow bolt retraction device location approximately six feet from the floor.
 - 2. Furnish dust proof strikes for bottom bolts.
 - 3. Surface bolts to be minimum 8" in length and U.L. listed for labeled fire doors and U.L. listed for windstorm components where applicable.
 - 4. Provide related accessories (mounting brackets, strikes, coordinators, etc.) as required for appropriate installation and operation.
 - 5. Basis of Design:
 - a. Rockwood Products; ASSA ABLOY Architectural Door Accessories (RO).

2.4 CYLINDERS AND KEYING

- A. General: Cylinder manufacturer to have minimum (10) years experience designing secured master key systems and have on record a published security keying system policy.
- B. Source Limitations: Obtain each type of keyed cylinder and keys from the same source manufacturer as locksets and exit devices, unless otherwise indicated.
- C. Cylinders: Original manufacturer cylinders complying with the following:
 - 1. Mortise Type: Threaded cylinders with rings and cams to suit hardware application.
 - 2. Rim Type: Cylinders with back plate, flat-type vertical or horizontal tailpiece, and raised trim ring.
 - 3. Bored-Lock Type: Cylinders with tailpieces to suit locks.
 - 4. Mortise and rim cylinder collars to be solid and recessed to allow the cylinder face to be flush and be free spinning with matching finishes.
 - 5. Keyway: Match Facility Standard.
- D. Permanent Cores: Manufacturer's standard; finish face to match lockset; complying with the following:
 - 1. Interchangeable Cores: Core insert, removable by use of a special key; usable with other manufacturers' cylinders.
- E. Patented Cylinders: ANSI/BHMA A156.5, Grade 1, certified patented cylinders employing a utility patented and restricted keyway requiring the use of a patented key. Cylinders are to be protected from unauthorized manufacture and distribution by manufacturer's United States patents. Cylinders are to be factory keyed with owner having the ability for on-site original key cutting.
 - 1. Basis of Design:
 - a. Medeco (MC) X4 Series.
- F. Keying System: Each type of lock and cylinders to be factory keyed.
 - 1. Conduct specified "Keying Conference" to define and document keying system instructions and requirements.
 - 2. Furnish factory cut, nickel-silver large bow permanently inscribed with a visual key control number as directed by Owner.
 - 3. Existing System: Key locks to Owner's existing system.
- G. Key Quantity: Provide the following minimum number of keys:
 - 1. Change Keys per Cylinder: Three (3).
 - 2. Master Keys (per Master Key Level/Group): Five (5).
 - 3. Construction Keys (where required): Ten (10).
 - 4. Construction Control Keys (where required): Two (2).
 - 5. Permanent Control Keys (where required): Two (2).
- H. Construction Keying: Provide temporary keyed construction cores.

2.5 MECHANICAL LOCKS AND LATCHING DEVICES

- A. Mortise Locksets, Grade 1 (Heavy Duty): ANSI/BHMA A156.13, Series 1000, Operational Grade 1 certified. Locksets are to be manufactured with a corrosion resistant steel case and be field-reversible for handing without disassembly of the lock body.
 - 1. Basis of Design:
 - a. Sargent Manufacturing (SA) 8200 Series.
- B. Tubular Locksets, Grade 1 (Extra-Heavy Duty): ANSI/BHMA A156.2 Series 4000, Grade 1 certified.
 - 1. Locksets to withstand 3000 inch pounds of torque applied to the locked lever without gaining access.
 - 2. Locksets to fit a standard 2 1/8" bore without the use of through-bolts.
 - 3. Lever handles to be made of solid material with no plastic fillers.
 - 4. Latchbolt head to be one-piece stainless steel construction encased within the lock body.

- 5. Extended cycle test: Locks to have been cycle tested in ordinance with ANSI/BHMA A156.2 requirements to 34 million cycles.
- 6. Furnish with standard 2 3/4" backset and 1/2" throw latchbolt (3/4" at rated paired openings).
- 7. Basis of Design:
 - a. Sargent Manufacturing (SA) 11 Line.

2.6 LOCK AND LATCH STRIKES

- A. Strikes: Provide manufacturer's standard strike with strike box for each latch or lock bolt, with curved lip extended to protect frame, finished to match door hardware set, unless otherwise indicated, and as follows:
 - 1. Flat-Lip Strikes: For locks with three-piece antifriction latchbolts, as recommended by manufacturer.
 - 2. Extra-Long-Lip Strikes: For locks used on frames with applied wood casing trim.
 - 3. Aluminum-Frame Strike Box: Provide manufacturer's special strike box fabricated for aluminum framing.
 - 4. Double-lipped strikes: For locks at double acting doors. Furnish with retractable stop for rescue hardware applications.
- B. Standards: Comply with the following:
 - 1. Strikes for Mortise Locks and Latches: BHMA A156.13.
 - 2. Strikes for Bored Locks and Latches: BHMA A156.2.
 - 3. Strikes for Auxiliary Deadlocks: BHMA A156.36.
 - 4. Dustproof Strikes: BHMA A156.16.

2.7 CONVENTIONAL EXIT DEVICES

- A. General Requirements: All exit devices specified herein shall meet or exceed the following criteria:
 - 1. At doors not requiring a fire rating, provide devices complying with NFPA 101 and listed and labeled for "Panic Hardware" according to UL305. Provide proper fasteners as required by manufacturer including sex nuts and bolts at openings specified in the Hardware Sets.
 - 2. Where exit devices are required on fire rated doors, provide devices complying with NFPA 80 and with UL labeling indicating "Fire Exit Hardware". Provide devices with the proper fasteners for installation as tested and listed by UL. Consult manufacturer's catalog and template book for specific requirements.
 - 3. Except on fire rated doors, provide exit devices with hex key dogging device to hold the pushbar and latch in a retracted position. Provide optional keyed cylinder dogging on devices where specified in Hardware Sets.
 - 4. Devices must fit flat against the door face with no gap that permits unauthorized dogging of the push bar. The addition of filler strips is required in any case where the door light extends behind the device as in a full glass configuration.
 - 5. Lever Operating Trim: Where exit devices require lever trim, furnish manufacturer's heavy duty escutcheon trim with threaded studs for thru-bolts.
 - a. Lock Trim Design: As indicated in Hardware Sets, provide finishes and designs to match that of the specified locksets.
 - b. Where function of exit device requires a cylinder, provide a cylinder (Rim or Mortise) as specified in Hardware Sets.
 - 6. Vertical Rod Exit Devices: Where surface or concealed vertical rod exit devices are used at interior openings, provide as less bottom rod (LBR) unless otherwise indicated. Provide dust proof strikes where thermal pins are required to project into the floor.
 - 7. Narrow Stile Applications: At doors constructed with narrow stiles, or as specified in Hardware Sets, provide devices designed for maximum 2" wide stiles.
 - 8. Dummy Push Bar: Nonfunctioning push bar matching functional push bar.

- 9. Rail Sizing: Provide exit device rails factory sized for proper door width application.
- 10. Through Bolt Installation: For exit devices and trim as indicated in Door Hardware Sets.
- B. Conventional Push Rail Exit Devices (Heavy Duty): ANSI/BHMA A156.3, Grade 1 certified panic and fire exit hardware devices furnished in the functions specified in the Hardware Sets. Exit device latch to be stainless steel, pullman type, with deadlock feature.
 - 1. Basis of Design:
 - a. Sargent Manufacturing (SA) 80 Series.
- C. Tube Steel Removable Mullions: ANSI/BHMA A156.3 removable steel mullions with malleable-iron top and bottom retainers and a primed paint finish.
 - 1. Provide keyed removable feature where specified in the Hardware Sets.
 - 2. Provide stabilizers and mounting brackets as required.
 - 3. Provide electrical quick connection wiring options as specified in the hardware sets.
 - 4. Basis of Design:
 - a. Sargent Manufacturing (SA) 980S Series.

2.8 DOOR CLOSERS

- A. All door closers specified herein shall meet or exceed the following criteria:
 - 1. General: Door closers to be from one manufacturer, matching in design and style, with the same type door preparations and templates regardless of application or spring size. Closers to be non-handed with full sized covers including installation and adjusting information on inside of cover.
 - 2. Standards: Closers to comply with UL-10C for Positive Pressure Fire Test and be U.L. listed for use of fire rated doors.
 - 3. Cycle Testing: Provide closers which have surpassed 15 million cycles in a test witnessed and verified by UL.
 - 4. Size of Units: Comply with manufacturer's written recommendations for sizing of door closers depending on size of door, exposure to weather, and anticipated frequency of use. Where closers are indicated for doors required to be accessible to the physically handicapped, provide units complying with ANSI ICC/A117.1.
 - 5. Closer Arms: Provide heavy duty, forged steel closer arms unless otherwise indicated in Hardware Sets.
 - 6. Closers shall not be installed on exterior or corridor side of doors; where possible install closers on door for optimum aesthetics.
 - 7. Closer Accessories: Provide door closer accessories including custom templates, special mounting brackets, spacers and drop plates as required for proper installation. Provide through-bolt and security type fasteners as specified in the hardware sets.
- B. Door Closers, Surface Mounted (Heavy Duty): ANSI/BHMA A156.4, Grade 1 surface mounted, heavy duty door closers with complete spring power adjustment, sizes 1 thru 6; and fully operational adjustable according to door size, frequency of use, and opening force. Closers to be rack and pinion type, one piece cast iron or aluminum alloy body construction, with adjustable backcheck and separate non-critical valves for closing sweep and latch speed control. Provide non-handed units standard. Provide metal covers for all closures with powder coat to match door trim.
 - 1. Basis of Design:
 - a. Sargent Manufacturing (SA) 351 Series

2.9 ARCHITECTURAL TRIM

- A. Door Protective Trim
 - 1. General: Door protective trim units to be of type and design as specified below or in the Hardware Sets.

- 2. Size: Fabricate protection plates (kick, armor, or mop) not more than 2" less than door width (LDW) on stop side of single doors and 1" LDW on stop side of pairs of doors, and not more than 1" less than door width on pull side. Coordinate and provide proper width and height as required where conflicting hardware dictates. Height to be as specified in the Hardware Sets.
- 3. Where plates are applied to fire rated doors with the top of the plate more than 16" above the bottom of the door, provide plates complying with NFPA 80. Consult manufacturer's catalog and template book for specific requirements for size and applications.
- 4. Protection Plates: ANSI/BHMA A156.6 certified protection plates (kick, armor, or mop), fabricated from the following:
 - a. Stainless Steel: 300 grade, 050-inch thick.
- 5. Options and fasteners: Provide manufacturer's designated fastener type as specified in the Hardware Sets. Provide countersunk screw holes.
- 6. Basis of Design:
 - a. Rockwood Products; ASSA ABLOY Architectural Door Accessories (RO).

2.10 DOOR STOPS AND HOLDERS

- A. General: Door stops and holders to be of type and design as specified below or in the Hardware Sets.
- B. Door Stops and Bumpers: ANSI/BHMA A156.16, Grade 1 certified door stops and wall bumpers. Provide wall bumpers, either convex or concave types with anchorage as indicated, unless floor or other types of door stops are specified in Hardware Sets. Do not mount floor stops where they will impede traffic. Where floor or wall bumpers are not appropriate, provide overhead type stops and holders.
 - 1. Basis of Design:
 - a. Rockwood Products; ASSA ABLOY Architectural Door Accessories (RO).
- C. Overhead Door Stops and Holders: ANSI/BHMA A156.6, Grade 1 certified overhead stops and holders to be surface or concealed types as indicated in Hardware Sets. Track, slide, arm and jamb bracket to be constructed of extruded bronze and shock absorber spring of heavy tempered steel. Provide non-handed design with mounting brackets as required for proper operation and function.
 - 1. Basis of Design:
 - a. Rixson Door Controls (RF).

2.11 ARCHITECTURAL SEALS

- A. General: Thresholds, weatherstripping, and gasket seals to be of type and design as specified below or in the Hardware Sets. Provide continuous weatherstrip gasketing on exterior doors and provide smoke, light, or sound gasketing on interior doors where indicated. At exterior applications provide non-corrosive fasteners and elsewhere where indicated.
- B. Smoke Labeled Gasketing: Assemblies complying with NFPA 105 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for smoke control ratings indicated, based on testing according to UL 1784.
 - 1. Provide smoke labeled perimeter gasketing at all smoke labeled openings.
- C. Fire Labeled Gasketing: Assemblies complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire ratings indicated, based on testing according to UL-10C.
 - 1. Provide intumescent seals as indicated to meet UL10C Standard for Positive Pressure Fire Tests of Door Assemblies, and NPFA 252, Standard Methods of Fire Tests of Door Assemblies.
- D. Sound-Rated Gasketing: Assemblies that are listed and labeled by a testing and inspecting agency, for sound ratings indicated.
- E. Replaceable Seal Strips: Provide only those units where resilient or flexible seal strips are easily replaceable and readily available from stocks maintained by manufacturer.
- F. Basis of Design:

1. Pemko Products; ASSA ABLOY Architectural Door Accessories (PE).

2.12 KEY CONTROLS

- A. Key Management System: For each keyed lock on project, provide one set of consecutively numbered duplicate key tags with hanging hole and snap catch.
 - 1. Provide key collection envelopes, receipt cards, and index cards in quantity suitable to number of keys to be managed.

2.13 FABRICATION

A. Fasteners: Provide door hardware manufactured to comply with published templates generally prepared for machine, wood, and sheet metal screws. Provide screws according to manufacturers recognized installation standards for application intended.

2.14 FINISHES

- A. Standard: Designations used in the Hardware Sets and elsewhere indicate hardware finishes complying with ANSI/BHMA A156.18, including coordination with traditional U.S. finishes indicated by certain manufacturers for their products.
- B. Provide quality of finish, including thickness of plating or coating (if any), composition, hardness, and other qualities complying with manufacturer's standards, but in no case less than specified by referenced standards for the applicable units of hardware
- C. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

| ANSI | US | FINISHES | BASIC METAL |
|------|---------|-------------------------------|---------------------|
| 626 | US26D | SATIN CHROMIUM | BRASS, BRONZE |
| 628 | US28 | SATIN ALUMINUM CLEAR ANODIZED | ALUMINUM |
| 630 | US32D | SATIN STAINLESS STEEL | STAINLESS STELL 304 |
| 689 | US28 | ALUMINUM PAINTED | ANY COLOR |
| AL | US28 | ALUMINUM MILL FINISH | ALUMINUM |
| GRY | | GREY | RUBBER |
| | | | |
| 316 | No 4 SS | STAINLESS STEEL | SATINLESS STEEL |
| | | | |

PART 3 EXECUTION

3.1 EXAMINATION

- A. Prior to installation of hardware, examine doors and frames, with Installer present, for compliance with requirements for installation tolerances, labeled fire-rated door assembly construction, wall and floor construction, and other conditions affecting performance.
- B. Existing Door and Frame Compatibility: Field verify existing doors and frames receiving new hardware and existing conditions receiving new openings. Verify that new hardware is compatible with existing door and frame preparation and existing conditions.
- C. Proceed with installation only after unsatisfactory
- D. Verify that doors and frames are ready to receive work; labeled, fire-rated doors and frames are present and properly installed, and dimensions are as indicated on shop drawings.
- E. The installer shall notify the architect, in writing, of all unacceptable condition that could affect the proper operation of the finish hardware.
- F. Locate hardware per SDI-100 and applicable building, fire, life-safety, accessibility, and security codes.
- G. Where new hardware is to be installed near existing doors/hardware scheduled to remain, match locations of existing hardware.

H. Contractor to fill/patch any old hardware preparations in existing frames that will no longer be used with new door/hardware. Contractor is responsible for any new mortises/cylindricals Hardware preparation to existing frame to accommodate new door and hardware.

3.2 PREPARATION

- A. Where on-site modification of doors and frames is required:
 - 1. Carefully remove existing door hardware and components being reused. Clean, protect, tag, and store in accordance with storage and handling requirements specified herein.
 - 2. Field modify and prepare existing door and frame for new hardware being installed.
 - 3. When modifications are exposed to view, use concealed fasteners, when possible.
 - 4. Prepare hardware locations and reinstall in accordance with installation requirements for new door hardware and with:
 - a. Steel Doors and Frames: For surface applied door hardware, drill and tap doors and frames according to ANSI/SDI A250.6.
 - 5. Doors in rated assemblies: NFPA 80 for restrictions on on-site door hardware preparation

3.3 INSTALLATION

- A. Install hardware in accordance with manufacturer's instructions and applicable codes.
- B. Use templates provided by hardware item manufacturer.
- C. Mounting heights for hardware from finished floor to center line of hardware item: shall conform to ADA requirements unless indicated otherwise.
 - 1. Standard Steel Doors and Frames: ANSI/SDI A250.8.
- D. Do not install surface-mounted items until finishes have been completed on substrate. Set units level, plumb and true to line and location. Adjust and reinforce attachment substrate for proper installation and operation.
- E. Unless otherwise specified, locate all hardware in accordance with the recommended locations for builders hardware for standard doors and frames as published by the Door and Hardware Institute.
- F. Drill and countersink units that are not factory prepared for anchorage fasteners. Space fasteners and anchors according to industry standards.
- G. Frame set into new or existing masonry wall and filled with mortar, drill and tap fasteners.
- H. Gaskets: install jamb-applied gaskets before closers, overhead stops, rim strikes, etc. Install sweeps across bottoms of doors before astragals, cope sweeps around bottom pivots, trim astragals to tops of sweeps.
- I. Unless otherwise specified or detailed, install thresholds with the bevel in vertical alignment with the outside door face. Notch and closely fit thresholds to frame profile. Set thresholds in full bed of sealant.
- J. When hardware is to be attached to existing metal surface and insufficient reinforcement exists, use RivNuts, NutSerts or similar anchoring device for screws.
- K. Install operating parts so they move freely and smoothly without binding, sticking, or excessive clearance.
- L. Hinges: Install types and in quantities indicated in door hardware schedule but not fewer than quantity recommended by manufacturer for application indicated or one hinge for every 30 inches (750 mm) of door height, whichever is more stringent, unless other equivalent means of support for door, such as spring hinges or pivots, are provided.
- M. Lock Cylinders: Install construction cores to secure building and areas during construction period.
 - 1. Replace construction cores with permanent cores as indicated in keying section.
- N. Door Closers: Mount closers on room side of corridor doors, inside of exterior doors, and stair side of stairway doors from corridors. Closers shall not be visible in corridors, lobbies and other public spaces unless approved by Architect.

- 1. Adjust spring power of door closers to insure exterior and fire rated doors will consistently close and latch doors under existing conditions. Adjust all other door closers to insure opening force does not to exceed 5 lbs.
- 2. Adjust "sweep", "latch", & "back check" valves on all door closers to properly control door throughout the opening and closing cycle. Adjust total closing speed as required to comply with all applicable state and local building codes
- O. Stops: Provide wall stops for doors unless floor or other type stops are indicated in door hardware schedule. Do not mount floor stops where they may impede traffic or present tripping hazard.
- P. Locate floor stops not more than 4 inches from the wall.
- Q. Locate floor stops not more than 4 inches from the wall.
- R. Shim doors as required to maintain proper operating clearance between door and frame.
- S. Use only fasteners supplied by or approved by the manufacturer for each respective item of hardware.
- T. Where necessary, adjust doors and hardware as required to eliminate binding between strike and latchbolt. Doors should not rattle.
- U. Deliver to the owner 1 complete set of installation and adjustment instructions, and tools as furnished with the hardware.
- V. Set exterior door thresholds with full-width bead of elastomeric sealant on each point of contact with floor providing a continuous weather seal; anchor thresholds with stainless steel countersunk screws.

3.4 FIELD QUALITY CONTROL

- A. Field inspection and testing will be performed under provisions of Section 01 4000 Quality Requirements.
- B. Hardware Supplier shall provide an Architectural Hardware Consultant, duly certified by the Hardware Industry to certify that hardware and installation has been furnished and installed in accordance with manufacturer's instructions and as specified and is improper working order. Submit written report.
 - 1. Meet with Contractor's installer, select a hardware set for mockup and approve mockup.
 - 2. Inspect installation at 1/3 and 2/3 completion. Submit report and deficiencies.
 - 3. After installation has been completed, the hardware supplier and manufacturers representative for locksets, door closers, exit devices, and overhead stops shall check the project and verify compliance with installation instructions, adjustment of all hardware items, and proper application according to the approved hardware schedule. Hardware supplier shall submit a list of all hardware that has not been installed correctly.
- C. After installation has been completed, inspected and report issued the hardware supplier and manufacturers representative shall meet with the owner to explain the functions, uses, adjustment, and maintenance of each item of hardware.

3.5 ADJUSTING

- A. Adjust work under provisions of Section 01 7000 Execution.
- B. Adjust hardware for smooth operation.
- C. Adjust gasketing for complete, continuous seal; replace if unable to make complete seal.

3.6 DEMONSTRATION:

- A. Demonstrate electrical, electronic and pneumatic hardware systems, including adjustment and maintenance procedures.
- B. Provide training for Owner's maintenance personnel to adjust, operate, and maintain door hardware and door hardware finishes. Refer to Division 01 Section "Demonstration and Training."

3.7 CLEANING

A. Clean adjacent surfaces soiled by hardware installation. Clean finished hardware per manufacturer's instructions after final adjustments has been made. Replace items that cannot be cleaned to manufacturer's level of finish quality at no additional cost.

3.8 PROTECTION

- A. Protect finished Work under provisions of Section 01 7000.
- B. Do not permit adjacent work to damage hardware or finish.

3.9 FINISHES

- A. Finish: BHMA 626/652 (US26D); except:
 - 1. Continuous Hinges: BHMA 628 (US28)
 - 2. Push Plates, Pulls, and Push Bars: BHMA 630 (US32D)
 - 3. Protection Plates: BHMA 630 (US32D)
 - 4. Overhead Stops and Holders: BHMA 630 (US32D)
 - 5. Door Closers: Powder Coat to Match
 - 6. Wall Stops: BHMA 630 (US32D)
 - 7. Latch Protectors: BHMA 630 (US32D)
 - 8. Weatherstripping: Clear Anodized Aluminum
 - 9. Thresholds: Mill Finish Aluminum

NOTE: CONTRACTOR TO FILL/PATCH ANY OLD HARDWARE PREPARATIONS IN EXISTING FRAME THAT WILL BE NO LONGER USED WITH NEW DOOR/HARDWARE. CONTRACTOR IS RESPONSIBLE FOR ANY NEW MORTISES/HARDWARE PREPARATION TO EXISTING FRAME TO ACCOMMODATE NEW DOOR AND HARDWARE.

ALL LOCK SETS: SHALL BE OPENABLE AT ALL TIMES FROM THE INSIDE (OCCUPIED SIDE) WITHOUT THE USE OF A KEY OR ANY SPECIAL KNOWLEDGE OR EFFORT.

CONTRACTOR SHALL VERIFY BACKSET ON ALL LOCKSETS BEING REUSED.

HARDWARE SETS

Set: 1.0

Doors: D4

| 1 | Continuous Hinge | CFM_SLF-HD1 | | PE |
|----|--------------------------|--------------------------|-------|----|
| 1 | Exit Device (nightlatch) | 16 43 72 8813 ETL | US32D | SA |
| 1 | Permanent Core | 33700006N | 26 | MC |
| 1 | Flush Pull | by Assembly Manufacturer | | OT |
| 1 | Conc Overhead Stop | 1-X36 | 630 | RF |
| 1 | Door Closer | MC SRI 351 UO | EN | SA |
| | 1 Kick Plate | K1050 12" high CSK BEV | US32D | RO |
| 1 | Threshold | 253x3AFG | | PE |
| Se | t: 2.0 | | | |
| Do | oors: D10, D8 | | | |
| 2 | Continuous Hinge | CFM_SLF-HD1 | | PE |
| 1 | Removable Mullion | L980 | PC | SA |
| 2 | Exit Device (classroom) | 16 43 72 8813 ETL | US32D | SA |
| 5 | Permanent Core | 33700006N | 26 | MC |
| | | | | |

GREENWICH PUBLIC SCHOOLS GREENWICH HIGH SCHOOL LOCKER ROOM RENOVATIONS PHASE II DOOR HARDWARE

| 1 | Cylinder | 72 980C1 | US26D | SA |
|---|-------------|------------------------|-------|----|
| 2 | Door Closer | 351 UO | EN | SA |
| 2 | Kick Plate | K1050 12" high CSK BEV | US32D | RO |
| 2 | Mop Plate | K1050 6" high CSK BEV | US32D | RO |
| 2 | Wall Stop | 406 | US32D | RO |
| 2 | Silencer | 608-RKW | | RO |

Set: 3.0

| 2 | Continuous Hinge | CFM_SLF-HD1 | | PE |
|---|-------------------|------------------------|-------|----|
| 1 | Dust Proof Strike | 570 | US26D | RO |
| 2 | Flush Bolt | 555 | US26D | RO |
| 1 | Storeroom Lock | 72 11G04 OLUS | 26D | SA |
| 1 | Permanent Core | 33700006N | 26 | MC |
| 2 | Door Closer | 351 PS | EN | SA |
| 2 | Kick Plate | K1050 12" high CSK BEV | US32D | RO |
| 2 | Mop Plate | K1050 6" high CSK BEV | US32D | RO |
| 2 | Silencer | 608-RKW | | RO |

Set: 4.0

Doors: D7

| 1 | Continuous Hinge | CFM_SLF-HD1 | | PE |
|---|------------------|------------------------|-------|----|
| 1 | Office Lock | 72 11G05 OL | US26D | SA |
| 1 | Permanent Core 3 | 3700006N | 26 | MC |
| 1 | Kick Plate | K1050 12" high CSK BEV | US32D | RO |
| 1 | Mop Plate | K1050 6" high CSK BEV | US32D | RO |
| 1 | Wall Stop | 406 | US32D | RO |
| 3 | Silencer | 608-RKW | | RO |

Set: 5.0

Doors: D11

| 1 | Continuous Hinge | CFM_SLF-HD1 | | PE |
|---|--------------------|------------------------|-------|----|
| 1 | Office Lock | 72 11G05 OL | US26D | SA |
| 1 | Conc Overhead Stop | 1-X36 | 630 | RF |
| 1 | Kick Plate | K1050 12" high CSK BEV | US32D | RO |
| 1 | Mop Plate | K1050 6" high CSK BEV | US32D | RO |
| 3 | Silencer | 608-RKW | | RO |

Set: 6.0

| 1 | Continuous Hinge | CFM_SLF-HD1 | | PE |
|---|------------------|------------------------|-------|----|
| 1 | Classroom Lock | 72 11G37 OL | US26D | SA |
| 1 | Permanent Core | 33700006N | 26 | MC |
| 1 | Door Closer | 351 UO | EN | SA |
| 1 | Kick Plate | K1050 12" high CSK BEV | US32D | RO |
| 1 | Mop Plate | K1050 6" high CSK BEV | US32D | RO |
| 3 | Silencer | 608-RKW | | RO |
| | | | | |

Set: 7.0

DOORS: D6

| 1 | Continuous Hinge | CFM_SLF-HD1 | | PE |
|---|-------------------------|------------------------|-------|----|
| 1 | Classroom Lock | 72 11G37 OL | US26D | SA |
| 1 | Permanent Core | 33700006N | 26 | MC |
| 1 | Door Closer | 351 PS | EN | SA |
| 1 | Kick Plate | K1050 12" high CSK BEV | US32D | RO |
| 1 | Mop Plate | K1050 6" high CSK BEV | US32D | RO |
| 3 | Silencer | 608-RKW | | RO |

Set: 8.0

DOORS: D1,D2, D5

| 1 | Continuous Hinge | CFM_SLF-HD1 | | PE |
|---|------------------|------------------------|-------|----|
| 1 | Dormitory Lock | 50 72 8225 LNL | US26D | SA |
| 1 | Permanent Core | 33700006N | 26 | MC |
| 1 | Kick Plate | K1050 12" high CSK BEV | US32D | RO |
| 1 | Mop Plate | K1050 6" high CSK BEV | US32D | RO |
| 1 | Wall Stop | 406 | US32D | RO |
| 3 | Silencer | 608-RKW | | RO |

END OF SECTION

LOUVERS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SECTION INCLUDES

A. Sightproof. fixed louvers.

1.3 RELATED REQUIREMENTS

- A. Section 04 2600 Single-Wythe Unit Masonry: Preparing opening in existing wall.
- B. Section 07 9200 Joint Sealants: Sealing joints between frames and adjacent construction.

1.4 REFERENCE STANDARDS

- A. AAMA 611 Voluntary Specification for Anodized Architectural Aluminum; 2012.
- B. AAMA 2603 Voluntary Specification, Performance Requirements and Test Procedures for Pigmented Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix); 2015.
- C. AAMA 2604 Voluntary Specification, Performance Requirements and Test Procedures for High Performance Organic Coatings on Aluminum Extrusions and Panels; 2013.
- D. AMCA 500-L Laboratory Methods of Testing Louvers for Rating; 2012.
- E. AMCA 511 Certified Ratings Program for Air Control Devices; 2010.
- F. ASTM B209 Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2014.
- G. ASTM B221 Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2014.

1.5 SUBMITTALS

- A. See Section 01 3000 Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data describing design characteristics, maximum recommended air velocity, design free area, materials and finishes.
- C. Samples: Submit two samples 2 by 2 inches in size illustrating finish and color of interior surfaces.

1.6 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing products of the type specified in this section, with minimum three years of documented experience.
- B. Source Limitations: Obtain louvers and vents through one source from a single manufacturer where indicated to be of same type, design, or factory-applied color finish.
- C. Welding: Qualify procedures and personnel according AWS D1.2, "Structural Welding Code--Aluminum."
- D. AMCA Seal: Mark units with AMCA Certified Ratings Seal.

1.7 WARRANTY

- A. See Section 01 7800 Closeout Submittals, for additional warranty requirements.
- B. Provide five year manufacturer's warranty against distortion, metal degradation, and connection failures of louver components.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Louvers:
 - 1. Airolite Company, LLC; Model K601: www.airolite.com.

2. Substitutions: See Section 01 2500 Substitution Procedures.

2.2 LOUVERS

- A. Louvers: Factory fabricated and assembled, complete with frame, mullions, and accessories; AMCA Certified in accordance with AMCA 511.
- B. Stationary Louvers: Horizontal blade, extruded aluminum construction.
 - 1. Free Area: 50 percent, minimum.
 - 2. Blades: V-shaped, sight-proof.
 - 3. Frame: 4 inches deep, channel profile; corner joints mitered and, with continuous recessed caulking channel each side.
 - 4. Aluminum Thickness: Frame 12 gage, 0.0808 inch minimum; blades 12 gage, 0.0808 inch minimum.

2.3 MATERIALS

A. Extruded Aluminum: ASTM B221 (ASTM B221M).

2.4 FINISHES

- A. Pigmented Organic Coatings: AAMA 2603; polyester or acrylic baked enamel finish.
- B. Color: As selected from manufacturer's standard colors.

2.5 ACCESSORIES

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify that prepared openings are ready to receive this work and opening dimensions are as indicated on shop drawings.
- B. Verify that field measurements are as indicated.

3.2 INSTALLATION

- A. Install louver assembly in accordance with manufacturer's instructions.
- B. Install louvers level and plumb.
- C. Secure louver frames in openings with concealed fasteners.

3.3 CLEANING

- A. Strip protective finish coverings.
- B. Clean surfaces and components.

END OF SECTION

GYPSUM BOARD ASSEMBLIES

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SECTION INCLUDES

- A. Metal channel soffit/ceiling framing.
- B. Metal Trim
- C. Gypsum wallboard.
- D. Joint treatment and accessories.

1.3 RELATED REQUIREMENTS

- A. Section 06 1000 Rough Carpentry: Wood blocking product and execution requirements.
- B. Section 07 9200 Joint Sealants: Sealing acoustical gaps in construction other than gypsum board or plaster work.

1.4 REFERENCE STANDARDS

- A. AISI S100-12 North American Specification for the Design of Cold-Formed Steel Structural Members; American Iron and Steel Institute; 2012.
- B. ASTM C475/C475M Standard Specification for Joint Compound and Joint Tape for Finishing Gypsum Board; 2015.
- C. ASTM C754 Standard Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products; 2015.
- D. ASTM C840 Standard Specification for Application and Finishing of Gypsum Board; 2013.
- E. ASTM C954 Standard Specification for Steel Drill Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Steel Studs From 0.033 in. (0.84 mm) to 0.112 in. (2.84 mm) in Thickness; 2015.
- F. ASTM C1002 Standard Specification for Steel Self-Piercing Tapping Screws for Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs; 2014.
- G. ASTM C1047 Standard Specification for Accessories For Gypsum Wallboard and Gypsum Veneer Base; 2014a.
- H. ASTM C1396/C1396M Standard Specification for Gypsum Board; 2014.
- I. ASTM E84 Standard Test Method for Surface Burning Characteristics of Building Materials; 2015a.
- J. GA-216 Application and Finishing of Gypsum Board; 2013.

1.5 SUBMITTALS

- A. See Section 01 3000 Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data on metal framing, gypsum board, accessories, and joint finishing system.

1.6 QUALITY ASSURANCE

- A. Perform in accordance with ASTM C 840. Comply with requirements of GA-600 for fire-rated assemblies.
- B. Installer Qualifications: Company specializing in performing gypsum board installation and finishing, with minimum ____years of experience.

PART 2 PRODUCTS

2.1 METAL FRAMING MATERIALS

- A. Manufacturers Metal Framing, Connectors, and Accessories:
 - 1. Marino: www.marinoware.com.
- B. Non-Loadbearing Framing System Components: ASTM C645; galvanized sheet steel, of size and properties necessary to comply with ASTM C754 for the spacing indicated, with maximum deflection of wall framing of L/120 at 5 psf.
 - 1. Studs: "C" shaped with flat or formed webs with knurled faces.
 - a. Minimum Base Metal Thickness: 0.0312 (20 gauge).
 - b. Depth: Match existing and as indicated on drawings
 - 2. Runners: U shaped, sized to match studs.
 - 3. Ceiling Channels: C-shaped.
 - 4. Furring: Hat-shaped sections, minimum depth of 7/8 inch.
- C. Partition Head to Structure Connections: Provide mechanical anchorage devices that accommodate deflection using slotted holes, screws and anti-friction bushings, preventing rotation of studs while maintaining structural performance of partition.
 - 1. Structural Performance: Maintain lateral load resistance and vertical movement capacity required by applicable code, when evaluated in accordance with AISI S100-12.
 - 2. Material: ASTM A653/A653M steel sheet, SS Grade 50/340, with G60/Z180 hot dipped galvanized coating.
- D. Non-Loadbearing Framing Accessories:
 - 1. Ceiling Hangers: Type and size as specified in ASTM C754 for spacing required.
 - 2. Framing Connectors: ASTM A653/A653M G90 galvanized steel clips; secures cold rolled channel to wall studs for lateral bracing.
- E. Suspended Ceiling and Soffit Framing:
 - 1. Components, General: Comply with ASTM C 754 for conditions indicated.
 - 2. Tie Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.0625-inch-diameter wire, or double strand of 0.0475-inch-diameter wire.
 - 3. Hangers:
 - a. Wire Hangers: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.162-inch diameter.
 - b. Rod Hangers: ASTM A 510, mild carbon steel.
 - a) Diameter: 1/4-inch.
 - b) Protective Coating: ASTM A 153/A 153M, hot-dip galvanized.
 - 4. Carrying Channels: Cold-rolled, commercial-steel sheet with a base metal thickness of 0.0538 inch, a minimum 1/2-inch-wide flange, with ASTM A 653, G40 (Z120), hot-dip galvanized zinc coating.
 - a. Depth: 1-1/2" unless otherwise indicated.
 - 5. Furring Channels (Furring Members): Commercial-steel sheet with ASTM A 653/A 653M, G40, hot-dip galvanized zinc coating.
 - a. Cold Rolled Channels: 0.0538-inch bare steel thickness, with minimum 1/2-inch-wide flange, 3/4 inch deep.
 - b. Steel Studs: ASTM C 645.
 - a) Minimum Base Metal Thickness: As indicated.
 - b) Depth: As indicated.
 - 6. Grid Suspension System for Interior Ceilings: ASTM C 645, direct-hung system composed of main beams and cross-furring members that interlock.

- a. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following: a)
 - Armstrong World Industries, Inc.; Furring Systems/Drywall.
- Main Beam: Shall be double-web construction (minimum 0.0179 inch prior to protective b. coating), hot dipped galvanized (per ASTM A653).
 - HD8901: 1-1/2 inch web height, prefinished 15/16 inch flange with minimum G40 a) hot dipped galvanization.
- c. Primary Cross Tees: Shall be double-web steel construction (minimum 0.0179 inch prior to protective coating), hot dipped galvanized (minimum G40 or G90 per ASTM A653), web height 1-1/2 inch with rectangular bulb and prefinished 1-1/2" knurled flange.
- Secondary Framing Cross Tees : Shall be double web steel construction (minimum 0.0179) d. inch prior to protective coating), hot dipped galvanized (minimum G40, web height 1-1/2inch rectangular bulb and 15/16 inch flange (XL8341)
- Hat Furring Channel, HD8940: Shall be 48 inch x 1-3/8 inch x 7/8 inch, hot dipped e. galvanized steel (minimum G40 per ASTM A653); compatible with HD8901 and HD8906 main beams.
- Wall Molding: f.
 - HD7859: Hot dipped galvanized (minimum G40), hemmed angle molding, 1-1/4 a) inch height with 1-1/4 inch flange.
- Clips: g.
 - MBAC Main Beam Adapter Clip a)
 - DWACS, DW50, DW58 Drywall Attachment Clip for transitions to acoustical b) ceilings
 - XTAC Cross Tee Adapter Clip c)
- Screws for wallboard application shall be bugle head screws in accordance with thickness h. of material used.
- 7. Structural Classification:
 - Main Beam shall be heavy duty per ASTM C 635. a.
 - Classification can require wires to be closer together for additional loading when used to b. support double layer gypsum, verticals, slopes, domes, half barrels, circles, soffits, canopies, and step conditions which call for loading or unusual designs and shapes in drywall construction. Using cross tees in the construction of circles, barrels, etc. is common in order to hold the radius.
 - Deflection of fastening suspension system supporting light fixtures, ceiling grilles, access С doors, verticals and horizontal loads shall have a maximum deflection of 1/360 of the span

2.2 BOARD MATERIALS

- A. Manufacturers - Gypsum-Based Board:
 - 1. Georgia-Pacific Gypsum: www.gpgypsum.com.
 - 2. National Gypsum Company: www.nationalgypsum.com.
 - USG Corporation: www.usg.com. 3.
- Gypsum Wallboard: Paper-faced gypsum panels as defined in ASTM C1396/C1396M; sizes to minimize Β. joints in place; ends square cut.
 - 1. Application: Use for ceilings, unless otherwise indicated.
 - 2. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.
 - Mold resistant board is required at all locations. a.
 - 3. Thickness:
 - Vertical Surfaces: 5/8 inch. a.
 - Ceilings: 1/2 inch. b.

- 4. Mold Resistant Paper Faced Products:
 - a. Georgia-Pacific Gypsum; ToughRock Fireguard X Mold-Guard.
 - b. National Gypsum Company; Gold Bond 3/4" Ultra-Shield FS XP Gypsum Board.
 - c. USG Corporation: www.usg.com.
- 5. Glass Mat Faced Products:
- C. Abuse Resistant Wallboard:
 - 1. Application: Face layer of all partitions unless noted otherwise.
 - 2. Surface Abrasion: Level 3, minimum, when tested in accordance with ASTM C1629/C1629M.
 - 3. Indentation: Level 2, minimum, when tested in accordance with ASTM C1629/C1629M.
 - 4. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.
 - 5. Paper-Faced Type: Gypsum wallboard as defined in ASTM C1396/C1396M.
 - 6. Thickness: 5/8 inch.
 - 7. Microbial Resistance (ASTM D6329, EPA 12-week protocol): Will not support microbial growth.
 - 8. R-Value (ASTM C518): 0.67.
 - 9. Humidified Deflection (ASTM C473, ASTM C1658): Not more than 1/8 inch.
 - 10. Hardness, Core, Edges, and Ends (ASTM C473, ASTM C1396, ASTM C1658): Not less than 15.
 - 11. Water Absorption (ASTM C630, ASTM C1396, ASTM C1658): Less than 5 percent of weight.
 - 12. Edges: Tapered.
 - 13. Paper-Faced Products:
 - a. Georgia-Pacific Gypsum; ToughRock Fireguard X Mold Guard Abuse-Resistant.
 - b. National Gypsum Company; Gold Bond Hi-Abuse XP Gypsum Board.
- D. Backing Board For Wet Areas: One of the following products:
 - 1. Application: Surfaces behind tile in wet areas including toilets and janitor'closet.
 - 2. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.
 - 3. ANSI Cement-Based Board: Non-gypsum-based; aggregated Portland cement panels with glass fiber mesh embedded in front and back surfaces complying with ANSI A118.9-SystemDeleted or ASTM C1325.
 - a. Thickness: 1/2 inch.
 - b. Products:
 - a) National Gypsum Company; PermaBase Cement Board:
 - www.nationalgypsum.com/#sle.
 - b) USG Corporation: www.usg.com.
 - c) Substitutions: See Section 01 6000 Product Requirements.
- E. Ceiling Board: Special sag resistant gypsum ceiling board as defined in ASTM C1396/C1396M; sizes to minimize joints in place; ends square cut.
 - 1. Application: Ceilings, unless otherwise indicated.
 - 2. Thickness: 1/2 inch.
 - 3. Edges: Tapered.
 - 4. Products:
 - a. Georgia-Pacific Gypsum; ToughRock Span 24 Ceiling Board.
 - b. National Gypsum Company; Gold Bond Hi-Impact Brand XP Wallboard.

2.3 ACCESSORIES

- A. Acoustic Sealant: Acrylic emulsion latex or water-based elastomeric sealant; do not use solvent-based non-curing butyl sealant.
 - 1. Products:
 - a. Franklin International, Inc; Titebond GREENchoice Professional Acoustical Smoke and Sound Sealant: www.titebond.com/#sle.

- b. Substitutions: 01 2500 Substitution Procedures.
- B. Metal Edge Trim: Reveal Column, 6063T aluminum as manufactured by Fry Reglet Corporation.
 - 1. Model: Drywall DRWT, reveal joint WRM-75-75
 - 2. Size: 3/4"reveal width x 3/4" reveal depth x diameter as shown on drawings.
 - 3. Finish: Clear anodize aluminum.
- C. Beads, Joint Accessories, and Other Trim: ASTM C1047, rigid plastic, galvanized steel, or rolled zinc, unless noted otherwise.
 - 1. Corner Beads: Low profile, for 90 degree outside corners.
 - 2. L-Trim with Tear-Away Strip: Sized to fit 1/2 inch thick gypsum wallboard.
 - 3. Architectural Reveal Beads:
 - 4. Expansion Joints:
 - a. Type: V-shaped PVC with tear away fins.
- D. Joint Materials: ASTM C475 and as recommended by gypsum board manufacturer for project conditions.
 - 1. Mold resistant and asbestos free.
 - 2. Products:
 - a. Continental Building Products: www.continental-bp.com/#sle.
 - 3. Joint Compound: Drying type, vinyl-based, ready-mixed.
 - a. Products:
 - a) CertainTeed Corporation; Extreme All-Purpose Joint Compound: www.certainteed.com/#sle.
- E. Screws for Fastening of Gypsum Panel Products to Cold-Formed Steel Studs Less than 0.033 inch in Thickness and Wood Members: ASTM C1002; self-piercing tapping screws, corrosion resistant.
- F. Screws for Fastening of Gypsum Panel Products to Steel Members from 0.033 to 0.112 inch in Thickness: ASTM C954; steel drill screws, corrosion resistant.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that project conditions are appropriate for work of this section to commence.

3.2 FRAMING INSTALLATION

- A. Metal Framing: Install in accordance with ASTM C754.
- B. Provide metal bracing: at midpoint up to 8' 0"; at third point over 8'-0".
- C. Suspended Ceilings and Soffits: Space framing and furring members as indicated.
 - 1. Level ceiling system to a tolerance of 1/1200.
 - 2. Laterally brace entire suspension system.
- D. Studs: Space studs at 16 inches on center unless shown otherwise
 - 1. Extend partition framing to structure in all locations.
 - 2. Partitions Terminating at Structure: Attach top runner to structure, maintain clearance between top of studs and structure, and connect studs to track using specified mechanical devices in accordance with manufacturer's instructions; verify free movement of top of stud connections; do not leave studs unattached to track.
- E. Openings: Reinforce openings as required for weight of doors or operable panels, using not less than double studs at jambs minimum 16 gauge..
- F. Standard Wall Furring: Install at masonry walls scheduled to receive gypsum board, not more than 4 inches from floor and ceiling lines and abutting walls. Secure in place on alternate channel flanges at maximum 16 inches on center.
 - 1. Orientation: Horizontal.

- 2. Spacing: At 12 inches on center.
- G. Blocking: Install blocking for support of plumbing fixtures, wall cabinets, wood frame openings, toilet accessories, and hardware. Comply with Section 06 1000 for wood blocking.
- H. Suspended Ceiling and Soffits: Space framing and furring members as indicated.

3.3 ACOUSTIC ACCESSORIES INSTALLATION

- A. Acoustic Insulation: Place tightly within spaces, around cut openings, behind and around electrical and mechanical items within partitions, and tight to items passing through partitions.
- B. Acoustic Sealant: Install in accordance with manufacturer's instructions.
 - 1. Place one bead continuously on substrate before installation of perimeter framing members.
 - 2. Seal around all penetrations by conduit, pipe, ducts, and rough-in boxes, except where firestopping is provided.

3.4 BOARD INSTALLATION

- A. Comply with ASTM C 840.
- B. Single-Layer Non-Rated: Install gypsum board in most economical direction, with ends and edges occurring over firm bearing.
- C. Exposed Gypsum Board in Interior Wet Areas: Seal joints, cut edges, and holes with water-resistant sealant.
- D. Cementitious Backing Board: Install over steel framing members where indicated, in accordance with ANSI A108.11-SystemDeleted and manufacturer's instructions.
- E. Installation on Metal Framing: Use screws for attachment of gypsum board.

3.5 INSTALLATION OF TRIM AND ACCESSORIES

- A. Control Joints: Place control joints consistent with lines of building spaces and as follows:
 - 1. Not more than 30 feet apart on walls and ceilings over 50 feet long.
- B. Corner Beads: Install at external corners, using longest practical lengths.
- C. Edge Trim: Install at locations where gypsum board abuts dissimilar materials.

3.6 JOINT TREATMENT

- A. Paper Faced Gypsum Board: Use fiberglass joint tape, embed with drying type joint compound and finish with drying type joint compound.
 - 1. Finish gypsum board in accordance with levels defined in ASTM C840, as follows:
 - 2. Level 5: Walls and ceilings to receive semi-gloss or gloss paint finish and other areas specifically indicated.
 - 3. Level 4: Walls and ceilings to receive paint finish or wall coverings, unless otherwise indicated.
 - 4. Level 2: In utility areas, behind cabinetry, and on backing board to receive tile finish.
 - 5. Level 1: Wall areas above finished ceilings, whether or not accessible in the completed construction.
- B. Tape, fill, and sand exposed joints, edges, and corners to produce smooth surface ready to receive finishes.
 - 1. Feather coats of joint compound so that camber is maximum 1/32 inch.
- C. Where Level 5 finish is indicated, spray apply high build drywall surfacer over entire surface after joints have been properly treated; achieve a flat and tool mark-free finish.

3.7 TOLERANCES

A. Maximum Variation of Finished Gypsum Board Surface from True Flatness: 1/8 inch in 10 feet in any direction.

END OF SECTION

TILING

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SECTION INCLUDES

- A. Tile for wall and column applications.
- B. Tile for column band applications.
- C. Tile for wall accent.
- D. Cementitious backer board as tile substrate.
- E. Stone thresholds.
- F. Various Non-ceramic cove and wall SS trim pieces.

1.3 RELATED REQUIREMENTS

- A. Section 04 2600 Single-Wythe Unit Masonry.
- B. Section 07 9200 Joint Sealants: Sealing joints between tile work and adjacent construction and fixtures.
- C. Section 09 2116 Gypsum Board Assemblies: Tile backer board.
- D. Section 09 6725 Epoxy Resin Flooring

1.4 REFERENCE STANDARDS

- A. ANSI A108/A118/A136 American National Standard Specifications for the Installation of Ceramic Tile (Compendium); 2017.
- B. ANSI A108.6 American National Standard Specifications for Installation of Ceramic Tile with Chemical Resistant, Water Cleanable Tile-Setting and -Grouting Epoxy; 1999 (Reaffirmed 2010).
- C. ANSI A108.8 American National Standard Specifications for Installation of Ceramic Tile with Chemical Resistant Furan Resin Mortar and Grout; 1999 (Reaffirmed 2010).
- D. ANSI A108.9 American National Standard Specifications for Installation of Ceramic Tile with Modified Epoxy Emulsion Mortar/Grout; 1999 (Reaffirmed 2010).
- E. ANSI A108.10 American National Standard Specifications for Installation of Grout in Tilework; 1999 (Reaffirmed 2010).
- F. ANSI A108.11 American National Standard Specifications for Interior Installation of Cementitious Backer Units; 2010 (Reaffirmed 2016).
- G. ANSI A108.12 American National Standard for Installation of Ceramic Tile with EGP (Exterior Glue Plywood) Latex-Portland Cement Mortar; 1999 (Reaffirmed 2010).
- H. ANSI A108.13 American National Standard for Installation of Load Bearing, Bonded, Waterproof Membranes for Thin-Set Ceramic Tile and Dimension Stone; 2005 (Reaffirmed 2010).
- I. ANSI A118.9 American National Standard Specifications for Test Methods and Specifications for Cementitious Backer Units; 1999 (Reaffirmed 2016).
- J. ANSI A118.12 American National Standard Specifications for Crack Isolation Membranes for Thin-set Ceramic Tile and Dimension Stone Installation; 2014.
- K. ANSI A136.1 American National Standard for Organic Adhesives for Installation of Ceramic Tile; 2008 (Reaffirmed 2013).
- L. ANSI A137.1 American National Standard Specifications for Ceramic Tile; 2013.1.
- M. TCNA (HB) Handbook for Ceramic, Glass, and Stone Tile Installation; 2015.

1.5 SUBMITTALS

- A. See Section 01 3000 Administrative Requirements, for submittal procedures.
- B. Product Data: Provide manufacturers' data sheets on tile, mortar, grout, and accessories. Include instructions for using grouts and adhesives.
- C. Samples: Mount tile and apply grout on two plywood panels, minimum 18 by 18 inches in size illustrating pattern, color variations, and grout joint size variations.
- D. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
- E. Maintenance Data: Include recommended cleaning methods, cleaning materials, and stain removal methods.
- F. Maintenance Materials: Furnish the following for Greenwich Public Schools's use in maintenance of project.
 - 1. See Section 01 6000 Product Requirements, for additional provisions.
 - 2. Extra Tile: 10 square feet of each size, color, and surface finish combination.

1.6 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the types of products specified in this section, with minimum five years of documented experience.
- B. Installer Qualifications: Company specializing in performing tile installation, with minimum of five years of documented experience.

1.7 MOCK-UP

- A. See Section 01 4000 Quality Requirements, for general requirements for mock-up.
- B. Construct tile mock-up where directed, incorporating all components specified for the location.1. Approved mock-up may remain as part of the Work.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Protect adhesives from freezing or overheating in accordance with manufacturer's instructions.

1.9 FIELD CONDITIONS

- A. Do not install solvent-based products in an unventilated environment.
- B. Maintain ambient and substrate temperature of 50 degrees F during installation of mortar materials.

PART 2 PRODUCTS

2.1 TILE

- A. Manufacturers:
 - 1. Casalgrande Padana.
 - 2. United States Ceramics.
 - 3. Refer to Finish Schedule.
 - 4. Substitutions: Section 01 2500 Substitution Procedures..
- B. Wall Tile, Type CT-1: ANSI A137.1and as follows:
 - 1. Manufacturers:
 - a. PROSPEC, LLC.
 - a) Casalgrande Padana, Terre Toscane, Verrazzano, 12" x 24", matte finish
 - b) Available from ProTile Distributors Inc. Pelham NY 914.665.0654 Attn: Steve Siciliano
 - 2. Moisture Absorption: 0.5 to 3.0 percent.
 - 3. Size and Shape: 12" x 24".
 - 4. Thickness: 3/8 inch.
 - 5. Edges: Rectified.

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- 6. Wall Surface Finish: Matt.
- 7. Color: As shown on the Finish Schedule.
- C. Column Band Tile, Type CT-2: ANSI A137.1, and as follows:
 - Products: United States Ceramics.
 - a. 3" x 6" Red Pepper U739.
- D. Wall Accent Tile, Type CT-3: ANSI A137.1, and as follows:
 - 1. Manufacturers:

1.

- a. PROSPEC, LLC.
 - a) Casalgrande Padana, Granitogres Unicolore, Polished.
 - b) Available from ProTile Distributors Inc. Pelham NY 914.665.0654 Attn: Steve Siciliano
- b. Size: 12" x 12" tile.
- c. Location: Corridors 713.A, 713.B qnd 713.C walls and related pockets, recesses, etc. provide accent colors as follows:
 - a) Ten (10%) percent of total 12" x 24" wall surface tile: Rosso Pompei.
 - b) Ten (10%) percent of total 12" x 24" wall surface tile Nero.
 - c) Five (5%) percent of total 12" x 24" wall surface tile Giallo Ocra.
 - NOTE: Two (2) accent tile for each 12" x 24" replacement.

d. NOTE: Two (2.2 TRIM AND ACCESSORIES

- A. Non-Ceramic Trim: Stainless Steel, style and dimensions to suit application, for setting using tile mortar or adhesive.
 - 1. Manufacturers:
 - Schluter Systems, L.P., 194 Pleasant Ridge Road, Plattsburgh, NY 12901-5841. Tel.: (800) 472-4588. Fax: (800) 477-9783. E-mail:specassist@schluter.com. Internet: www.schluter.com.
 - a) Description: roll-formed stainless steel profile with 1-15/32" (37 mm) wide exposed surfaces joined by a symmetrically rounded corner, with integrated trapezoid-perforated anchoring legs.
 - (a) Profile Angle:
 - (1) Profile with 90 degree angle
 - (b) Material and Finish:
 - (1) Stainless Steel Type 316 L
 - (c) Height: As required by tile installation.
 - b. Product:
 - a) Schluter ECK-E, brushed stainless steel.
 - b) Schluter QUADEC, brushed stainless steel.
 - c) Schluter DILEX-EHK, brushed stainless steel.
 - d) Locations: As shown on drawings.
 - Substitutions: Section 01 2500 Substitution Procedures.
- B. Thresholds: Marble, white or gray, honed finish; 3 inches wide by full width of wall or frame opening; 1/2 inch thick; beveled one long edge with radiused corners on top side; without holes, cracks, or open seams. Inside edge unbeveled align with new tile floor height.
 - 1. Applications:

c.

- a. At open edges of floor tile where adjacent finish is a different height.
- b. Where shown on drawings.

2.3 SETTING MATERIALS

A. Manufacturers:

- 1. Mapei Corporation,1144 East Newport Center Drive, Deerfield Beach, Florida 33442, 1-888-876-2734
 - a. Bond Primer:
 - a) Water-based acrylic primer
 - (a) Primer T (For use over existing tile, painted masonry or gypsum board)
 - b. Thin Set Mortar: (For all uses)
 - a) Single-component, high-performance, polymer-modified thin-set mortar, meets or exceeds ANSI A118.4 and ANSI A118.11.
 - (a) Ultraflex 2.
- 2. Substitutions: Section 01 2500 Substitution Procedures.

2.4 GROUTS

- A. Manufacturers:
 - 1. Mapei Corporation,1144 East Newport Center Drive, Deerfield Beach, Florida 33442, 1-888-876-2734.
 - a. Product: Non Epoxy Grout.
 - 2. Substitutions: Section 01 2500 Substitution Procedures.

2.5 ACCESSORY MATERIALS

- A. Backer Board: Cementitious type complying with ANSI A118.9; high density, glass fiber reinforced, 1/4 inch thick; 2 inch wide coated glass fiber tape for joints and corners.
 - 1. 1/4" thick for use over existing gypsum board, painted plaster and painted concrete masonry units.
 - 2. 7/16 thick for use over metal stud.
 - a. Products:
 - a) Custom Building Products; WonderBoard Lite Backerboard: www.custombuildingproducts.com.
- B. Expansion Joints: Provide expansion joints for Unglazed Porcelain Tile on each column line and as recommended by the TCA Handbook for the installation reference EJ171-04 manufacturer.
 - 1. Schluter Dilex as manufactured by Schluter Systems.
 - a. PVC anchor legs and side sections, with chlorinated polyethylene sealant

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify that wall surfaces are smooth and flat within the tolerances specified for that type of work, are dust-free, and are ready to receive tile.
- B. Verify that required floor-mounted utilities are in correct location.

3.2 PREPARATION

- A. Coordinate with Contractor and electrical subcontractor that:
 - 1. No conduit will be installed surface mounted over new tile.
 - 2. Notify Owner if existing conduit is found for direction as to it's removal.
 - 3. All switches, outlets and similar boxes are extended to be flush with new tile surfaces.
- B. Protect surrounding work from damage.
- C. Vacuum clean surfaces and damp clean.
- D. Seal substrate surface cracks with filler. Level existing substrate surfaces to acceptable flatness tolerances.
- E. Install backer board in accordance with ANSI A108.11 and board manufacturer's instructions. Tape joints and corners, cover with skim coat of setting material to a feather edge.

F. Prepare substrate surfaces for adhesive installation in accordance with adhesive manufacturer's instructions.

3.3 INSTALLATION - GENERAL

- A. Install primer over existing painted surfaces and gypsum board.
- B. Install tile and thresholds and grout in accordance with applicable requirements of ANSI A108.1A thru A108.13, manufacturer's instructions, and TCNA (HB) recommendations.
- C. Lay tile to pattern indicated. Do not interrupt tile pattern through openings.
- D. Cut and fit tile to penetrations through tile, leaving sealant joint space. Form corners neatly.
- E. Place tile joints uniform in width, subject to variance in tolerance allowed in tile size. Make grout joints without voids, cracks, excess mortar or excess grout, or too little grout.
- F. Install non-ceramic trim in accordance with manufacturer's instructions.
- G. Install thresholds where indicated.
- H. Sound tile after setting. Replace hollow sounding units.
- I. Prior to grouting, allow installation to completely cure; minimum of 48 hours.
- J. Grout tile joints unless otherwise indicated.
- K. At changes in plane and tile-to-tile control joints, use tile sealant instead of grout, with either bond breaker tape or backer rod as appropriate to prevent three-sided bonding.
- L. Apply sealant to junction of tile and dissimilar materials and junction of dissimilar planes.

3.4 INSTALLATION - WALL TILE

- A. Over cementitious backer units install in accordance with TCNA (HB) Method W244C-15.
- B. Over interior new concrete and masonry install in accordance with TCNA (HB) Method 211-15.
- C. Over existing painted masonry and gypsum board provide specified primer.

3.5 CLEANING

A. Clean tile and grout surfaces.

3.6 **PROTECTION**

A. Protect walls surfaces for 2 days after installation.

3.7 SCHEDULE

A. Refer to Finish Schedule.

END OF SECTION

ACOUSTICAL CEILINGS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SECTION INCLUDES

- A. Removals.
- B. Acoustical units.
- C. Suspension system.
- D. Cleaning, repairing and painting existing suspension system.

1.3 RELATED REQUIREMENTS

- A. Section 01 6116 Volatile Organic Compound (VOC) Content Restrictions.
- B. Divisions 26 for fire alarm and light fixtures.

1.4 REFERENCE STANDARDS

- A. ASTM C635/C635M Standard Specification for the Manufacture, Performance, and Testing of Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings; 2013a.
- B. ASTM C636/C636M Standard Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-In Panels; 2013.
- C. ASTM E580/E580M Standard Practice for Installation of Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels in Areas Subject to Earthquake Ground Motions; 2014.
- D. ASTM E84 Standard Test Method for Surface Burning Characteristics of Building Materials.
- E. UL (FRD) Fire Resistance Directory; current edition.
- F. Ceilings and Interior Systems Construction Association (CISCA): Code of Practices.

1.5 SUBMITTALS

- A. See Section 01 3000 Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data on acoustical units.
- C. Samples: Submit two samples 12 x 12 inch in size illustrating material and finish of acoustical units.
- D. Samples: Submit two samples each, 12 inches long, of suspension system main runner.
- E. Manufacturer's Installation Instructions: Indicate special procedures.
- F. Maintenance Materials: Furnish the following for Greenwich Public Schools's use in maintenance of project.
 - 1. See Section 01 6000 Product Requirements, for additional provisions.
 - 2. Extra Acoustical Units: Quantity equal to 5 percent of total installed for each type of acoustical units.

1.6 QUALITY ASSURANCE

- A. Fire Performance: ASTM E84 surface burning characteristics. Flame Spread index 25 or less. Smoke development index 50 or less. (UL Labeled) Class A in accordance to ASTM E1264
- B. Suspension System Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum ten (10) years documented experience.
- C. Acoustical Unit Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum five (5) years documented experience.

D. Installers Qualifications: Company specializing in the installation of acoustical ceilings specified in this section with minimum five (5) years documented experience.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver in unopened bundles and store in a dry place with adequate air circulation. Do not deliver material to building until wet conditions such as concrete, plaster, paint, and adhesives have been completed and cured.
- B. Store products in manufacturer's unopened packaging until ready for installation.
- C. Protect system components from excessive moisture in shipment, storage, and handling

1.8 WARRANTY

A. Warranty: Provide manufacturer's standard warranty against manufacturing defects in material or workmanship when installed in accordance with the current CISCA Handbook and ASTM C367.

1.9 FIELD CONDITIONS

A. Maintain uniform temperature of minimum 60 degrees F, and maximum humidity of 40 percent prior to, during, and after acoustical unit installation.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Acoustic Tiles/Panels:
 - 1. Armstrong World Industries, Inc; ACT-1: www.armstrong.com/#sle.

2.2 ACOUSTICAL UNITS

- A. Acoustical Panels Type ACT-1: Ceramaguard Fine Fissured.
 - 1. Size: 24 x 24 inches Refer to drawings for location.
 - 2. Thickness: 5/8".
 - 3. Classification: ASTM E1264 Classification; Type XX (high density ceramic-like composition, with scrubbable finish).
 - 4. Light Reflectance: 0.82 percent, determined as specified in ASTM E 1264.
 - 5. NRC Range: 55, determined as specified in ASTM E 1264.
 - 6. Ceiling Attenuation Class (CAC): 38, determined as specified in ASTM E 1264.
 - 7. Fire Performance: ASTM E84; Class, Flame Spread Index 25 or less, Smoke Developed Index 50 or less (UL labeled
 - 8. Panel Edge: Square.
 - 9. Surface Pattern: Fine fissured.
 - 10. Surface Color: White.
 - 11. Humidity/Sag Resistance: HumiGuard® Max.
 - 12. Mold/Mildew Protection: BioBlock paint on face and back.
 - 13. Product: Ceramaguard 607 by Armstrong World Industries, Inc www.armstrong.com..
 - 14. Suspension System: Exposed grid Type Prelude XL.

2.3 SUSPENSION SYSTEM(S)

- A. Manufacturers:
 - 1. Armstrong World Industries, Inc; Product Prelude XL 15/16" and 9/16":: www.armstrong.com.
 - 2. Structural Classification: Intermediate duty, ASTM C 635.
- B. Metal Suspension Systems General: Complying with ASTM C635/C635M; die cut and interlocking components, with stabilizer bars, clips, splices, and perimeter moldings as required.
- C. Exposed Steel Suspension System: Formed steel, commercial quality cold rolled; heavy-duty.
 - 1. Profile: ACT-1 and 2; Tee; 15/16 inch wide face
 - 2. Construction: Double web.

D. Concealed Suspension System: Formed steel, commercial quality cold rolled; light-duty.

2.4 ACCESSORIES

- A. Support Channels and Hangers: Galvanized steel; size and type to suit application, seismic requirements, and ceiling system flatness requirement specified.
- B. Perimeter Moldings: Same material and finish as grid.
 - 1. Minimum 7/8" horizontal flange
 - 2. At Exposed Grid: Provide L-shaped molding for mounting at same elevation as face of grid.
 - 3. At Concealed Grid: Provide exposed L-shaped molding.
- C. Seismic Clips: Manufacturer's standard seismic clips designed and spaced to secure acoustical panels in-place.
- D. Paint: Type and color to match acoustical and paint grid units as recommended by the manufacturer.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify existing conditions before starting work.
- B. Verify existing grade is level.

3.2 INSTALLATION - SUSPENSION SYSTEM

- A. Install suspension system in accordance with ASTM C 636/C 636M, ASTM E 580/E 580M, and manufacturer's instructions and as supplemented in this section.
- B. Rigidly secure system, including integral mechanical and electrical components, for maximum deflection of 1:360.
- C. Locate system on room axis according to reflected plan.
- D. Install after major above-ceiling work is complete. Coordinate the location of hangers with other work.
- E. Provide hanger clips maximum 48" oc. Provide additional hangers and inserts as required.
- F. Hang suspension system independent of walls, columns, ducts, pipes and conduit. Where carrying members are spliced, avoid visible displacement of face plane of adjacent members.
- G. Where ducts or other equipment prevent the regular spacing of hangers, reinforce the nearest affected hangers and related carrying channels to span the extra distance.
- H. Do not support components on main runners or cross runners if weight causes total dead load to exceed deflection capability.
- I. Support fixture loads using supplementary hangers located within 6 inches of each corner, or support components independently.
- J. Do not eccentrically load system or induce rotation of runners.
- K. Perimeter Molding: Install at intersection of ceiling and vertical surfaces and at junctions with other interruptions.
 - 1. Refer to drawings for wood ceiling trim.

3.3 INSTALLATION - ACOUSTICAL UNITS

- A. Install acoustical units in accordance with manufacturer's instructions.
- B. Fit acoustical units in place, free from damaged edges or other defects detrimental to appearance and function.
- C. Fit border trim neatly against abutting surfaces.
- D. Install acoustical units level, in uniform plane, and free from twist, warp, and dents.
- E. Cutting Acoustical Units:
 - 1. Make field cut edges of same profile as factory edges.

3.4 TOLERANCES

- A. Maximum Variation from Flat and Level Surface: 1/8 inch in 10 feet.
- B. Maximum Variation from Plumb of Grid Members Caused by Eccentric Loads: 2 degrees.

3.5 ADJUSTING AND CLEANING

- A. Replace damaged or broken material, Clean exposed surfaces of acoustical ceilings, including trim, edge moldings, and suspension members. Comply with mfg,, touch up procedures using touch up paint as required for small nicks and minor scratches in the surface, Remove and replace any work that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.
 - 1. Provide touch up kit for Owner's use.

END OF SECTION

EPOXY RESIN FLOORING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Decorative monolithic epoxy-resin flooring.
 - 2. Integral cove base.
 - 3. Aluminum exoxy area separation strip.

1.3 SUBMITTALS

- A. Product Data: For each type of product specified. Include manufacturer's technical data, installation instructions, and recommendations for each resinous flooring component required.
- B. Samples for Initial Selection: Manufacturer's color charts showing the full range of colors, textures, and patterns available for each resinous flooring system indicated.
- C. Installer Certificates: Signed by manufacturer certifying that installers comply with specified requirements.
- D. Material Certificates: Signed by manufacturers certifying that materials furnished comply with requirements.
- E. Maintenance Data: For resinous flooring to include in the maintenance manuals specified in Division 1.

1.4 QUALITY ASSURANCE

- A. Installer Qualifications: Engage an experienced installer (applicator) who has specialized in installing resinous flooring similar in material, design, and extent to that indicated for this Project and who is acceptable and is certified, in writing, to resinous flooring manufacturer.
 - 1. Engage an installer who is certified in writing by resinous flooring manufacturer as qualified to install resinous flooring systems specified.
- B. Source Limitations: Obtain primary resinous flooring materials, including primers, resins, hardening agents, and sealing or finish coats, through one source from a single manufacturer. Provide secondary materials including patching and fill material, joint sealant, and repair materials of type and from source recommended by manufacturer of primary materials.
- C. Field Samples: On floor area selected by Architect, provide full-thickness resinous flooring system samples that are at least 48 inches square to demonstrate texture, color, thickness, chemical resistance, cleanability, and other features of each resinous flooring system required. Simulate finished lighting conditions for review of in-place field samples.
 - 1. If field samples are unacceptable, make adjustments to comply with requirements and apply additional samples until field samples are approved.
 - 2. After field samples are approved, these surfaces will be used to evaluate resinous flooring.
 - 3. Obtain Architect's approval of field samples before applying resinous flooring.
 - 4. Final approval of colors will be from field samples, not samples submitted for verification.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials in original packages and containers, with seals unbroken, bearing manufacturer's labels indicating brand name and directions for storage and mixing with other components.
- B. Store materials to comply with manufacturer's written instructions to prevent deterioration from moisture, heat, cold, direct sunlight, or other detrimental effects.

1.6 PROJECT CONDITIONS

- A. Environmental Limitations: Comply with resinous flooring manufacturer's written instructions for substrate temperature, ambient temperature, moisture, ventilation, and other conditions affecting resinous flooring installation.
- B. Close spaces to traffic during resinous flooring application and for not less than 24 hours after application, unless manufacturer recommends a longer period.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, those indicated in the Resinous Flooring Schedule at the end of Part 3.

2.2 MATERIALS

- A. Resinous Flooring: Resinous floor surfacing system consisting of primer; body coat(s) including resin, hardener, aggregates, and colorants, if any; and sealing or finish coat(s). Comply with requirements indicated in the Resinous Flooring Schedule.
 - 1. Reinforcing Membrane: Manufacturer's flexible resin recommended for crack isolation to help prevent substrate cracks from reflecting through resinous flooring.
 - a. Provide fiberglass scrim embedded in reinforcing membrane.
- B. Patching and Fill Material: Resinous product of or approved by resinous flooring manufacturer and recommended by manufacturer for application indicated.
- C. Joint Sealant: Type recommended or produced by resinous flooring manufacturer for type of service and joint condition indicated.
- D. Waterproofing Membrane: Type recommended or produced by manufacturer of epoxy resin composition flooring system for type of service and floor condition indicated.
- E. Anti Microbial Additive: Incorporate antimicrobial chemical additive to control growth of most algae, bacteria, fungi, mildew and mold.
- F. Moisture Mitigation System: Concrete, especially slab on grade should be tested in accordance with ASTM F1869. If pounds exceed flooring limit remedial action must be taken.
- G. Separation Strip: Extruded Aluminum "L" shape 3/8" high x 1/8" wide.
 - 1. Product: Manhattan American Terrazzo Strip Company.Inc.; 1-888-462-2813.

PART 3 - EXECUTION

3.1 INSPECTION

A. Examine the areas and conditions where decorative quartz epoxy flooring is to be installed and notify the Architect of conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions have been corrected by the Contractor in a manner acceptable to the Architect

3.2 PREPARATION

- A. General: Prepare and clean substrate according to resinous flooring manufacturer's written instructions for substrate indicated. Provide clean, dry, and neutral substrate for resinous flooring application.
- B. Concrete and painted concretee Substrates: Provide sound surfaces free of laitance, paint, glaze, efflorescence, curing compounds, form-release agents, dust, dirt, grease, oil, existing floor finish and other contaminates incompatible with resinous flooring.
 - 1. Comply with ASTM C 811 requirements, unless manufacturer's written instructions are more stringent.

- 2. Shot-blast surfaces with an apparatus that abrades the concrete surface, contains the dispensed shot within the apparatus, and recirculates the shot by vacuum pickup. Prepareconcrete surface to a suface profile equal to CSP4-6.
- 3. Repair and flash patched damaged and deteriorated concrete according to resinous flooring manufacturer's written recommendations and do a level of acceptance by the manufacturer.
- C. Existing Ceramic Tile Surface:
 - 1. Remove any existing surface coatings or waxes.
 - 2. Remove any loose tile or grout and patch flush with adjacent surface.
 - 3. Mechanically abrade existing ceramic tile surface to remove glaze and profile surface to a level acceptable to the flooring manufacturer's recomendation.
- D. Resinous Materials: Mix components and prepare materials according to resinous flooring manufacturer's written instructions.
- E. Use patching and fill material to fill holes and depressions in substrates according to manufacturer's written instructions.
- F. Treat control joints and other nonmoving substrate cracks to prevent cracks from reflecting through resinous flooring according to manufacturer's written recommendations.

3.3 APPLICATION

- A. General: Apply components of resinous flooring system according to manufacturer's written instructions to produce a uniform, monolithic wearing surface of thickness indicated.
 - 1. Coordinate application of components to provide optimum adhesion of resinous flooring system to substrate and optimum intercoat adhesion.
 - 2. Cure resinous flooring components according to manufacturer's written instructions. Prevent contamination during application and curing processes.
- B. Apply epoxy primer over prepared substrate at manufacturer's recommended spreading rate.
- C. Apply reinforcing membrane to substrate cracks.
- D. Apply self-leveling epoxy slurry body coat(s) in thickness required to cover all tile joints to smooth level prior to application of finish coats.
- E. Broadcast Coats: Apply liberal application of clear epoxy resin mixture, allow to self level, broadcast (by hand or spray machine) ceramic coated quartz aggregate, allow to set to hardness, sweep off excess unbonded aggregate and repeat process to achieve total nominal thickness of 1/16" 1/8".
- F. Integral Cove Base: Apply cove base mix to wall surfaces at locations indicated. Round internal and external corners. Install cove base according to manufacturer's written instructions and details including taping, mixing, priming, troweling, sanding, and topcoating of cove base.
- G. Finish or Sealing Coats: After quartz filled broadcast coats have cured sufficiently, apply finish coats of type recommended by flooring manufacturer to produce a slip resistant finish matching approved submittal sample and in number of coats and spreading rates recommended by manufacturer.
 - 1. Finished floor shall be 1/8" thick, uniform in color and free of trowel marks

3.4 FIELD QUALITY CONTROL

- A. Material Sampling: Owner may at any time and any number of times during flooring application require material samples for testing for compliance with requirements.
 - 1. Owner may engage an independent testing agency to take samples of materials being used. Material samples will be taken, identified and sealed, and certified in presence of Contractor.
 - 2. If test results show installed materials do not comply with specified requirements, pay for testing, remove noncomplying materials, prepare surfaces coated with unacceptable materials, and reapply flooring materials to comply with requirements.

3.5 CURING, CLEANING AND PROTECTING

- A. Cure decorative quartz epoxy flooring materials according to manufacturer's directions, taking care to prevent contamination during application stages and before completing curing process. Close application area for a minimum of 24 hours.
- B. Protect resinous flooring from damage and wear during the remainder of construction period. Use protective methods and materials, including temporary covering, recommended in writing by resinous flooring manufacturer.
- C. Clean resinous flooring not more than 4 days before dates scheduled for inspections intended to establish date of Substantial Completion in each Project area. Use cleaning materials and procedures recommended in writing by resinous flooring manufacturer.

3.6 **RESINOUS FLOORING SCHEDULE**

- A. Epoxy Resinous Flooring : Provide resinous flooring system complying with the following:
 - 1. Products: Provide the following, or approved equal:
 - a. Sherwin Williams Decorative Flake Mortar Flooring System."
 - 2. Color and Pattern:
 - a. Field: Decorative Mosaic WB D Flake Color: EC 83.
 - b. Accent Strip: Ceramic Carper #400, Decorative Broadcast, Color: Buccaneer.
 - 3. System Thickness: 3/8 inch.
 - a. Primer Coat.
 - b. Slurry broadcast
 - c. Bonding coat 2nd Broadcast
 - d. Grout Coat
 - e. Top Coat
 - 4. Wearing Surface: Antislip
 - 5. Base: Integral cove base as indicated on plans.
 - 6. Components: Provide manufacturer's standard components complying with requirements, unless otherwise indicated. Provide the following additional components:
 - a. Epoxy Primer.
 - b. Reinforcing membrane if required over existing surface cracks.
 - c. Body Coat.
 - d. Chemical-resistant sealing or finish coat(s)
 - 7. Physical Properties: Provide resinous flooring system with the following minimum physical property requirements when tested according to standard test methods indicated:
 - a. Compressive Strength: 12,000 psi per ASTM C 579
 - b. Tensile Strength: 2,500 psi per ASTM C 307
 - c. Impact Resistance: No chipping, cracking, or delamination and not more than 0.011" permanent indentation per MIL-D-3134.
 - d. Abrasion Resistance: ASTM D 4060 (CS-17 wheel) 1000 cycles
 - e. Flammability: Self-extinguishing per ASTM D 635

END OF SECTION

INTERIOR PAINTING

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SECTION INCLUDES

- A. Surface preparation.
- B. Field application of paints.
- C. Scope: Finish interior surfaces exposed to view, unless fully factory-finished and unless otherwise indicated.
 - 1. Both sides and edges of plywood backboards for electrical and telecom equipment before installing equipment.
 - 2. Steel doors and frames
 - 3. Plaster or stucco.
 - 4. Concrete masonry units (CMU), concrete block.
 - 5. Gypsum Board/Plaster walls and ceilings.
 - 6. Exposed surfaces of steel lintels.
 - 7. Mechanical and Electrical:
- D. Do Not Paint or Finish the Following Items:
 - 1. Items factory-finished unless otherwise indicated; materials and products having factory-applied primers are not considered factory finished.
 - 2. Items indicated to receive other finishes.
 - 3. Items indicated to remain unfinished.
 - 4. Fire rating labels, equipment serial number and capacity labels, bar code labels, and operating parts of equipment.
 - 5. Stainless steel, anodized aluminum, bronze, terne coated stainless steel, and lead items.
 - 6. Marble, granite, slate, and other natural stones.
 - 7. Floors, unless specifically indicated.
 - 8. Ceramic and other tiles.
 - 9. Brick.
 - 10. Glass.
 - 11. Acoustical materials, unless specifically indicated.
 - 12. Concealed pipes, ducts, and conduits.

1.3 RELATED REQUIREMENTS

- A. Section 01 6116 Volatile Organic Compound (VOC) Content Restrictions.
- B. Section 09 2116 Gypsum Board Assemblies.
- C. Refer to Division 21, 22, 23 and 26 for Tags, Charts And Identification: Color coding scheme for items to be painted under this section.

1.4 **DEFINITIONS**

A. Comply with ASTM D16 for interpretation of terms used in this section.

1.5 REFERENCE STANDARDS

- A. ASTM D16 Standard Terminology for Paint, Related Coatings, Materials, and Applications; 2014.
- B. MPI (APL) Master Painters Institute Approved Products List; Master Painters and Decorators Association; Current Edition.

- C. MPI (APSM) Master Painters Institute Architectural Painting Specification Manual; Current Edition.
- D. SSPC-SP 1 Solvent Cleaning; 2015.
- E. SSPC-SP 2 Hand Tool Cleaning; 1982 (Ed. 2004).
- F. SSPC-SP 3 Power Tool Cleaning; 1982 (Ed. 2004).

1.6 SUBMITTALS

- A. See Section 01 3000 Administrative Requirements, for submittal procedures.
- B. Product Data: Provide complete list of products to be used, with the following information for each:
 - 1. Manufacturer's name, product name and/or catalog number, and general product category (e.g. "alkyd enamel").
 - 2. MPI product number (e.g. MPI #47).
 - 3. Cross-reference to specified paint system(s) product is to be used in; include description of each system.
 - 4. Manufacturer's installation instructions.
- C. Samples: Submit three paper "draw down" samples, 8-1/2 by 11 inches in size, illustrating range of colors available for each finishing product specified.
 - 1. Where sheen is specified, submit samples in only that sheen.
 - 2. Where sheen is not specified, discuss sheen options with Fuller and D'Angelo, P.C. before preparing samples, to eliminate sheens definitely not required.
- D. Certification: By manufacturer that paints and finishes comply with VOC limits specified.
- E. Manufacturer's Instructions: Indicate special surface preparation procedures.
- F. Maintenance Data: Submit data including finish schedule showing where each product/color/finish was used, product technical data sheets, material safety data sheets (MSDS), care and cleaning instructions, touch-up procedures, and repair of painted and finished surfaces.
- G. Maintenance Materials: Furnish the following for Greenwich Public Schools's use in maintenance of project.
 - 1. See Section 01 6000 Product Requirements, for additional provisions.
 - 2. Extra Paint and Finish Materials: 1 gallon of each color; from the same product run, store where directed.
 - 3. Label each container with color in addition to the manufacturer's label.

1.7 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the products specified, with minimum 10 years documented experience.
- B. Applicator Qualifications: Company specializing in performing the type of work specified with minimum 3 years experience.

1.8 MOCK-UP

- A. See Section 01 4000 Quality Requirements, for general requirements for mock-up.
- B. Provide door and frame assembly illustrating paint color, texture, and finish.
- C. Locate Owner's Representative

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Deliver products to site in sealed and labeled containers; inspect to verify acceptability.
- B. Container Label: Include manufacturer's name, type of paint, brand name, lot number, brand code, coverage, surface preparation, drying time, cleanup requirements, color designation, and instructions for mixing and reducing.

C. Paint Materials: Store at minimum ambient temperature of 45 degrees F and a maximum of 90 degrees F, in ventilated area, and as required by manufacturer's instructions.

1.10 FIELD CONDITIONS

- A. Do not apply materials when surface and ambient temperatures are outside the temperature ranges required by the paint product manufacturer.
- B. Follow manufacturer's recommended procedures for producing best results, including testing of substrates, moisture in substrates, and humidity and temperature limitations.
- C. Minimum Application Temperatures for Paints: 50 degrees F for interiors unless required otherwise by manufacturer's instructions.
- D. Provide lighting level of 80 ft candles measured mid-height at substrate surface.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Provide paints and finishes from the same manufacturer to the greatest extent possible.
- B. Paints:
 - 1. Base Manufacturer: Sherwin-Williams Company: www.sherwin-williams.com.
- C. Primer Sealers: Same manufacturer as top coats.

2.2 PAINTS AND FINISHES - GENERAL

- A. Paints and Finishes: Ready mixed, unless intended to be a field-catalyzed paint.
 - 1. Where MPI paint numbers are specified, provide products listed in Master Painters Institute Approved Product List, current edition available at www.paintinfo.com, for specified MPI categories, except as otherwise indicated.
 - 2. Provide paints and finishes of a soft paste consistency, capable of being readily and uniformly dispersed to a homogeneous coating, with good flow and brushing properties, and capable of drying or curing free of streaks or sags.
 - 3. Provide materials that are compatible with one another and the substrates indicated under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.
 - 4. For opaque finishes, tint each coat including primer coat and intermediate coats, one-half shade lighter than succeeding coat, with final finish coat as base color.
 - 5. Supply each paint material in quantity required to complete entire project's work from a single production run.
 - 6. Do not reduce, thin, or dilute paint or finishes or add materials unless such procedure is specifically described in manufacturer's product instructions.
- B. Volatile Organic Compound (VOC) Content: Comply with Section 01 6116.
- C. Flammability: Comply with applicable code for surface burning characteristics.
- D. Sheens: Provide the sheens specified; where sheen is not specified, sheen will be selected later by Fuller and D'Angelo, P.C. from the manufacturer's full line.
- E. Colors: As indicated in Finish Schedule.
 - 1. In all areas, finish pipes, ducts, conduit, and equipment the same color as the wall/ceiling they are mounted on/under.

2.3 PAINT SYSTEMS - INTERIOR

- A. Concrete/Masonry, Opaque, Latex, Three coats: (New surfaces)
 - 1. Block Filler: One Coat Spreading rate recommended by manufacturer to achieve a dry film thickness of 16 mils wet; 7.7 mils dry
 - a. Sherwin Williams Super PrepRite Block FillerCraft No. 285.

- 2. Topcoat: Two Coats latex enamel spreading rate recommended by manufacturer to achieve a dry film thickness of 4 mils wet; 1.3 mils dry.
 - a. Sherwin Williams ProMar 400 Zero VOC Semi-Gloss
- B. Concrete/Masonry, Opaque, Latex, 2 coat: (Existing surfaces)
 - 1. Latex Primer Sealer: One Coat latex enamel spreading rate recommended by manufacturer to achieve a dry film thickness of 4 mils wet; 1.3 mils dry..
 - a. Sherwin Williams Multi-Purpose Interior Exterior Latex Primer EW
 - 2. Topcoat: Semi-gloss: One coat.
 - a. Sherwin Williams ProMar 400 Zero VOC Semi-Gloss
- C. Ferrous metals, Not Primed, Acrylic Latex, 3 coat:
 - 1. One Coat latex primer spreading rate recommended by manufacturer to achieve a dry film thickness of 3.0 to 5.6 mils.
 - a. Sherwin Williams Direct-to-Metal Semi-Gloss
 - 2. Top Coat: Two Coats Acrylic Latex spreading rate recommended by manufacturer to achieve a dry film thickness of 4 mils wet; 1.3 mils dry to 5.6 mils:
 - a. Sherwin Williams ProMar 400 Zero VOC Semi-Gloss
- D. Ferrous metals, Primed, Acrylic Latex, 2 coat:
 - 1. Touch up with latex primer.
 - 2. Two Coats Acrylic Latex spreading rate recommended by manufacturer to achieve a dry film thickness of 4 mils wet; 1.3 nils dry to 5.6 mils:
 - a. Sherwin Williams ProMar 400 Zero VOC Semi-Gloss
- E. Aluminum and Galvanized Metals, Not Primed, Acrylic Latex, 3 coat:
 - 1. One Coat latex primer spreading rate recommended by manufacturer to achieve a film thickness of 5.0 to 10 mils wet; 1.8.to 3.6 mils dry..
 - a. Sherwin Williams Pro-Cryl Universal Primer
 - 2. Two Coats Acrylic Latex spreading rate recommended by manufacturer to achieve a dry film thickness of 4 mils wet; 1.3 nils dry to 5.6 mils:
 - a. Sherwin Williams ProMar 400 Zero VOC Semi-Gloss
- F. Gypsum Board/Plaster, Latex, 3 coat: (New Surfaces)
 - 1. One Coat latex primer spreading rate recommended by manufacturer to achieve a dry film thickness of 4 mils wet and 1.3 mils dry.
 - a. Sherwin Williams QUICK DRY Interior Exterior Stain Blocking Primer Latex
 - 2. Topcoat: Two Coats of Acylic Latex spreading rate recommended by manufacturer to achieve a dry film thickness of 4 mils wet; 1.3 nils dry to 5.6 mils
 - a. Sherwin Williams ProMar 400 Zero VOC Semi-Gloss
- G. Gypsum Board/Plaster, Latex, 2 coat: (Existing Surfaces)
 - 1. One Coat latex primer spreading rate recommended by manufacturer to achieve a dry film thickness of 4 mils wet and 1.1 mils dry..
 - a. Sherwin Williams QUICK DRY Interior Exterior Stain Blocking Primer Latex
 - 2. Topcoat: One Coat of Latex spreading rate recommended by manufacturer to achieve a dry film thickness of 4 mils wet; 1.3 nils dry to 5.6 mils
 - a. Sherwin Williams ProMar 400 Zero VOC Semi-Gloss

2.4 ACCESSORY MATERIALS

A. Accessory Materials: Provide primers, sealers, cleaning agents, cleaning cloths, sanding materials, and clean-up materials as required for final completion of painted surfaces.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Do not begin application of paints and finishes until substrates have been properly prepared.
- B. Verify that surfaces are ready to receive work as instructed by the product manufacturer.
- C. Examine surfaces scheduled to be finished prior to commencement of work. Report any condition that may potentially effect proper application.
- D. Test shop-applied primer for compatibility with subsequent cover materials.
- E. Measure moisture content of surfaces using an electronic moisture meter. Do not apply finishes unless moisture content of surfaces are below the following maximums:
 - 1. Gypsum Wallboard: 12 percent.
 - 2. Plaster and Stucco: 12 percent.
 - 3. Masonry, Concrete, and Concrete Masonry Units: 12 percent.

3.2 PREPARATION

- A. Clean surfaces thoroughly and correct defects prior to application.
- B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.
- C. Remove or mask surface appurtenances, including electrical plates, hardware, light fixture trim, escutcheons, and fittings, prior to preparing surfaces or finishing.
- D. Seal surfaces that might cause bleed through or staining of topcoat.
- E. Remove mildew from impervious surfaces by scrubbing with solution of tetra-sodium phosphate and bleach. Rinse with clean water and allow surface to dry.
 - 1. Prior to removing mildew, test any cleaner on a small, inconspicuous area prior to use.
 - 2. Bleach and bleaching type cleaners may damage or discolor existing paint films. Alternative cleaning solutions may be required
 - 3. Wear protective eyewear, waterproof gloves, and protective clothing.
- F. Masonry:
 - 1. Remove efflorescence and chalk. Do not coat surfaces if moisture content or alkalinity of surfaces or if alkalinity of mortar joints exceed that permitted in manufacturer's written instructions. Allow to dry.
 - 2. Prepare surface as recommended by top coat manufacturer.
- G. Gypsum Board: Fill minor defects with filler compound. Spot prime defects after repair.
- H. Plaster: Fill hairline cracks, small holes, and imperfections with latex patching plaster. Make smooth and flush with adjacent surfaces. Wash and neutralize high alkali surfaces.
- I. Ferrous Metal:
 - 1. Solvent clean according to SSPC-SP 1.
 - 2. Shop-Primed Surfaces: Sand and scrape to remove loose primer and rust. Feather edges to make touch-up patches inconspicuous. Clean surfaces with solvent. Prime bare steel surfaces.
 - 3. Remove rust, loose mill scale, and other foreign substances using using methods recommended in writing by paint manufacturer and SSPC-SP 3. Protect from corrosion until coated.
- J. Cleaning Existing Walls: Remove all loose paint, plaster and other coatings.
 - 1. Working from bottom to top, apply prepared cleaning solution to a dry surface.
 - 2. Leave solution on the surface for 5-20 minutes. If solution begins to dry, reapply.
 - 3. Gently scrub heavily soiled areas.
 - 4. Rinse thoroughly with clean water with by masonry washing equipment generating 400-1000 psi with a water flow rate of 6-8 gallons per minute delivered through a 15-45 degree fan spray tip.

- 5. Apply after wash. Let the Afterwash stay on the surface for three to five minutes.
- 6. Pressure rinse from the bottom of the treated area to the top.
- K. Metal Doors to be Painted: Prime metal door top and bottom edge surfaces.

3.3 APPLICATION

- A. Remove unfinished louvers, grilles, covers, and access panels on mechanical and electrical components and paint separately.
- B. Apply products in accordance with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual".
- C. Do not apply finishes to surfaces that are not dry. Allow applied coats to dry before next coat is applied.
- D. Apply each coat to uniform appearance in thicknesses specified by manufacturer.
- E. Sand metal surfaces lightly between coats to achieve required finish.
- F. Vacuum clean surfaces of loose particles. Use tack cloth to remove dust and particles just prior to applying next coat.
- G. Reinstall electrical cover plates, hardware, light fixture trim, escutcheons, and fittings removed prior to finishing.

3.4 FIELD QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements, for general requirements for field inspection.

3.5 CLEANING

A. Collect waste material that could constitute a fire hazard, place in closed metal containers, and remove daily from site.

3.6 **PROTECTION**

- A. Protect finishes until completion of project.
- B. Touch-up damaged finishes after Substantial Completion.

END OF SECTION

VISUAL DISPLAY BOARDS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SECTION INCLUDES

A. Markerboards and Tackboards.

1.3 RELATED REQUIREMENTS

A. Section 06 1000 - Rough Carpentry: Blocking and supports.

1.4 REFERENCE STANDARDS

- A. ANSI A135.4 American National Standard for Basic Hardboard; 2012.
- B. ANSI A208.1 American National Standard for Particleboard; 2009.
- C. ASTM C208 Standard Specification for Cellulosic Fiber Insulating Board; 2012.
- D. ASTM E84 Standard Test Method for Surface Burning Characteristics of Building Materials; 2015a.
- E. ASTM F793 Standard Classification of Wall Covering by Use Characteristics; 2010a.

1.5 SUBMITTALS

- A. See Section 01 3000 Administrative Requirements, for submittal procedures.
- B. Product Data: Provide manufacturer's data on markerboard, tackboard, tackboard surface covering, trim, and accessories.
- C. Shop Drawings: Indicate wall elevations, dimensions, joint locations, special anchor details.
- D. Samples: Submit color charts for selection of color and texture of markerboard, tackboard, and trim.
- E. Manufacturer's printed installation instructions.
- F. Maintenance Data: Include data on regular cleaning, stain removal.

1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum five (5) years documented experience.

1.7 WARRANTY

- A. Porcelain Enamel Markerboard Warranty: Submit a written warranty executed by manufacturer agreeing to replace porcelain enamel markerboards that do not retain their original writing and erasing qualities, become slick and shiny, or exhibit crazing, cracking, or flaking within the specified warranty period, provided the manufacturer's written instructions for handling, installation, protection, and maintenance have been followed.
 - 1. Warranty Period: 50 years from date of Substantial Completion

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Visual Display Boards:
 - 1. Claridge Products and Equipment, Inc: www.claridgeproducts.com.

2.2 VISUAL DISPLAY BOARDS

- A. Fixed Markerboards: Porcelain enamel on steel, laminated to core.
 - 1. Color: White.
 - 2. Steel Face Sheet Thickness: 24 gage, 0.0239 inch .
 - 3. Core: Particleboard, 1/2 inch thick, laminated to face sheet.

- 4. Backing: Aluminum foil, laminated to core.
- 5. Size: As indicated on drawings.
- 6. Frame: Extruded aluminum, with concealed fasteners.
 - a. Provide continuous wall connector, top and bottom, standard bottom clips for each board.
- 7. Frame Profile: As indicated on drawings
- 8. Frame Finish: Anodized, natural.
- B. Accessories: Provide
 - 1. Manufacturer's standard, continuous, box-type, aluminum chalktray with slanted front and cast-aluminum end closures for each markerboard.
 - 2. Map Rail: Furnish map rail at top of each unit, complete with the following accessories:
 - a. Display Rail: Provide continuous cork display rail, 2 inches (25 or 50 mm) wide integral with map rail.
 - b. End Stops: Provide one end stop at each end of map rail.
 - c. Map Hooks: Provide 2 map hooks for every 48 inches of map rail or fraction thereof.

2.3 TACKBOARDS Fabric laminated to cork.

- A. Cork Thickness: 7/32 inch.
- B. Fabric: Vinyl coated fabric.
- C. Color: As selected from manufacturer's full range.
- D. Backing: Hardboard, 1/4 inch thick, laminated to tack surface.
- E. Surface Burning Characteristics: Flame spread index of 25, maximum, and smoke developed index of 450, maximum, when tested in accordance with ASTM E84.
- F. Size: As indicated on drawings.
- G. Frame: Extruded aluminum, with concealed fasteners.
- H. Frame Profile: Manufacturer's standard
- I. Frame Finish: Anodized, natural.

2.4 MATERIALS

- A. Porcelain Enameled Steel Sheet: ASTM A424/A424M, Type I, Commercial Steel, with fired-on vitreous finish.
- B. Vinyl Coated Fabric: ASTM F793 Category VI.
- C. Hardboard for Cores: ANSI A135.4, Class 1 Tempered, S2S (smooth two sides).
- D. Particleboard: ANSI A208.1; wood chips, set with waterproof resin binder, sanded faces.
- E. Fiber Board: ASTM C208, cellulosic fiber board.
- F. Foil Backing: Aluminum foil sheet, 0.005 inch thick.

2.5 ACCESSORIES

- A. Map Supports: Formed aluminum sliding hooks and roller brackets to fit map rail.
- B. Chalk Tray: Aluminum, manufacturer's standard profile, one piece full length of chalkboard, molded ends, concealed fasteners, same finish as frame.
- C. Mounting Brackets: Concealed.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify that field measurements are as indicated.
- B. Verify that internal wall blocking is ready to receive work and positioning dimensions are as indicated on shop drawings.

GREENWICH PUBLIC SCHOOLS GREENWICH HIGH SCHOOL LOCKER ROOM RENOVATIONS PHASE II VISUAL DISPLAY BOARDS

3.2 INSTALLATION

- A. Install boards in accordance with manufacturer's instructions.
- B. Secure units level and plumb.
- C. Butt Joints: Install with tight hairline joints.

3.3 CLEANING

- A. Clean board surfaces in accordance with manufacturer's instructions.
- B. Remove temporary protective cover at Date of Substantial Completion.

END OF SECTION

TOILET AND BATH ACCESSORIES

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SECTION INCLUDES

- A. Commercial toilet accessories include but not limited to:
- B. Commercial toilet accessories include but not limited to:
 - 1. Grab bars.
 - 2. Mirror Units.
 - 3. Toilet Tissue Dispenser. (Provided and installed by Owner).
 - 4. Liquid Soap Dispenser. (Provided and installed by Owner).
 - 5. Surface Mount Sanitary Napkin Disposal.
 - 6. Semi-Recessed Convertible Combination Towel Dispenser/Waste Receptacle.
 - 7. Waste receptacle.
 - 8. Folding Shower Seat.
 - 9. Lavatory Protective Enclosure.
 - 10. Surface mounted shelf.
 - 11. Double Robe Hook.

1.3 RELATED REQUIREMENTS

1.4 REFERENCE STANDARDS

- A. ADA Standards Americans with Disabilities Act (ADA) Standards for Accessible Design; 2010.
- B. ASTM A167 Standard Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip; 1999 (Reapproved 2009).
- C. ASTM A269/A269M Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service; 2015.
- D. ASTM A653/A653M Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2015.
- E. ASTM A666 Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar; 2015.
- F. ASTM B456 Standard Specification for Electrodeposited Coatings of Copper Plus Nickel Plus Chromium and Nickel Plus Chromium; 2011.
- G. ASTM C1036 Standard Specification for Flat Glass; 2011.
- H. ASTM C1048 Standard Specification for Heat-Strengthened and Fully Tempered Flat Glass; 2012.

1.5 ADMINISTRATIVE REQUIREMENTS

A. Coordinate the work with the placement of internal wall reinforcement and reinforcement of toilet partitions to receive anchor attachments.

1.6 SUBMITTALS

- A. See Section 01 3000 Administrative Requirements, for submittal procedures.
- B. Product Data: Submit data on accessories describing size, finish, details of function, and attachment methods.
- C. Manufacturer's Installation Instructions: Indicate special procedures and conditions requiring special attention.

1.7 WARRANTY

- A. Warranty: Contractor shall provide a warranty for two (2) years after the date of Substantial Completion of the Contractor's work or designated portion thereof. Refer to Article 15 B.1.
- B. Manufacturer's Mirror Warranty: Written warranty, executed by mirror manufacturer agreeing to replace mirrors that develop visible silver spoilage defects within minimum warranty period indicated.
 - 1. Minimum Warranty Period: 5 years from date of Substantial Completion.
- C. Manufacturers Warranty: Warranty period of 15 years from date of substantial completion against defects in product workmanship and materials.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- Basis of Design: American Specialties, Inc, 441 Saw Mill River Road, Yonkers, NY 10701; 914.476.9000.
- B. Substitutions: Refer to Section 01 2500 Substitution Procedures.
- C. All items of each type to be made by the same manufacturer, unless noted otherwise.

2.2 MATERIALS

- A. Accessories General: Shop assembled, free of dents and scratches and packaged complete with anchors and fittings, steel anchor plates, adapters, and anchor components for installation.
 - 1. Grind welded joints smooth.
 - 2. Fabricate units made of metal sheet of seamless sheets, with flat surfaces.
- B. Keys: Provide two (2) keys for each accessory to Greenwich Public Schools; master key lockable accessories.
- C. Stainless Steel Sheet: ASTM A666, Type 304.
- D. Stainless Steel Tubing: ASTM A269/A269M, Grade TP304 or TP316.
- E. Galvanized Sheet Steel: Hot-dipped galvanized steel sheet, ASTM A653/A653M, with G90/Z275 coating.
- F. Mirror Glass: Tempered safety glass, ASTM C1048; and ASTM C1036 Type I, Class 1, Quality Q2, with silvering as required.
- G. Fasteners, Screws, and Bolts: Hot dip galvanized; tamper-proof.
- H. Expansion Shields: Fiber, lead, or rubber as recommended by accessory manufacturer for component and substrate.

2.3 FINISHES

- A. Stainless Steel: Satin finish, unless otherwise noted.
- B. Chrome/Nickel Plating: ASTM B456, SC 2, polished finish, unless otherwise noted.
- C. Baked Enamel: Pretreat to clean condition, apply one coat primer and minimum two coats epoxy baked enamel.

2.4 COMMERCIAL TOILET ACCESSORIES

- A. Combination Towel Dispenser/Waste Receptacle: Semi-Recessed with projecting waste receptacle, stainless steel; seamless wall flanges, continuous piano hinges, tumbler locks on upper and lower doors.
 - 1. fabricated of alloy 18-8 stainless steel, type 304, 22 gauge
 - 2. Semi-Recessed Paper Towel Dispenser and Waste Receptacle dispenser door, frame, waste container and cabinet shall be fabricated of alloy 18-8 stainless steel, type 304, 22 gauge.
 - 3. Waste receptacle liner: Reusable, heavy-duty vinyl.
 - 4. Towel dispenser capacity: 600 C-fold or 800 multi-fold paper towels.
 - 5. Waste receptacle capacity: 12 gallons.

- 6. Products:
 - a. Model 0469-2 manufactured by American Specialties..
 - b. Substitutions: Refer to Section 01 2500 Substitution Procedures.
- B. Mirrors: Stainless steel framed, 1/4 inch thick tempered safety glass; ASTM C1048.
 - 1. Channel Frame Mirror shall have frame fabricated of alloy 18-8 stainless steel, type 304, 20 gauge with mitered corners.
 - 2. Back of mirror shall be protected by full size shock-absorbing water-resistant filler and full size one piece 20 gauge corrosion protected steel
 - 3. Size: 18" x 30" and 24" x 60".
 - 4. Backing: Back of mirror shall be protected by full size shock-absorbing water-resistant filler and full size one piece 20 gauge corrosion protected steel.
 - 5. Products:
 - a. Model 0620 manufactured by American Specialties .
- C. Grab Bars: Stainless steel, nonslip grasping surface finish.
 - 1. Standard Duty Grab Bars:
 - a. Push/Pull Point Load: 250 pound-force, minimum to meet and exceed ADA requirements.
 - b. Dimensions: 1-1/4 inch outside diameter, minimum 0.05 inch wall thickness, exposed flange mounting, 1-1/2 inch clearance between wall and inside of grab bar.
 - c. Length and Configuration: As indicated on drawings.
 - d. Snap-On Flange Covers, shall be 22 gauge for concealed mounting, type 304 stainless steel alloy 18-8.
 - e. Products:
 - a) ASI 3700P Series manufactured by American Specialties.
 - f. Substitutions: Refer to Section 01 2500 Substitution Procedures.
- D. Sanitary Napkin Disposal Unit: Stainless steel, surface-mounted, self-closing door, locking bottom panel with full-length stainless steel piano-type hinge, removable receptacle.
 - 1. Capacity: 1 gallon.
 - 2. Cabinet: Full top seamless and receptacle body with bowed front face and gently radiused front vertical edges heavy-duty stainless steel multi-staked piano hinge
 - 3. Unit shall be 22 gauge type 304 stainless steel alloy 18-8 with satin finish and shall have contoured cover finger lift relief and be protected during shipment with PVC film.
 - 4. Full top door shall be 22 gauge type 304 stainless steel alloy 18-8 with satin finish and shall be attached to the cabinet at back with a concealed full-width 9/64" diameter heavy-duty stainless steel multi-staked piano hinge.
 - 5. Receptacle: Full top edge is hemmed with return to inside for user and service safety no exposed fastening devices or spot-welded seams
 - 6. Products:
 - a. Model #20852 manufactured by American Specialties .
 - b. Substitutions: Refer to Section 01 2500 Substitution Procedures.
- E. Double Robe Hook: Double Robe Hook shall be type 304 stainless steel alloy 18-8. Wall flange shall lock to wall bracket with stainless steel M5 hex socket set screw concealed on bottom perimeter of flange. Post shall be 22 gauge tubing with formed 18 gauge threaded bracket welded inside end. Hook shall be solid pin. Flange shall be 1/16" (1.5) thick with 3/32" (2.3) thick sides and heavy reinforcement ribs. Post shall be bolted to flange with concealed and locked M6 (Ø1/4") screw.
 - 1. All exposed surfaces shall have satin finish. Wall bracket shall be 18 gauge with embossed ribs for added strength and shall have two (2) mounting slots to accommodate M4 pan head screws (provided) and allow slight installation alignment adjustment.
 - 2. Hex L-key (M2.5) is provided to lock set screw to secure unit to wall bracket .

- 3. Products:
 - a. Model #7312 manufactured by American Specialties .
 - b. Substitutions: Refer to Section 01 2500 Substitution Procedures.
- F. Surface mounted Shelf: Surface Mounted Shelf shall be fabricated of alloy 18-8 stainless steel, type 304. Brackets shall be 16 gauge and shelf shall be 18 gauge, with a 1/2" (13) lip on all four (4) sides. Front lip shall be hemmed under for safety.
 - 1. All exposed surfaces shall be No 4 satin finish and shall be protected during shipment with PVC film easily removable after installation. Structural assembly of shelf and bracket supports shall be of welded construction.
 - 2. Shelf shall be sized and brackets located as per standard schedule or shall be custom fabricated to customer supplied drawing. Scheduled shelves equal to or less than 8" (203) deep shall have standard 4" (102)high brackets and shelves in the depth range greater than 8" (203) to 12" (305) shall have 6" (152) high brackets. Consult factory for shelves deeper than 12" (305).
 - 3. Products:
 - a. Model #0692 Series manufactured by American Specialties .
 - b. Substitutions: Refer to Section 01 2500 Substitution Procedures.

2.5 SHOWER ACCESSORIES

- A. Folding Shower Seat: Compact, Wall-mounted surface; welded tubular seat frame, structural support members, hinges and mechanical fasteners all of Type 304 stainless steel, Provide self locking mechanism.
 - 1. Seat: 5/16" th. solid phenolic one-piece seat ivory color, reversible for right or left hand installation, with as indicated project 16" from wall.
 - 2. Size: ADA Standards compliant.
 - 3. Products:
 - a. Model #8206 manufactured by American Specialties .
 - b. Substitutions: Refer to Section 01 2500 Substitution Procedures.
 - 4. Clearance between back of shower seat and wall shall be 1-1/2" (38 mm) to comply with ADA Accessibility Guidelines (ADAAG).
 - 5. Seat shall be able to lock in upright position when not in use.

2.6 LAVATORY PROTECTIVE ENCLOSURE

- A. ADA-conforming, lavatories molded lavatory enclosure..
 - 1. Molded Ridged vinyl, High-impact, stain-resistant 1/8 in. thick.
 - 2. Size: 20" x 18"
 - 3. Color: China white.
 - 4. Flammability: UL-94 V-0 Rating.
 - 5. Fasteners: 7-tamperproof stainless steel.
 - 6. Product: LAV-SHIELD Model #20181 manufactured by TRUEBRO, INC.
 - a. Coordinate size with plumbing fixtures submitted.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify existing conditions before starting work.
- B. Verify exact location of accessories for installation.
- C. For electrically-operated accessories, verify that electrical power connections are ready and in the correct locations.
- D. Verify that field measurements are as indicated on drawings.

E. See Section 06 1000 for installation of blocking, reinforcing plates, and concealed anchors in walls and ceilings.

3.2 PREPARATION

- A. Deliver inserts and rough-in frames to site for timely installation.
- B. Provide templates and rough-in measurements as required.

3.3 INSTALLATION

- A. Install accessories in accordance with manufacturers' instructions in locations indicated on drawings.
- B. Install plumb and level, securely and rigidly anchored to substrate.
- C. Mounting Heights: As required by accessibility regulations, unless otherwise indicated.
 1. Grab Bars: As indicated on drawings.

3.4 **PROTECTION**

A. Protect installed accessories from damage due to subsequent construction operations.

3.5 SCHEDULE OF ACCESSORIES

- A. Refer to drawings for locations.
 - AC-1 GRAB BAR 36"
 - AC-3 VERTICAL GRAB BAR 18"
 - AC-4 MIRROR 18" x 30"
 - AC-5 MIRROR 24" x 60"
 - AC-6 LAVATORY PROTECTIVE ENCLOSURE
 - AC-7 PAPER TOWEL DISPENSER AND WASTE RECEPTACLE
 - AC-8 HORIZONTAL TWO-WALL GRAB BAR 18" x 30"
 - AC-9 SHOWER PANEL (SEE PLUMBING DWG AND SPECS)
 - AC-10 SURFACE MOUNTED STAINLESS-STEEL SHELF 8" DEEP x 36" LONG
 - AC-11 HANDICAP SHOWER SEAT. SEE SPECIFICATIONS.
 - AC-12 SANITARY NAPKIN DISPOSAL
 - AC-13 DOUBLE ROBE HOOK

END OF SECTION

GREENWICH PUBLIC SCHOOLS GREENWICH HIGH SCHOOL LOCKER ROOM RENOVATIONS PHASE II PLASTIC LOCKERS

PLASTIC LOCKERS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SECTION INCLUDES

- A. Remvals.
- B. Salvage.
- C. Plastic HDPE lockers.
- D. ADA Lockers: 5% of each locker types shall be ADA compliant. Location as indicated on the drawings
- E. HDPE Plastic filler panels and end panels.
- F. Locker benches.
- G. Locker accessories

1.3 RELATED REQUIREMENTS

- A. Section 03 3000 Cast-in-Place Concrete:
- B. Section 06 1000 Rough Carpentry: Wood blocking and nailers, furring and shims.
- C. Section 07 9200 Joint Sealants.

1.4 REFERENCE STANDARDS

- A. ADAAG American with Disabilities Act Accessibility Guidelines
- B. ANSI A117.1 Accessible and Usable Buildings and Facilities.
- C. ASTM International (ASTM)
 - 1. ASTM 1008- Standard specification for steel carbon, cold rolled commercial quality.
 - 2. ASTM D 4976 Standard specification for polyethylene plastic molding and extrusion materials.
 - 3. ASTM E 84 Standard test method for surface burning characteristics of building materials.

1.5 SUBMITTALS

- A. See Section 01 3000 Administrative Requirements, for submittal procedures.
- B. Product Data: Manufacturer's published data on locker construction, sizes and accessories.
- C. Shop Drawings: Indicate locker plan layout, numbering plan.
- D. Full Size Sample: One full-size locker of each construction specified for evaluation of construction.
- E. Sample of locker bench finish.
- F. Manufacturer's Installation Instructions: Indicate component installation assembly.
- G. Maintenance Data: For adjusting, repairing, and replacing locker doors and latching mechanisms to include in maintenance manuals.

1.6 QUALITY ASSURANCE

A. Source Limitations: Obtain locker units and accessories through one source from a single manufacturer.

1.7 MOCK-UP

- A. Provide mock-up of one full size locker, each locker tier with sloped top, in selected colors.
- B. Locate where directed.
- C. Mock-up may remain as part of the Work.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Protect locker finish and adjacent surfaces from damage.

1.9 WARRANTY

A. Locker manufacturer shall warrant the locker for a period of 15 years against delamination or breakage of any components under normal use, from the date of substantial completion. Warranty shall include all defects in material and workmanship, excluding vandalism and improper installation.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. HDPE Plastic Lockers:
 - 1. ASI Storage Solutions.2171 Liberty Hill Road, Estanollee, GA, 30538; (706) 827-2720).
 - 2. Basis of Design: Plastic Traditional Series by ASI, Heavy duty, High Impact, High Density PolyethelenePlastic (HDPE).
 - a. Lockers to match existing HDPE lockers)
 - 3. Substitutions: See Section 01 2500 Substitution Procedures.

2.2 LOCKER APPLICATIONS

- A. Two tier plastic (HDPE) lockers, on concrete curbs.
 - 1. Width: 15 inches.
 - 2. Depth: 15 inches.
 - 3. Height: 72 inches. On 4" base.
 - 4. Height: 60 inches.On 12" base.
 - 5. Fittings: Coat hooks, zinc plate forged steel; ball ends.
 - 6. Fabricate lockers to receive the locking devices, as indicated in paragraph 2.5, installed on lockers using stainless steel security type fasteners.
 - 7. Provide sloped top and finished end panel at exposed locations.

2.3 HDEP PLASTIC LOCKERS

- A. Construction:
 - 1. Components: High density polyethylene (HDPE) sheet. Commercial grade texture finish on flat surface.
 - a. Doors shall be constructed of 1/2". water resistant and non-absorbing HDPE. Colors(2) shall be as selected by the Architect. Doors shall be fitted with recessed handle, number plate, padlock hasp and locking device as indicated. Door latches shall be mounted at the mid-point of each door. Handles shall be capable of release from the inside of the locker. Hasps shall be mounted within each handle and will accept standard padlock styles. Doors shall be mounted to door frame using continuous piano style hinge and steel fasteners.
 - b. Tops, bottoms shall be constructed of 1/2". water resistant and non-absorbing HDPE.
 - c. End cover panels shall be 1" water resistant and non-absorbing HDPE.
 - d. Side panels shall be constructed of 3/8". water resistant and non-absorbing HDPE.
 - e. Shelving shall be constructed of 3/8" water resistant and non-absorbing HDPE.
 - f. Slope tops, special aluminum slope top supports , filler panels and recessed locker trim shall be constructed of 1/2". water resistant and non-absorbing HDPE. Provide where scheduled or indicated. Color as indicated on the drawings. Provide finished end panels at all exposed ends. Slope tops and finished end panels shall accommodate furring/blocking distance behind lockers. See drawing details for blocking distance, (which varies), behind lockers.
 - g. Hinges: Continuous full length zinc plated steel powder coated black color.
 - h. Latches: Securely attach to the door, continuous in design and be capable of accepting various locking mechanisms.

GREENWICH PUBLIC SCHOOLS GREENWICH HIGH SCHOOL LOCKER ROOM RENOVATIONS PHASE II PLASTIC LOCKERS

- 2. Interior Equipment:
 - a. Double tier lockers, two wall hooks.
 - b. Number plates: Polished aluminum attached to door face with black numerals, 1/2" high.
 - c. Assembly Units: Each unit shall be seperatly installed.
 - d. Locker components to be square, rigid and free of scratches.
 - e. Assemble locker box enclosure by means of machined joints, pins and tamper resistant mechanical fasteners.
 - f. Locate mechanical fasteners internal to locker box enclosure or on rear of unit.
 - g. CNC machine locker door frames from single piece of solid HDPE material.
 - h. Provide CNC machined lattice ventilation positioned in an array pattern matching existing HDPE lockers .
 - i. Mount door handle to internal latch mechanism.
 - j. Lockers shall have a full face 1/2" door frame without any seams or joints to keep locker rigid and prevent racking.
 - k. Mounting: Floor mounting. Lockers shall be elevated a minimum 1/2" above finished floor. (Existing concrete base to be used.)
 - 1. Slope Tops: Rise to equal 1/3 of depth.
 - m. Accessible Lockers: Lockers shall be the lower opening of a double tier locker where indicated on drawings. Minimum ADA lockers shall be 5% of total lockers. All shelves shall be located 15" above the floor. Doors assigned for handicapped use shall have the appropriate symbol sign installed by the manufacturer. Lockers shall be supplied with an ADA compliant single touch latch or electronic lock as specified. (Note the existing locker bases vary in height as shown on drawings)

2.4 LOCKER (and LOCKER ROOM) ACCESSORIES

- A. Accessories For each double tier locker: Two double prong wall hooks in each locker opening, 20 inches tall or more, coat hanger bar steel, formed with ball points, zinc-plated and attached with two bolts or rivets.
- B. Number Plates: Each locker shall have a polished aluminum number plate with etched black numerals not less than 1/2" high. Plates shall be attached with rivets.
 - 1. Locate number plate on door center.
 - 2. Owner to furnish numbering and sequence.
- C. Provide ADA designation labels which shall be turned over to the Owner for use when needed.
- D. ADA shelving and hooks: Provide five (5) additional loose shelving and hooks for in quantities indicated on drawings and turn over for the Owner's for use.
- E. Benches: Sizes and lengths as indicated on drawings.
 - Benches: Provide HDPE bench tops double layered HDPE totaling 1 1/2inch thick. Bench tops shall be fabricated from water resistant and non-absorbing HDPE with all edges and corners rounded.
 - 2. ADA Benches: 1'4"H x 24"W x length as indicated on drawings.
 - a. Cold Steel, 0.250" thick, with diagonal brace and rounded edges.
 - b. Provide three (3) bench back brackets.
 - 3. Heavy Duty Bench Pedestals: 16 ga. stainless steel pedestals with trapezoidal style legs. Bottom shall be 14" wide with 4 mounting holes. Pedestal shall be 16 1/4" high.

2.5 LOCKS

- A. Fabricate lockers to receive the following locking devices, installed on lockers using security-type fasteners:
 - 1. Locking: Padock hasp where indicated and located in handle recess.

GREENWICH PUBLIC SCHOOLS GREENWICH HIGH SCHOOL LOCKER ROOM RENOVATIONS PHASE II PLASTIC LOCKERS

- 2. Provide electronic locks where indicated on drawings:
 - a. Master Lock Co.; Model 3685 Black Dial
 - b. Master Lock Co.; Model 3681 Black Dial for ADA lockers.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify that prepared bases are in correct position and configuration.
- B. Verify bases and embedded anchors are properly sized.

3.2 REMOVALS AND SALVAGE

- A. All locker are to be removed.
- B. Owner will identify fifty (50) lockers to be salvage and stored on site where directed by the Owner.
- C. All other lockers not selected for salvage shall be disposed of off site by the Contractor.

3.3 INSTALLATION

- A. Wall Installation
 - 1. Securely anchor every locker to wall and /or base before use. Installation hardware to be determined based upon wall / base construction.
 - 2. Tie adjacent locker units by bolting at four points, two at top and two at bottom, using 1"cadmium plated bolts.
- B. Install in accordance with manufacturer's instructions.
- C. Install lockers plumb and square.
- D. Place and secure on existing concrete base. Field verify conditions. Flash patch and level the existing bases as required to provide smooth and level substrate. Fill and repair any holes or damage which may or may not result from existing Locker removal.
- E. Secure lockers with anchor devices to suit substrate materials. Anchor lockers to bases and walls at 48" OC or less, as recommended by manufacturer. Minimum Pullout Force: 100 lb.
- F. Fasten adjoining locker units together to provide rigid installation.
- G. Install end panels, filler panels, and sloped tops.
- H. Install accessories.
- I. Replace components that do not operate smoothly.
- J. Install benches by fastening bench tops to pedestals and securely anchoring to the floor using appropriate fasteners for the floor material. Anchorage method shall with stand vertical or horizontal force of 250lbs applied at any point on the bench.

3.4 ADJUSTING.

A. General Requirements: Upon completion of installation, inspect lockers and adjust for proper door and locking mechanism operation

3.5 CLEANING

- A. Clean locker interiors and exterior surfaces.
- B. Touch up scratches and abrasions to match original finish.
- C. Polish stainless steel and non-ferrous metal surfaces.
- D. Replace locker units that cannot be restored to factory-finished appearance.
- E. Use only materials and procedures recommended by locker manufacturer.

END OF SECTION

PROJECTION SCREENS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SECTION INCLUDES

A. Front projection screen assemblies.

1.3 RELATED REQUIREMENTS

- A. Section 06 1000 Rough Carpentry: Wood blocking in walls and ceilings.
- B. Section 09 2116 Gypsum Board Assemblies: Metal framing for recessed screens.
- C. Section 09 5100 Acoustical Ceilings: Suspended panel ceilings for recessed screens.

1.4 REFERENCES

A. NFPA 701-99 - Fire Tests for Flame-Resistant Textiles and Films.

1.5 SUBMITTALS

- A. See Section 01 3000 Administrative Requirements, for submittal procedures.
- B. Product Data: Manufacturer's catalog cuts and descriptive information 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: For installations, indicate dimensions, verified field measurements, mounting details, and interface with adjacent construction.
- D. Samples: For screen fabrics, submit two samples 6 x 6 inch in size.
- E. Operation and Maintenance Data: Provide manufacturer's operation and maintenance instructions.
- F. Warranty: Submit manufacturer warranty and ensure that forms have been completed in Greenwich Public Schools's name and registered with manufacturer.

1.6 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Experienced in manufacturing products with minimum of ten (10) years experience in the fabrication of projection screen specified in this section.
- B. Installer Qualifications: Experienced in installation of the work of this section with minimum of five (5) years .
- C. Preinstallation Meetings: Conduct preinstallation meeting to verify project requirements and manufacturer's instructions. Comply with Section 01 3000 Administrative Requirements.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver projection screens to project site in manufacturer's original unopened packaging, and inspect for damage and proper size before accepting delivery.
- B. Store in a protected, clean, dry area with temperature maintained above 50 degrees F, and stack in accordance with manufacturer's recommendations.
- C. Acclimate screens to building temperatures for 24 hours prior to installation, in accordance with manufacturer's recommendations.

1.8 FIELD CONDITIONS

A. Case Finish: Baked enamel.

1.9 WARRANTY

- A. See Section 01 7800 Closeout Submittals, for additional warranty requirements.
- B. Provide two (2) year manufacturer warranty for projection screen assembly.

PART 2 PRODUCTS

2.1 MANUFACTURERS

 Da-Lite Screen Company; Contact: P.O. Box 137, 3100 N. Detroit St., Warsaw, IN 46581-0137; Telephone: (800) 622-3737, (574) 267-8101; Fax: (877) 325-4832, (574) 267-7804; E-mail: info@da-lite.com; website: www.da-lite.com

2.2 PROJECTION SCREEN SYSTEMS

2.3 FRONT PROJECTION SCREENS

- A. Manufacturers:
 - 1. Draper, Inc (Manual); Apex: www.draperinc.com.
 - 2. Substitutions: Section 01 2500 Substitution Procedures.
- B. Front Projection Screens: Factory assembled unless otherwise indicated.
 - 1. Location: As shown on drawings: Manual, matte light diffusing fabric screen, horizontally tensioned, ceiling recessed.
 - a. Screen Viewing Area: As shown on drawings.
- C. Matte Light Diffusing Fabric: Light diffusing screen fabric; washable, flame retardant and mildew resistant.
 - 1. Material: Matte white vinyl on fiberglass backing, with nominal gain of 1.0 over viewing angle not less than 70 degrees from axis, horizontally and vertically.
 - 2. Seams: No seams permitted in fabric up to 96 inch high by 72 inch wide.
- D. Masking Borders: Black, on four sides.
- E. Extra Drops: White; 12 inch.
- F. Concealed-in-Ceiling Screen Cases: Steel, with integral roller brackets.
 - 1. Door Slat: Self trim; .
 - 2. Case Finish: Baked enamel.
 - 3. Case Color: White.
 - 4. End Caps: Steel; finished to match case.
- G. Manually-Operated Screens:
 - 1. Roller: 1-3/4 inch aluminum; spring loaded.
 - 2. Screen Pull: Ring on bottom bar.
 - 3. Vertical Tensioning: Screen fabric weighted at bottom with steel bar and plastic end caps.
 - 4. Horizontal Tensioning: Tensioning bar.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify that substrate is finished and ready to accept screen installation.
- B. If substrate preparation is the responsibility of another installer, notify Fuller and D'Angelo, P.C. of unsatisfactory preparation before proceeding.
- C. Verify that openings for recessed screens are correctly sized.
- D. Do not install projection screens until climate control systems are in place and interior painting and other finishes are completed.

3.2 PREPARATION

A. Coordinate screen installation with installation of projection systems.

3.3 INSTALLATION

- A. Install in accordance with manufacturer's instructions, using manufacturer's recommended hardware for relevant substrates.
- B. Do not field cut screens.
- C. Install screens in mountings as specified and as indicated on drawings.
- D. Install plumb and level.
- E. Adjust projection screens and related hardware in accordance with manufacturer's instructions for proper placement and operation.
- F. Test electrically operated units to verify that screen, controls, limit switches, closure and other operating components are in optimum functioning condition.

3.4 FIELD QUALITY CONTROL

- A. Manufacturer's Field Services: Have manufacturer's technical representative schedule site visits to review work as follows:
 - 1. 2 times during progress of work at 25% and completion.
 - 2. Upon completion of work, after cleaning is carried out.
- B. Testing and Inspection: Operate each screen [3] times to ensure viewing surfaces extend and retract through full range of motion.
 - 1. Verify controls, limit switches, [automatic doors] and other components function as designed and meet project requirements.
 - 2. Ensure viewing surface raising operation fully engages and lifts screen closure door into closed position.
 - 3. Adjust motors, controls and components to allow for smooth, unobstructed screen operation

3.5 **PROTECTION**

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

END OF SECTION

ROLLER SHADES

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SECTION INCLUDES

- A. Classrooms:
 - 1. For locations see drawings.

1.3 RELATED SECTIONS

- A. Section 01 2300 Alternates.
- B. Section 06 1000 Rough Carpentry: Wood blocking and grounds for mounting roller shades and accessories.
- C. Section 08 1113 Hollow Metal Doors and Frames.

1.4 REFERENCES

- A. ASTM G 21 Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi.
- B. NFPA 70 National Electrical Code.
- C. NFPA 701 Fire Tests for Flame-Resistant Textiles and Films.

1.5 SUBMITTALS

- A. Submit under provisions of Section 01 3000 Administrative Requirements.
- B. Manufacturer's data sheets on each product to be used, including:
 - 1. Preparation instructions and recommendations.
 - 2. Styles, material descriptions, dimensions of individual components, profiles, features, finishes and operating instructions.
 - 3. Storage and handling requirements and recommendations.
 - 4. Mounting details and installation methods.
- C. Shop Drawings: Plans, elevations, sections, product details, installation details, operational clearances, wiring diagrams and relationship to adjacent work.
 - 1. Prepare shop drawings on Autocad format using base sheets provided electronically by the Architect.
- D. Selection Samples: For each finish product specified, one set of shade cloth options and aluminum finish color samples representing manufacturer's full range of available colors and patterns.
- E. Maintenance Data: Methods for maintaining roller shades, precautions regarding cleaning materials and methods, instructions for operating hardware and controls.
- F. Maintenance Materials: Furnish the following for Greenwich Public Schools's use in maintenance of project.

1.6 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Obtain roller shades through one source from a single manufacturer with a minimum of twenty years experience in manufacturing products comparable to those specified in this section.
- B. Installer Qualifications: Installer trained and certified by the manufacturer with a minimum of ten years experience in installing products comparable to those specified in this section and approved by the manufacturer.
- C. Fire-Test-Response Characteristics: Passes NFPA 701 small and large-scale vertical burn. Materials tested shall be identical to products proposed for use.

D. Anti-Microbial Characteristics: 'No Growth' per ASTM G 21 results for fungi ATCC9642, ATCC 9644, ATCC9645.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver shades in factory-labeled packages, marked with manufacturer and product name, fire-test-response characteristics, and location of installation using same room designations indicated on Drawings and in the Window Treatment Schedule.

1.8 PROJECT CONDITIONS

A. Environmental Limitations: Install roller shades after finish work including painting is complete and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

1.9 WARRANTY

- A. Roller Shade Hardware and Chain Warranty: Manufacturer's standard non-depreciating twenty-five year limited warranty.
- B. Standard Shadecloth: Manufacturer's standard twenty-five year warranty.
- C. Roller Shade Installation: Two years from date of Substantial Completion.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Acceptable Manufacturer: MechoShade Systems, Inc., which is located at: 42-03 35th St., Long Island City, NY 11101; Tel: 718-729-2020; Fax: 718-729-2941; Email: jesse.fried@mechoshade.com. Web: www.mechoshade.com
- B. Requests for substitutions will be considered in accordance with provisions of Section [].

2.2 ROLLER SHADE TYPES

A. Manual operating, chain drive, sunscreen roller shades shall be provided at fixes vision panels shown on the Drawings. Shades are to be reverse roll unless otherwise noted.

2.3 SHADE CLOTH

- A. Solar Shadecloths:
 - 1. Visually Transparent Shadecloth: MechoShade Systems, Inc., ThermoVeil series, single thickness non-raveling 0.030-inch (0.762 mm) thick vinyl fabric, woven from 0.018-inch (0.457 mm) diameter extruded vinyl yarn comprising of 21 percent polyester and 79 percent reinforced vinyl.
 - 2. Color: As selected by the Architect from manufacturer's standard colors.

2.4 SHADE BAND

- A. Shade Bands: Construction of shade band includes the fabric, the hem weight, hem-pocket, shade roller tube, and the attachment of the shade band to the roller tube. Sewn hems and open hem pockets are not acceptable.
 - 1. Hem Pockets and Hem Weights: Fabric hem pocket with RF-welded seams (including welded ends) and concealed hem weights. Hem weights shall be of appropriate size and weight for shade band. Hem weight shall be continuous inside a sealed hem pocket. Hem pocket construction and hem weights shall be similar, for all shades within one room.
 - 2. Shade Band and Shade Roller Attachment:
 - a. Use extruded aluminum shade roller tube of a diameter and wall thickness required to support shade fabric without excessive deflection. Roller tubes less than 1.55 inch (39.37 mm) in diameter for manual shades, and less than 2.55 inches (64.77 mm) for motorize shades are not acceptable.
 - b. Provide for positive mechanical engagement with drive / brake mechanism.

- c. Provide for positive mechanical attachment of shade band to roller tube; shade band shall be made removable / replaceable with a "snap-on" snap-off" spline mounting, without having to remove shade roller from shade brackets.
- d. Mounting spline shall not require use of adhesives, adhesive tapes, staples, and/or rivets.
- e. Any method of attaching shade band to roller tube that requires the use of: adhesive, adhesive tapes, staples, and/or rivets are not acceptable.

2.5 SHADE FABRICATION

- A. Fabricate units to completely fill existing openings from head to sill and jamb-to-jamb, unless specifically indicated otherwise.i
- B. Fabricate shadecloth to hang flat without buckling or distortion. Fabricate with heat-sealed trimmed edges to hang straight without curling or raveling. Fabricate unguided shadecloth to roll true and straight without shifting sideways more than 1/8 inch (3.18 mm) in either direction per 8 feet (2438 mm) of shade height due to warp distortion or weave design. Fabricate hem as follows:
 - 1. Standard concealed hem bar.
- C. Provide battens in standard shades as required to assure proper tracking and uniform rolling of the shadebands. Contractor shall be responsible for assuring the width-to-height (W:H) ratios shall not exceed manufacturer's standards or, in absence of such standards, shall be responsible for establishing appropriate standards to assure proper tracking and rolling of the shadecloth within specified standards. Battens shall be roll-formed stainless steel or tempered steel, as required.
- D. For railroaded shadebands, provide seams in railroaded multi-width shadebands as required to meet size requirements and in accordance with seam alignment as acceptable to Architect or Construction Manager. Seams shall be properly located. Furnish battens in place of plain seams when the width, height, or weight of the shade exceeds manufacturer's standards. In absence of such standards, assure proper use of seams or battens as required to, and assure the proper tracking of the railroaded multi-width shadebands.
- E. Provide battens for railroaded shades when width-to-height (W:H) ratios meet or exceed manufacturer's standards. In absence of manufacturer's standards, be responsible for proper use and placement of battens to assure proper tracking and roll of shadebands.
- F. Blackout shadebands, when used in side channels, shall have horizontally mounted, roll-formed stainless steel or tempered-steel battens not more than 3 feet (115 mm) on center extending fully into the side channels. Battens shall be concealed in a integrally-colored fabric to match the inside and outside colors of the shadeband, in accordance with manufacturer's published standards for spacing and requirements.
 - 1. Batten pockets shall be self-colored fabric front and back RF welded into the shadecloth. A self-color opaque liner shall be provided front and back to eliminate any see through of the batten pocket that shall not exceed 1-1/2 inches (38.1 mm) high and be totally opaque. A see-through moire effect, which occurs with multiple layers of transparent fabrics, shall not be acceptable.

2.6 COMPONENTS

- A. Access and Material Requirements:
 - 1. Provide shade hardware allowing for the removal of shade roller tube from brackets without removing hardware from opening and without requiring end or center supports to be removed.
 - 2. Provide shade hardware that allows for removal and re-mounting of the shade bands without having to remove the shade tube, drive or operating support brackets.
 - 3. Use only Delrin engineered plastics by DuPont for all plastic components of shade hardware. Styrene based plastics, and /or polyester, or reinforced polyester will not be acceptable.
- B. Manual Operated Chain Drive Hardware and Brackets:
 - 1. Provide for universal, regular and offset drive capacity, allowing drive chain to fall at front, rear or non-offset for all shade drive end brackets. Universal offset shall be adjustable for future change.
 - 2. Provide hardware capable for installation of a removable fascia, for both regular and/or reverse roll, which shall be installed without exposed fastening devices of any kind.

- 3. Provide shade hardware system that allows for removable regular and/or reverse roll fascias to be mounted continuously across two or more shade bands without requiring exposed fasteners of any kind.
- 4. Provide shade hardware system that allows for operation of multiple shade bands (multi-banded shades) by a single chain operator, subject to manufacturer's design criteria. Connectors shall be offset to assure alignment from the first to the last shade band.
- 5. Provide shade hardware system that allows multi-banded manually operated shades to be capable of smooth operation when the axis is offset a maximum of 6 degrees on each side of the plane perpendicular to the radial line of the curve, for a 12 degrees total offset.
- 6. Provide positive mechanical engagement of drive mechanism to shade roller tube. Friction fit connectors for drive mechanism connection to shade roller tube are not acceptable
- 7. Provide shade hardware constructed of minimum 1/8-inch (3.18 mm) thick plated steel or heavier as required to support 150 percent of the full weight of each shade.

2.7 ACCESSORIES

- A. Fascia:
 - 1. Continuous removable extruded aluminum fascia that attaches to shade mounting brackets without the use of adhesives, magnetic strips, or exposed fasteners.
 - 2. Fascia shall fully conceal brackets, shade roller and fabric on the tube.
 - 3. Provide bracket / fascia end caps where mounting conditions expose outside of roller shade brackets.
 - 4. Notching of Fascia for manual chain shall not be acceptable.
- B. Bead chain Hold Down Device: WCMA approved.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Do not begin installation until substrates have been properly prepared.
- B. If substrate preparation is the responsibility of another installer, notify Architect or Ron Matten, Director of Facilities of unsatisfactory preparation before proceeding.

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.

3.3 INSTALLATION

- A. Install roller shades level, plumb, square, and true according to manufacturer's written instructions, and located so shade band is not closer than 2 inches (50 mm) to interior face of glass. Allow proper clearances for window operation hardware.
- B. Adjust and balance roller shades to operate smoothly, easily, safely, and free from binding or malfunction throughout entire operational range.
- C. Clean roller shade surfaces after installation, according to manufacturer's written instructions.
- D. Engage Installer to train Owner's maintenance personnel to adjust, operate and maintain roller shade systems.

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

PLASTIC LAMINATED CASEWORK

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Provide all plastic laminated casework and accessory items as specified herein. Refer to drawings for specific details, requirements, types and locations.
 - 1. All casework shall be plastic laminate, unless noted otherwise and shall include but not be limited to the following:
 - a. Base cabinets
 - b. Wall cabinets.
 - c. Tall cabinets.
 - d. Wardrobe units
 - e. Sink Cabinets.
 - f. Shelf units.
 - g. Plastic laminated countertops
 - h. Plastic laminated backsplashes
 - i. Solid-surfacing-material countertops and backsplash.
 - j. Work Counters.
 - k. Grommets.
 - l. Cable trays.
 - m. Under Counter support legs.
 - n. Separate wood bases for laminated cabinets.
 - o. Custom units where indicated.
 - p. Locks master keyed to room doors and other special locks.
- B. Installation of all items specified herein, including sinks and sink covers.
 - 1. Service fittings, water and electrical shall be installed by the casework contractor. Final connection shall be made by the respective mechanical electrical contractor.

1.3 RELATED WORK SPECIFIED ELSEWHERE

- A. Section 06 1000 Rough Carpentry for blocking within walls.+
- B. Section 09 2116 Gypsum Board Assemblies for metal contour framing.
- C. Section 09 6725 Epoxy Resin Flooring for base molding.
- D. Section 12 3600 Countertops for counter tops.
- E. Fixture installation/services connections: Setting and installation of equipment and fixtures, and related utility connections, are provided under the other sections of the Project Specification governing that utility.
- F. Division 22 for Stainless steel sinks, fittings, traps, stops, tailpieces, vacuum breakers, electrical outlets and other fixtures, etc. Furnished and installed by plumbing contractor.
- G. Refer to Division 22 for mechanical runs connections.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: A single installer shall perform the work of this section, and shall be a firm with not less than ten (10) continuous years of successful experience in the installation of this work, similar to that required for this project and approved by the manufacturer.

- 1. The installer shall provide a list of at least five projects of comparable size and similar in design within a fifty mile radius of this project, which may be observed by the representative of the Architect, and or Owner.
- 2. Provide laminate clad casework and countertops furnished and installed by the same supplier for single responsibility and integration with other building trades.
- B. Manufacturer shall show evidence of a minimum of ten (10) years experience in providing manufactured casework systems for similar types of projects, produce evidence of financial stability, bonding capacity, and adequate facilities and personnel required to perform on this project
- C. Casework must conform to design quality of materials, workmanship and function of casework specified and shown on drawings.
- D. ADA, Americans with Disabilities Act Requirements: The special requirements specified herein shall be met and shall be in compliance with Federal Register Volume 56, No. 144, Rules and Regulations.
- E. Design: Door/Drawer to set flush between cabinet end panels, flush inset design. Door/Drawer and all cabinet body edges to be 3mm PVC as specified herein. Overlay door designs and/or edging other than specified are not acceptable.
- F. 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.
- G. Preinstallation Conference: Conduct conference at Project site.

1.5 SUBMITTALS

- A. Samples:
 - 1. Submit 2-2" x 3" samples of casework manufacturer's standard decorative laminate colors, patterns and textures, for exposed and semi-exposed materials for architect's selection. Samples will be reviewed by Architect for color, texture, and pattern only. Compliance with other specified requirements is the exclusive responsibility of the contractor.
 - 2. Submit one full-size sample wall cabinet unit complete with hardware, doors, and adjustable shelves.
 - 3. Acceptable sample units will be used for comparison inspections at the project. Unless otherwise directed, acceptable sample units may be incorporated in the work. Notify architect of their exact locations. If not incorporated in the work, retain acceptable sample units in the building until completion and acceptance of the work.
 - 4. Remove sample units from the premises when directed by the Owner's Representative
 - 5. Plastic-laminate products, 8 by 10 inches, for each type, color, pattern, and surface finish.
 - 6. Corner pieces as follows:
 - a. Cabinet front frame joints between stiles and rail, as well as exposed end pieces, 18 inches high by 18 inches wide by 6 inches deep.
 - b. Miter joints for standing trim.
- B. Shop Drawings:
 - 1. Submit CAD production shop drawings prepared by manufacturer for laminate clad casework and countertops showing layout, elevations, ends, cross-sections, service run spaces, and location of services. Show details and location of all anchorages.
 - 2. Verify all dimensions and conditions in field.
 - 3. Include layout of units with relation to surrounding walls, doors, windows, and other building components.
 - 4. Include details of utility spaces showing supports for conduits and piping.
 - 5. Coordinate shop drawings with other work involved.

1.6 PRODUCT HANDLING:

A. Deliver laminate clad casework and countertops only after wet operations in building are completed.

- B. Store completed laminate clad casework and countertops in a ventilated place, protected from the weather, with relative humidity range of 20% to 50%.
- C. Protect finished surfaces from soiling and damage during handling and installation. Keep covered with a protective covering.

1.7 JOB CONDITIONS:

A. Advise contractor of requirements for maintaining heating, cooling and ventilation in installation areas as required to reach relative humidity necessary to maintain optimum moisture content.

1.8 WARRANTY:

A. All materials shall be guaranteed for a period of 5 years from manufacturer's defects and workmanship from date of acceptance.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS:

- A. Basis of Design: For purpose of determining minimum performance and quality standards, this specification is based upon drawings, specifications and manufacturer's literature fixed modular, flexible rail mounted, and mobile casework and accessories as manufactured by TMI SYSTEMS CORPORATION, 50 South Third Avenue West, Dickinson, North Dakota, 58601, Phone: 800-456-6716.
 - 1. Substitutions: Refer to Section 01 2500 Substitution Procedures.
- B. Regardless of manufacturer or model numbers indicated, construction shall be in accordance with LSI Corporation of America Inc. and AWI Standard Specifications for modular cabinets except where modified by these specifications. Where standard manufacturers' units do not conform to layout and/or dimensions indicated, custom fabricate unit to conform to these specifications unless such non-conformance is specifically approved by the Architect.
 - 1. Submit proof of ability to provide Certificate of Compliance in AWI, Architectural Woodwork Institute Quality Certification Program, including QCP labels on finished goods.
- C. Substitutions: Refer to Section 01 2500 Substitution Procedures.

2.2 MATERIALS:

- A. Core Materials:
 - All core material shall be a blended bio fiber composition with ultra-low formaldehyde resin system. Board shall exceed performance requirements listed below. Testing for conformance to the listed specifications must be done in accordance with procedures described in the American National Standard for Particleboard (ANSI A208.1 2016 section 5.2 Sampling for Acceptance). Board shall comply with formaldehyde emission requirements for Particleboard in CPA-ECC-2011, ANSI A208.1 2016 and CCR 93120.2 (CARB Composite Wood ATCM Phase II) Casework manufacturer shall provide documentation and certification of use within the entire cabinet. No formaldehyde, no exceptions.
 - 2. Core material shall meet the following average performance requirements: Submit compliance data from the manufacturer prior to fabrication:

| a. | Density: | Minimum 45 lbs. | |
|----|--|------------------|--|
| b. | Modulus of Rupture: | 1,800 psi. | |
| c. | Modulus of Elasticity: | 298,000 psi. | |
| d. | Average Internal Bond: | 80 psi. | |
| e. | Screw holding Face: 2 | 225 lbs. | |
| f. | Screw holding Edge: | 155 lbs. | |
| g. | Thickness Tolerance: | 0.003+/- inches. | |
| h. | Linear expansion: | 0.2% | |
| i. | Thickness swell: | 5.5% | |
| j. | Thickness used are $1/4$ ", $1/2$ ", $3/4$ " and 1". | | |

- k. Plywood: Shall be 9-ply pressure treated hardwood plywood, "A" faced, hardwood veneer.
 - Provide moister resistant core material at sink locations and wet areas:
 - a) Meeting ANSI MR10 minimum requirements, adding protection against occasional wetting and high humidity.
- B. Decorative Laminates:

1.

- 1. High Pressure Decorative Laminates (HPDL) shall be as follows:
 - a. Horizontal Surfaces: (Countertops etc.)
 - a) 107HGS, matte finish, nominal thickness .048.±005 HIGH WEAR as manufactured by Wilsonart Brand Decorative Laminate
 - b) 10/HGS High Pressure Grade .048 ±005 as manufactured by Formica Brand Laminate.
 - b. Exposed Casework Surfaces, Including Exposed Interior Surfaces:
 - a) 335VGS, matte finish, nominal thickness .028+0.001-0.004 as manufactured by Wilsonart Brand Decorative Laminate.
 - b) 335VGP, matte finish, nominal thickness .028+0.001-0.004 HIGH WEAR as manufactured by Wilsonart Brand Decorative Laminate.
 - c) 12/HGP High Pressure Grade (Standard grade) .028" as manufactured by Formica Brand Laminate.
 - c. Thermally Fused Laminate (TFL) meeting, NEMA Test LD 3-2005. (TFM allowed on casework interiors only, as specified below. Utilization of TFL on any exterior casework surfaces, including door and drawer faces and finished ends, will not be permitted.)
 - d. All laminate shall be counter balanced with heavy gauge neutral colored backing sheet.
- 2. Plastic laminate shall comply with the following minimum:

| Р | HYSICAL PI | ROPERTIES | |
|----------------------------------|------------|-----------------|----------------|
| PYSICAL PROPERTIES | LD3 TEST | Type 107 | Туре 335 |
| Appearance | 3.1 | No ABC Defects. | No ABC Defects |
| Light Resistance | 3.3 | Slight. | Slight |
| Cleanability | 3.4 | 10. | 10. |
| Stain Resistance | 3.4 | | |
| Reagents 1 - 10 | | No Effect. | No Effect. |
| Reagents 11 - 15 | | Slight. | Slight. |
| Boiling Water Resistance | 3.5 | No Effect. | No Effect. |
| High Temperature Resistance | 3.6 | Slight. | No Effect. |
| Ball Impact Resistance - in | 3.8 | 65 | 40". |
| Radiant Heat Resistance - sec | 3.10 | 210 minimum. | 200. |
| Dimensional Change | 3.11 | | |
| Machine Direction -% | | 0.3 | 0.5 |
| Cross Direction - % | | 0.7 | 0.8 |
| Wear Resistance - cycles | 3.13 | 400 (min.) | 400 (min.) |
| Formability - inches | | N/A | 5/16". |
| Blistering -sec | | N/A | 45. |
| Weight: | | 0.322 psf. | 0.186 psf |
| Fire Rating: ASTM E -84: | | | |
| As required by NYS Building Code | | Flame spread 50 | 45. |
| | | Smoke: 45 | 40. |

3. Substitutions: Refer to Section 01 2500 - Substitution Procedures.

C. Wall Panel System: Media Center Reception Desk

1. Concealed Clip Hangers

- 2. Two piece interlocking assembly.
- 3. Extruded 6063-T6 aluminum in accordance to ASTM B 221; mill finish.
 - a. Product: Monarch Z Clip: MF-375, . Phone: 631-563-8967; zclip@monarchmetal.com.
- D. Laminate Color Selection as indicated on drawings are as selected by the Architect. Final acceptance of colors by other manufacturer(s) even if listed, as "acceptable manufactures" shall be at the sole discretion of the Architect.
- E. Edgebanding: 3mm PVC banding, machine applied with waterproof hot melt adhesive with external edges and outside corners of door machine profiled to 1/8" radius for safety.
- F. Metal Parts: Countertop support brackets, legs and miscellaneous metal parts shall be furniture steel, welded, degreased, cleaned, treated and epoxy powder coated in color selected by the Architect.

2.3 CABINET HARDWARE:

- A. Hinges:
 - Shall be five knuckle, institutional grade, 2 3/4" overlay type with hospital tip, eased edges for safety, and a full, 270° door swing for easy access Steel shall be minimum .095" thick and have minimum of nine (9) edge and leaf fastenings. Hinges shall pass ANSI-BHMA standard A156.9, Grade 1 requirement for both vertical and horizontal set and sag (pair of hinges will hold minimum of 310 pounds); copy of test result shall be provided upon request. Casework manufacturer shall use nine specifically engineered screws for attachment of hinges; wood screws shall not be permitted. Doors 48" and over in height shall have three (3) hinges per door.
 - 2. Color: As selected by the Architect,
 - 3. Provide magnetic door catch with minimum seven (7) pound pull, attached with screws and slotted for adjustment.
- B. Pulls:
 - 1. Door and drawer front pull shall be ABS plastic, semi recessed, designed of molded plastic and a large gripping space, impact resistance, and no sharp edges. Pull design shall be compatible with Americans with Disability Act (ADA), Federal Register Volume 56, No. 144, specifically paragraph 4.27.4. Other pulls may be acceptable pending architect approval.
 - a. Color: As selected by the Architect
- C. Drawer Slides:
 - 1. Standard use and knee space drawers shall be Accuride 3600 series or equal with epoxy finish. Slides will have a 150 pound load rating at **full extension and** a built-in, positive stop both directions, with self closing feature. Slides shall have a lifetime warranty as offered by the slide manufacturer.
 - a. File drawer slides shall be full extension. Slides shall have a lifetime warranty as offered by the slide manufacturer.
- D. Shelf Supports:
 - 1. Adjustable Shelf Supports: Twin pin design with anti tip-up shelf restraints for both 3/4 inch (19.1 mm) and 1 inch (25.4 mm) shelves. Design shall include slot for ability to mechanically attach shelf to clip. Load rating shall be minimum 300 lbs. (136 kg) each support without failure. Cabinet interior sides shall be flush, without shelf system permanent projection.
- E. Locks:
 - 1. Provide for all doors and drawers. Locks shall be National Lock N8103, removable core, pin tumbler, cam style lock with strike. Each lock shall be furnished with two (2) keys.
 - 2. Locks shall be keyed alike for each room and MASTERKEYED. Keying shall be reviewed with Owner and approved in writing by the Owner.
 - 3. Chain bolts shall be 3" long, shall have a 18" pull and an angle strike to secure inactive door on cabinets over 72" in height. Elbow catches shall be used on inactive doors-up to and including 72" in height.

- F. Wardrobe Rod: Shall be 1 1/16 inch (27 mm) rod, supported by flanges.
- G. Coat Hooks:
 - Double coat hooks, wall mount Bright Zinc.
 a. Rockwood #798
- H. Exposed Fastener: (at Reception Desk):
 - 1. #8 Simpson-Strongtie, SS screw, Model #S08C07KQC.
- I. Under Counter Support Legs:
 - 1. Chrome plated steel round support legs with adjustable feet and steel mounting plate.
 - a. Model: #635.68.271.
 - b. Manufacturer: Hafle of America 1-800-423-3531.
- J. Grommets: Mockett, mocket.com; "BRV2" flush mounted, single slot with steel cap.
 - 1. Finish Satin aluminum.
- K. Grommets: Mockett, mocket.com; "EDP"-Flip Top, Series 2-1/2" hole..
- L. Cable/Data Trays: Provide plastic laminate tray where shown on drawings.
- M. Metal Grilles: Where metal grilles are indicated for countertops and/or base cabinets to permit thermal heat flow, they shall be as follows:
 - 1. Countertop and Similar Deck Applications: Heavy gauge extruded aluminum construction, bar type, linear design with natural anodized finish. Frame to have a 5/8" perimeter boarder and frame is to have concealed fastenings and reinforcing bands. Exposed screws in top of frame will not be accepted. Core of frame must be removable allowing for cleaning and servicing of fin tubing below and core is to be held in place by spring clips. The core consists of pencil proof design with deflecting bars 1/8" wide and placed on 1/4" centers. Sizes to be as shown on drawings.
 - a. Model # AAG-100/B frame as manufactured by Advance Architectural Grills, New Hyde Park, NY; 516-488-0628 approved equal.
 - 2. Base Grill Units: Twelve (12) gauge extruded aluminum construction, Design E, 1/4" wide openings, 1/8" satin finish aluminum, counter-sunk tamperproof screws.
 - a. Manufactured by A.J. Manufacturing, Kansas City, MO, or equal.
 - 3. Lengths shall match the length off the baseboard

2.4 ADA AMERICANS WITH DISABILITIES ACT REQUIREMENTS:

- The following special requirements shall be met, where specifically indicated on architectural plans as "ADA" or by General Note. To be in compliance with Federal Register Volume 56, No. 144, Rules and Regulations:
 - 1. Countertop height: with or without cabinet below not to exceed a height of 34 inches A.F.F. (Above Finished Floor), at a surface depth of 24 inches.
 - a. Knee space clearance: to be a minimum 27 inches A.F.F., and 30 inches clear span width.
 - b. 12 inch deep shelving, adjustable or fixed: not to exceed a range from 9 inches A.F.F. to 54 inches A.F.F.
 - c. Wardrobe cabinets: to be furnished with rod/shelf adjustable to 48 inches A.F.F., and a maximum 21 inch shelf depth.
 - d. Sink cabinet clearances: in addition to above, upper knee space frontal depth to be no less than 8 inches, and lower toe frontal depth to be no less than 11 inches, at a point 9 inches A.F.F. and as further described in Volume 56, Section 4.19.
 - e. No cabinets shall be install closer than 18" to the pull side of any door. Co-ordinate with electrical drawings for electrical devices.

2.5 DECORATIVE LAMINATE COUNTERTOPS:

A. Countertops: High-pressure plastic laminate, as specified for horizontal surfaces, bonded to water resistant core material core. Thickness as shown on plans, but not less the 1-1/2".

- 1. Underside to be properly balanced with heavy gauge backing sheet.
 - a. Furnish countertops with 3-mm edge treatment.
 - b. Provide tops in as practical continuous lengths. Provide field glued splines at joints. No joints closer than 24 inch either side of sink cutout.
 - c. The Architect shall approve location of all joints.
 - d. Where countertop surfaces are at different heights the surface between the tops shall be provided with a vertical plastic laminate closure.
 - e. Where countertops adjoin unit ventilators the top of the countertops shall be flush with the unit ventilators. Co ordinate with mechanical contractors and with window stool.
 - f. All countertops shall be mechanically fastened to cabinets.

2.6 SOLID SURFACING COUNTERTOP

- A. Homogeneous solid sheets of filled plastic resin complying with ISSFA-2.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Meganite, Inc., 800-836-1118, 1461 South Balboa Avenue, Ontario, CA 91761, www.meganite.com
 - 2. Colors and Patterns: See finish schedule.
 - 3. Thickness: As indicated on drawings.
- B. Performance characteristics:
 - 1. Flame spread/smoke developed index: Class 1A, tested to ASTM E84.
 - 2. Stain resistance: No effect, tested to ANSI Z-124.3.
 - 3. Wear and cleanability: Pass ANSI Z-124.3.
 - 4. Fungus resistance: Does not support microbial growth, tested to ASTM G21.
 - 5. Bacteria resistance: Does not support microbial growth, tested to ASTM G22.
 - 6. Meet ANSI/NSF 51.
 - 7. Impact resistance: Pass 1/2 pound ball drop, tested to ANSI/NEMA LD 3-3.3.
 - 8. Color stability: No change, tested to ANSI/NEMA LD 3-3.3.
 - 9. Boiling water surface resistance: No effect, tested to ANSI/NEMA LD 3-3.5.
 - 10. High temperature resistance: No effect, tested to ANSI/NEMA LD 3-3.5.
 - 11. Water absorption: 0.04 percent, tested to ASTM D570.
 - 12. Retain the following for Meganite sinks; edit to suit project requirements. If more than one size or shape of sink is required, schedule on drawings or at end of this section.
- C. Sinks:
 - 1. Filled methyl methacrylate with integral drain and overflow holes.
 - 2. [[__] inch round.] [[__ x __] inch oval.] [[__ x __] inch rectangular.] [Size and shape as scheduled at end of Section.]

D. ACCESSORIES

- 1. Joint Adhesive:
 - a. Two component, type as recommended by solid surfacing manufacturer.
 - b. Include the following when required to meet sustainability standards.
 - c. Maximum volatile organic compound (VOC) content: [70] [_] grams per liter.
- 2. Countertop Adhesive:
 - a. Type: Silicone or flexible neoprene.
 - b. Include the following when required to meet sustainability standards.
 - c. Maximum volatile organic compound (VOC) content: [70] [_] grams per liter.
- 3. Joint Sealant: Mildew-resistant, FDA-compliant, 100 percent silicone sealant recommended by solid surfacing manufacturer, color to match solid surfacing.

2.7 STAINLEES STEEL SINKS

A. Refer to Division 22 Plumbing for furnishing and installing stainless steel sinks.

2.8 FABRICATION

- A. Caswork
 - 1. Detailed Requirements for Cabinet Construction:
 - a. Sub-Base: Cabinet Subbase: To be separate and continuous (no cabinet body sides-to-floor), water-resistant exterior grade plywood with concealed fastening to cabinet bottom. Ladder-type construction, of front, back and intermediates, to form a secure and level platform to which cabinets attach.
 - b. Sub-base at exposed cabinet end panels shall be recessed 1/4 inch (6.4 mm) from face of finished end, for flush installation of finished base material by other trades.
 - 2. Fabricate casework to dimensions, profiles, and details shown.
 - a. Cabinet Body Construction:
 - a) Solid sub-top shall be furnished for all base and tall cabinets.
 - b) At cabinets over 36 inches (914 mm), bottoms and tops shall be mechanically joined by a fixed divider.
 - c) Exterior exposed wall cabinet bottoms shall be white pressure fused laminate both sides. Assembly devices shall be concealed on bottom side of wall cabinets
 - d) Tops and bottoms shall be joined to cabinet ends and internal cabinet components such as fixed horizontals, rails and verticals shall be joined using 10mm diameter industrial grade hardwood dowels, laterally fluted with chamfered ends, securely glued and clamped under pressure during assembly to secure joints and cabinet squareness. Use minimum of six (6) dowels at each joint for 24" deep cabinets and minimum of four (4) dowels at each joint for 12" deep cabinets.
 - e) Unless specifically indicated, core shall be 3/4" thick particleboard. Edging and surface finishes as indicated herein.
 - f) Cabinet back shall be fully bound (dadoed) into sides, top, and bottom, recessed 7/8 inch (22.2 mm) from cabinet rear. Rear, unexposed, side of back shall be toe-nailed to cabinet body with mechanical fasteners and solidified with a continuous bead of industrial grade hot melt adhesive
 - (a) Exposed back on fixed or movable cabinets to be 3/4" particleboard, color matched to cabinet interior, exterior surface GP28 laminate as selected.
 - (b) Hang rails shall be located at rear of cabinet back and fastened to cabinet sides. Provide minimum of 2 at base, 2 at wall, and 3 at tall cabinets.
 - g) All fixed under counter and tall units shall have separate factory applied or field constru- cted base, constructed of 3/4" moisture resistant plywood. Base shall be 96mm (nominal 4") high unless otherwise indicated on the drawings.
 - h) All under counter units except sink base units, shall be provided with full sub top. Sink base units shall be provided with open top, front welded steel/epoxy painted sink rail full width at top front edge concealed behind face rail/doors, split back removable access panels and bottom panel to have CL20 high pressure cabinet liner both faces, color to match interior color. No exceptions will be permitted.
 - All end panels and vertical dividers, except sink base units, shall be prepared to receive adjustable shelf hardware at 32mm (approximately 1-1/4") centers. Door hinges, drawer slides and pull-out shelves shall mount on line boring to maintain vertical alignment of components and provide for future relocation of doors, drawers, shelves and/or pull-out shelves.
 - All exposed and semi exposed edges of basic cabinet components shall be factory edged with 3 mm PVC banding, machine applied with waterproof hot melt adhesive. Color as selected by the Architect.

- k) Adjustable shelf core shall be 3/4" thick particleboard up to 30" wide, 1" thick particleboard over 30" wide.
- (a) Front edge shall have factory applied 3 mm PVC, color to match shelf color.I) Interior Finish, Units with Open Interiors:
 - (a) Sides, top, bottom, horizontal, and vertical members, and adjustable shelving faced high pressure plastic laminate with matching back.
- m) Interior Finish, Units with Closed interiors:
 - (a) Sides, top, bottom, horizontal, and vertical members, and adjustable shelving faced with melamine laminate with matching prefinished back in color as selected by the Architect.
- n) Exposed Ends:
 - (a) Shall be faced with high pressure decorative laminate GP28 (.028) color from casework manufacturer's full range offering of at least 120 colors.
- o) Wall Unit Bottom:
 - (a) Shall be faced with melamine laminate in color as selected by the Architect.
- p) Wall and Tall Unit Tops:
 - (a) The top edge of all wall and tall unit end panels shall be factory edged with 3mm PVC to match basic cabinet body color; raw edges at top of wall and tall end panels will not be permitted.
 - (1) Top surface will be laminated with melamine in color as selected by the Architect.
- b. Balanced construction of all laminated panels is mandatory. Unfinished core stock surfaces, even on concealed surfaces (excluding edges), will not be permitted. No exceptions.
- 3. Drawers:
 - a. Sides, back and sub front shall be particleboard, 1/2" thick, laminated with melamine in dove gray, frosty white or light beige to match basic cabinet body color. The back and sub front are doweled and glued into the sides. Dowels shall be fluted, with chamfered ends and a minimum diameter of 8 mm. Top edges is banded with 3 mm PVC edging in a matching color.
 - a) Drawer bottom shall be particleboard, 1/2" thick, laminated with melamine in color to match basic cabinet body color, screwed directly to the bottom edges of the drawer box. Drawer bottom less than 1/2" thick will not be permitted.
 - b) Paper storage drawers are constructed similar except retaining hood shall be included at the rear of each drawer.
 - c) Painted finishes on drawer sides and/or bottom will not be permitted.
- 4. Door/Drawer Fronts:
 - a. Laminated door and drawer fronts shall be 13/16 inch (20.6 mm) thick for all hinged and sliding doors. Drawer fronts and hinged doors shall overlay the cabinet body. Maintain a maximum 1/8 inch (3.2 mm) reveal between pairs of doors, between door and drawer front, or between multiple drawer fronts within the cabinet.
- 5. Double doors shall be used on all cabinets in excess of 24" wide.
- 6. Exterior faces shall be laminated with high pressure decorative laminate specified, color as selected. Interior face shall be high pressure cabinet liner CL20.
- 7. All edges shall be finished with 3mm PVC available in color as selected by the Architect. External edges and outside corners shall be machine profiled to 1/8" radius.
- B. Door/Drawer Front Rail: Provide minimum 3/4 inch (19.1 mm) x 6 inch (152 mm) x full width cabinet body rails immediately behind all door/drawer and multiple drawer horizontal joints to maintain exact body dimensions, close off reveal, and be locator for lock strikes.

2.9 WORKMANSHIP:

- A. All exposed exterior cabinet surfaces to be decorative high pressure plastic laminate, color as selected by the Architect. Laminate surface/backer to core under controlled conditions, by approved and regulated laminating methods to assure a premium lamination. Natural-setting P.V.A. Type III water resistant adhesives that cure through chemical reaction, containing no health or environmentally hazardous ingredients, are required. Methods requiring heat are not allowed: "contact", methods of laminating are not allowed.
 - 1. Cabinet parts shall be accurately machined and bored for premium grade quality joinery construction utilizing automatic machinery to insure consistent sizing of modular components. End panels shall be doweled to receive bottom and top.
 - 2. Back panel to be housed per AWI Standards using concealed dado or dowel matched or interlocking mechanical fasteners. Concealed dado and dowel methods shall be assembled utilizing glue and pressure. Dado method must be reinforced with blind nailing or screwing.
 - 3. Drawer bottom shall be fully housed into sides, back and sub front. Sides of drawer shall be fully dadoed to receive drawer back, locked in fully to sub-front, fastened with glue and mechanical fasteners. Recessed construction methods to utilize blind nailing hang rails as required per AWI specifications.
 - 4. 3/4 inch thick hang rails shall be glued to backside and mechanically fastened to end panels of all wall, base and tall cabinets for extra rigidity and to facilitate installation.
 - 5. Rear of cabinet back and underside of drawer bottom joints to receive a continuous bead of hot melt adhesive to add to unit body strength and develop moisture and vermin seal.
 - 6. All cases shall be square, plumb, and true.
 - 7. Case body and drawer workmanship and quality of construction shall be further evidenced by Independent Testing Laboratory results as described in 1.04 D.
 - 8. Provide removable back panels and closure panels for plumbing access where shown on drawings.

2.10 ACCESS PANELS:

A. Provide removal full width, back panels and closure panels with tamper proof screws cam lock for access to heating and/or plumbing valves, traps, etc. as required. Coordinate with mechanical/electrical drawings.

PART 3 - EXECUTION

3.1 INSPECTION:

A. The installer must examine the jobsite and the conditions under which the work under this section is to be performed, and notify the contractor in writing of unsatisfactory conditions. Do not proceed with work under this section until unsatisfactory conditions have been corrected in a manner acceptable to the installer.

3.2 PREPARATION:

A. Condition laminate clad casework to average prevailing humidity conditions in installation areas prior to installing.

3.3 COORDINATION:

- A. Verify site dimensions of cabinet locations in building prior to fabrication
- B. Coordinate layout and installation of framing and reinforcements for support of casework, and equipment furnished by others and installed in casework.
- C. Coordinate installation of roughing with other prime contractors.
- D. Coordinate layout and installation of framing and reinforcements for support of casework.
- E. Coordinate installation of casework with installation of other casework equipments and accessories.

3.4 **PROTECTION**

A. Storage and Protection: Casework shall be protected in storage. Store under cover in a ventilated building not exposed to extreme temperature and humidity changes. Store off the floor to prevent chipping of laminate. Do not store or install casework in building until concrete, masonry or other wet trades are dry.

3.5 INSTALLATION OF CABINETS

- A. Install all base cabinets on a separate wood base.
- B. Install insulation to rear of cabinets as detailed.
- C. Install level, plumb, and true; shim as required, using concealed shims. Where casework abuts other finished work, apply filler strips and scribe for accurate fit, with fasteners concealed where practical. Do not exceed the following tolerances:
 - 1. Variation of Tops of Base Cabinets from Level: 1/16 inch in 10 feet.
 - 2. Variation of Bottoms of Upper Cabinets from Level: 1/8 inch in 10 feet.
 - 3. Variation of Faces of Cabinets from a True Plane: 1/8 inch in 10 feet.
 - 4. Variation of Adjacent Surfaces from a True Plane (Lippage): 1/32 inch.
 - 5. Variation in Alignment of Adjacent Door and Drawer Edges: 1/16 inch.
 - 6. Base Cabinets: Fasten cabinets to utility-space framing, partition framing, wood blocking, or reinforcements in partitions with fasteners spaced not more than 24 inches o.c. Bolt adjacent cabinets together with joints flush, tight, and uniform.
 - a. Where base cabinets are installed away from walls, fasten to floor at toe space at not more than 24 inches o.c. and at sides of cabinets with not less than 2 fasteners per side.
 - 7. Wall Cabinets: Fasten to hanging strips, masonry, partition framing, blocking, or reinforcements in partitions. Fasten each cabinet through back, near top, at not less than 24 inches o.c.
 - 8. Install hardware uniformly and precisely. Set hinges snug and flat in mortises.
 - 9. Adjust casework and hardware so doors and drawers align and operate smoothly without warp or bind and contact points meet accurately. Lubricate operating hardware as recommended by manufacturer.
- D. Erect casework, plumb, level, true and straight with no distortions. Shim as required. Where laminate clad casework abuts other finished work, scribe and cut to accurate fit.
- E. All fasteners shall be approved by the architect and provide with screw caps or approved washers. Gypsum board screws are not permitted.

3.6 INSTALLATION OF COUNTERTOPS

- A. Abut top and edge surfaces in one true plane with flush hairline joints and with internal supports placed to prevent deflection. Locate joints only where shown on Shop Drawings.
 - 1. Field Jointing: Where possible, make in same manner as shop-made joints using dowels, splines, fasteners, adhesives, and sealants recommended by manufacturer. Prepare edges in shop for field-made joints.
 - a. Use concealed clamping devices for field-made joints in plastic-laminate countertops. Locate clamping devices within 6 inches of front and back edges and at intervals not exceeding 24 inches (600 mm). Tighten according to manufacturer's written instructions to exert a uniform heavy pressure at joints.
 - 2. Fastening:
 - a. Secure countertops, except for epoxy countertops, to cabinets with Z-type fasteners or equivalent, using two or more fasteners at each cabinet front, end, and back.
 - b. Secure epoxy countertops to cabinets with epoxy cement, applied at each corner and along perimeter edges at not more than 48 inches o.c.

- a) Where necessary to penetrate countertops with fasteners, countersink heads approximately 1/8 inch and plug hole flush with material equal to countertop in chemical resistance, hardness, and appearance.
- 3. Provide required holes and cutouts for sinks and service fittings.
 - a. Seal unfinished edges and cutouts in plastic-laminate countertops with heavy coat of polyurethane varnish.
 - b. Provide scribe moldings for closures at junctures of countertop, curb, and splash with walls as recommended by manufacturer for materials involved. Match materials and finish to adjacent laboratory casework. Use chemical-resistant, permanently elastic sealing compound where recommended by manufacturer.
 - c. Carefully dress joints smooth, remove surface scratches, and clean entire surface.
- B. Adjust casework and hardware so that doors and drawers operate smoothly without warp or bind. Lubricate operating hardware as recommended by manufacturer.
- C. Seal joint between back/end splashes and vertical surfaces.

3.7 INSTALLATION OF STAINLESS STEEL SINKS

- A. Comply with requirements in Division 22 for installing sink, water, drainage, faucets and fittings.
 - 1. Install fittings according to Shop Drawings, installation requirements in SEFA 2.3, and manufacturer's written instructions. Set bases and flanges of sink- and countertop-mounted fittings in sealant recommended by manufacturer of sink or countertop material. Securely anchor fittings to laboratory casework unless otherwise indicated.

3.8 ADJUSTING

- A. Repair or remove and replace defective work, as directed by (Architect/Owner) upon completion of installation.
- B. Adjust doors, drawers, hardware, fixtures and other moving or operating parts to function smoothly.

3.9 CLEANING AND PROTECTION:

- A. Repair or remove and replace defective work as directed upon completion of installation.
 - 1. Clean plastic surfaces, repair minor damage per plastic laminate manufacturer's recommendations. Replace other damaged parts or units.
 - 2. Remove all cartons, debris, sawdust, scraps, etc. and leave space ready for final cleaning.
 - 3. Protect all casework and tops from damage by other trades until acceptance of the work by the Owner.

END OF SECTION

SECTION 210500 COMMON WORK RESULTS FOR FIRE SUPPRESSION

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. Piping materials and installation instructions common to most piping systems.
 - 2. Mechanical sleeve seals.
 - 3. Sleeves.
 - 4. Fire-suppression equipment and piping demolition.
 - 5. Painting and finishing.
 - 6. Supports and anchorages.

1.3 DEFINITIONS

- A. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe chases, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspaces, and tunnels.
- B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.
- C. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.
- D. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and in chases.
- E. Concealed, Exterior Installations: Concealed from view and protected from weather conditions and physical contact by building occupants but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.

1.4 SUBMITTALS

- A. Product Data: For the following:
 - 1. Mechanical sleeve seals.
 - 2. Escutcheons.
- B. Welding certificates.

1.5 QUALITY ASSURANCE

- A. Steel Support Welding: Qualify processes and operators according to AWS D1.1, "Structural Welding Code--Steel."
- B. Steel Pipe Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."
 - 1. Comply with provisions in ASME B31 Series, "Code for Pressure Piping."
 - 2. Certify that each welder has passed AWS qualification tests for welding processes involved and that certification is current.
- C. Electrical Characteristics for Fire-Suppression Equipment: Equipment of higher electrical characteristics may be furnished provided such proposed equipment is approved in writing and connecting electrical services, circuit breakers, and conduit sizes are appropriately modified. If minimum energy ratings or efficiencies are specified, equipment shall comply with requirements.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and to prevent entrance of dirt, debris, and moisture.

1.7 COORDINATION

- A. Arrange for pipe spaces, chases, slots, and openings in building structure during progress of construction, to allow for fire-suppression installations.
- B. Coordinate installation of required supporting devices and set sleeves in poured-in-place concrete and other structural components as they are constructed.
- C. Coordinate requirements for access panels and doors for fire-suppression items requiring access that are concealed behind finished surfaces. Access panels and doors are specified in Division 08 Section "Access Doors and Frames."

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 PIPE, TUBE, AND FITTINGS

- A. Refer to individual Division 21 piping Sections for pipe, tube, and fitting materials and joining methods.
- B. Pipe Threads: ASME B1.20.1 for factory-threaded pipe and pipe fittings.

2.3 JOINING MATERIALS

- A. Refer to individual Division 21 piping Sections for special joining materials not listed below.
- B. Pipe-Flange Gasket Materials: Suitable for chemical and thermal conditions of piping system contents.
 - 1. ASME B16.21, nonmetallic, flat, asbestos-free, 1/8-inch maximum thickness unless thickness or specific material is indicated.
 - a. Full-Face Type: For flat-face, Class 125, cast-iron and cast-bronze flanges.
 - b. Narrow-Face Type: For raised-face, Class 250, cast-iron and steel flanges.
 - 2. AWWA C110, rubber, flat face, 1/8 inch thick, unless otherwise indicated; and full-face or ring type, unless otherwise indicated.
- C. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.
- D. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.
- E. Brazing Filler Metals: AWS A5.8, BCuP Series, copper-phosphorus alloys for general-duty brazing, unless otherwise indicated; and AWS A5.8, BAg1, silver alloy for refrigerant piping, unless otherwise indicated.
- F. Welding Filler Metals: Comply with AWS D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

2.4 MECHANICAL SLEEVE SEALS

- A. Description: Modular sealing element unit, designed for field assembly, to fill annular space between pipe and sleeve.
 - 1. Manufacturers:
 - a. Thunderline
 - b. Calpico, Inc.
 - c. Metraflex Co.
 - 2. Sealing Elements: EPD Minterlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
 - 3. Pressure Plates: Plastic. Include two for each sealing element.
 - 4. Connecting Bolts and Nuts: Carbon steel with corrosion-resistant coating of length required to secure pressure plates to sealing elements. Include one for each sealing element.

2.5 SLEEVES

- A. Galvanized-Steel Sheet: 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint.
- B. Steel Pipe: ASTM A 53, Type E, Grade B, Schedule 40, galvanized, plain ends.
- C. Cast Iron: Cast or fabricated "wall pipe" equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.

- D. Stack Sleeve Fittings: Manufactured, cast-iron sleeve with integral clamping flange. Include clamping ring and bolts and nuts for membrane flashing.
 - 1. Underdeck Clamp: Clamping ring with set screws.
- E. Molded PE: Reusable, PE, tapered-cup shaped, and smooth-outer surface with nailing flange for attaching to wooden forms.

2.6 GROUT

- A. Description: ASTM C 1107, Grade B, nonshrink and nonmetallic, dry hydraulic-cement grout.
 - 1. Characteristics: Post-hardening, volume-adjusting, nonstaining, noncorrosive, nongaseous, and recommended for interior and exterior applications.
 - 2. Design Mix: 5000-psi, 28-day compressive strength.
 - 3. Packaging: Premixed and factory packaged.

PART 3 - EXECUTION

3.1 FIRE-SUPPRESSION DEMOLITION

- A. Refer to Division 01 Section "Cutting and Patching" and Division 02 Section "Selective Structure Demolition" for general demolition requirements and procedures.
- B. Disconnect, demolish, and remove fire-suppression systems, equipment, and components indicated to be removed.
 - 1. Piping to Be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material.
 - 2. Piping to Be Abandoned in Place: Drain piping and cap or plug piping with same or compatible piping material.
 - 3. Equipment to Be Removed: Disconnect and cap services and remove equipment.
 - 4. Equipment to Be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make equipment operational.
 - 5. Equipment to Be Removed and Salvaged: Disconnect and cap services and remove equipment and deliver to Owner.
- C. If pipe, insulation, or equipment to remain is damaged in appearance or is unserviceable, remove damaged or unserviceable portions and replace with new products of equal capacity and quality.

3.2 PIPING SYSTEMS - COMMON REQUIREMENTS

- A. Install piping according to the following requirements and Division 21 Sections specifying piping systems.
- B. 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 Coordination Drawings.
- C. Install piping in concealed locations, unless otherwise indicated and except in equipment rooms and service areas.

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- 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 to permit valve servicing.
- G. Install piping at indicated slopes or as required to facilitate positive drainage of piping.
- H. Install piping free of sags and bends.
- I. Install fittings for changes in direction and branch connections.
- J. Install piping to allow application of insulation.
- K. Select system components with pressure rating equal to or greater than system operating pressure.
- L. Install escutcheons for penetrations of walls, ceilings, and floors according to the following:
 - 1. New Piping:
 - a. Piping with Fitting or Sleeve Protruding from Wall: One-piece, deep-pattern type.
 - b. Insulated Piping: One-piece, stamped-steel type with spring clips.
 - c. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, stamped-steel type.
 - d. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece , cast-brass type with polished chrome-plated finish.
 - e. Bare Piping in Unfinished Service Spaces: One-piece, cast-brass type with polished chrome-plated finish.
 - f. Bare Piping in Equipment Rooms: One-piece, cast-brass type.
 - g. Bare Piping at Floor Penetrations in Equipment Rooms: One-piece, floor-plate type.
 - 2. Existing Piping: Use the following:
 - a. Insulated Piping: Split-plate, stamped-steel type with exposed-rivet hinge and spring clips.
 - b. Bare Piping at Wall and Floor Penetrations in Finished Spaces: Split-casting, cast-brass type with chrome-plated finish.
 - c. Bare Piping at Ceiling Penetrations in Finished Spaces: Split-casting, cast-brass type with chrome-plated finish.
 - d. Bare Piping in Unfinished Service Spaces: Split-casting, cast-brass type with polished chrome-plated finish.
 - e. Bare Piping in Equipment Rooms: Split-casting, cast-brass type.
 - f. Bare Piping at Floor Penetrations in Equipment Rooms: Split-casting, floor-plate type.
- M. Sleeves are not required for core-drilled holes.
- N. Permanent sleeves are not required for holes formed by removable PE sleeves.
- O. Install sleeves for pipes passing through concrete and masonry walls and concrete floor and roof slabs.
- P. Install sleeves for pipes passing through concrete and masonry walls, gypsum-board partitions, and concrete floor and roof slabs.
 - 1. Cut sleeves to length for mounting flush with both surfaces.

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- a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches above finished floor level. Extend cast-iron sleeve fittings below floor slab as required to secure clamping ring if ring is specified.
- 2. Install sleeves in new walls and slabs as new walls and slabs are constructed.
- 3. Install sleeves that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation. Use the following sleeve materials:
 - a. SteelPipe Sleeves: For pipes smaller than NPS 6.
 - b. Steel Sheet Sleeves: For pipes NPS 6 and larger, penetrating gypsum-board partitions.
 - c. Stack Sleeve Fittings: For pipes penetrating floors with membrane waterproofing. Secure flashing between clamping flanges. Install section of cast-iron soil pipe to extend sleeve to 2 inches above finished floor level. Refer to Division 07 Section "Sheet Metal Flashing and Trim" for flashing.
 - 1) Seal space outside of sleeve fittings with grout.
- 4. Except for underground wall penetrations, seal annular space between sleeve and pipe or pipe insulation, using joint sealants appropriate for size, depth, and location of joint. Refer to Division 07 Section "Joint Sealants" for materials and installation.
- Q. Aboveground, Exterior-Wall Pipe Penetrations: Seal penetrations using 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.
 - 1. Install steel pipe for sleeves smaller than 6 inches in diameter.
 - 2. Install cast-iron "wall pipes" for sleeves 6 inches and larger in diameter.
 - 3. Mechanical Sleeve Seal Installation: Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.
- R. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Refer to Division 07 Section "Penetration Firestopping" for materials.
- S. Verify final equipment locations for roughing-in.
- T. Refer to equipment specifications in other Sections of these Specifications for roughing-in requirements.

3.3 PIPING JOINT CONSTRUCTION

- A. Join pipe and fittings according to the following requirements and Division 21 Sections specifying piping systems.
- B. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
- C. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
- D. Soldered Joints: Apply ASTM B 813, water-flushable flux, unless otherwise indicated, to tube end. Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook," using lead-free solder alloy complying with ASTM B 32.
- E. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter, using copper-phosphorus brazing filler metal complying with AWS A5.8.

- F. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
 - 1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
 - 2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.
- G. Welded Joints: Construct joints according to AWS D10.12, using qualified processes and welding operators according to Part 1 "Quality Assurance" Article.
- H. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.

3.4 PAINTING

- A. Painting of fire-suppression systems, equipment, and components is specified in Division 09 Sections "Interior Painting" and "Exterior Painting."
- B. Damage and Touchup: Repair marred and damaged factory-painted finishes with materials and procedures to match original factory finish.

3.5 ERECTION OF METAL SUPPORTS AND ANCHORAGES

- A. Refer to Division 05 Section "Metal Fabrications" for structural steel.
- B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor fire-suppression materials and equipment.
- C. Field Welding: Comply with AWS D1.1.

3.6 ERECTION OF WOOD SUPPORTS AND ANCHORAGES

- A. Cut, fit, and place wood grounds, nailers, blocking, and anchorages to support, and anchor firesuppression materials and equipment.
- B. Select fastener sizes that will not penetrate members if opposite side will be exposed to view or will receive finish materials. Tighten connections between members. Install fasteners without splitting wood members.
- C. Attach to substrates as required to support applied loads.

END OF SECTION 210500

SECTION 211000 WATER-BASED FIRE-SUPPRESSION 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 fire-suppression piping inside the building:
 - 1. Wet-pipe sprinkler systems.
- B. Related Sections include the following:
 - 1. Division 22 Section "Facility Water Distribution Piping" for piping outside the building.

1.3 SYSTEM DESCRIPTIONS

A. Wet-Pipe Sprinkler System: Automatic sprinklers are attached to piping containing water and that is connected to water supply. Water discharges immediately from sprinklers when they are opened. Sprinklers open when heat melts fusible link or destroys frangible device. Hose connections are included if indicated.

1.4 PERFORMANCE REQUIREMENTS

- A. Standard Piping System Component Working Pressure: Listed for at least 175 psig.
- B. High-Pressure Piping System Component Working Pressure: Listed for 300 psig
- C. Fire-suppression sprinkler system design shall be approved by authorities having jurisdiction.
 - 1. Margin of Safety for Available Water Flow and Pressure: 10 percent, including losses through water-service piping, valves, and backflow preventers.
 - 2. Sprinkler Occupancy Hazard Classifications:
 - 3.
- a. General Storage Areas: Ordinary Hazard, Group 1.
- b. Mechanical Equipment Rooms: Ordinary Hazard, Group 1.
- c. Gymnasiums: Ordinary Hazard, Group 1.
- d. Office, Classroom, Locker Rooms, Bathrooms, Public Areas: Light Hazard.
- 4. Minimum Density for Automatic-Sprinkler Piping Design:
 - a. Light-Hazard Occupancy: 0.10 gpm over 1500-sq. ft.area.
 - b. Ordinary-Hazard, Group 1 Occupancy: 0.15 gpm over 2500-sq. ft.area.
 - c. Special Occupancy Hazard: As determined by authorities having jurisdiction.
- 5. Maximum Protection Area per Sprinkler:

- a. Light Hazard: 225 sq. ft.
- b. Ordinary Hazard: 130 sq. ft.
- c. Other Areas: According to NFPA 13 recommendations, unless otherwise indicated.
- 6. Total Combined Hose-Stream Demand Requirement: According to NFPA 13, unless otherwise indicated:
 - a. Light-Hazard Occupancies: 250 gpm for 30 minutes.
 - b. Ordinary-Hazard Occupancies: 250 gpm for 60 to 90 minutes.
- D. Seismic Performance: Fire-suppression piping shall be capable of withstanding the effects of earthquake motions determined according to NFPA 13 and IBC.

1.5 SUBMITTALS

- A. Product Data: For the following:
 - 1. Piping materials, including sprinkler specialty fittings.
 - 2. Pipe hangers and supports, including seismic restraints.
 - 3. Sprinklers, escutcheons, and guards. Include sprinkler flow characteristics, mounting, finish, and other pertinent data.
- B. Fire-hydrant flow test report.
- C. Approved Sprinkler Piping Drawings: Working plans, prepared according to NFPA 13, that have been approved by authorities having jurisdiction, including hydraulic calculations, if applicable.
- D. Field Test Reports and Certificates: Indicate and interpret test results for compliance with performance requirements and as described in NFPA 13 and NFPA 14. Include "Contractor's Material and Test Certificate for Aboveground Piping" and "Contractor's Material and Test Certificate for Underground Piping."
- E. Welding certificates.
- F. Field quality-control test reports.
- G. Operation and Maintenance Data: For standpipe and sprinkler specialties to include in emergency, operation, and maintenance manuals.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications:
 - 1. Installer's responsibilities include designing, fabricating, and installing fire-suppression systems and providing professional engineering services needed to assume engineering responsibility. Base calculations on results of fire-hydrant flow test.
 - a. Engineering Responsibility: Preparation of working plans, calculations, and field test reports by a qualified professional engineer.
- B. Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX.

- C. NFPA Standards: Fire-suppression-system equipment, specialties, accessories, installation, and testing shall comply with the following:
 - 1. NFPA 13, "Installation of Sprinkler Systems."

1.7 COORDINATION

A. Coordinate layout and installation of sprinklers with other construction that penetrates ceilings, including light fixtures, HVAC equipment, and partition assemblies.

1.8 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. Sprinkler Cabinets: Finished, wall-mounting, steel cabinet with hinged cover, with space for minimum of six spare sprinklers plus sprinkler wrench. Include number of sprinklers required by NFPA 13 and sprinkler wrench. Include separate cabinet with sprinklers and wrench for each type of sprinkler on Project.

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. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 STEEL PIPE AND FITTINGS

- A. Threaded-End, Standard-Weight Steel Pipe: ASTM A 53/A 53M, ASTM A 135, or ASTM A 795, with factory- or field-formed threaded ends.
 - 1. Cast-Iron Threaded Flanges: ASME B16.1.
 - 2. Malleable-Iron Threaded Fittings: ASME B16.3.
 - 3. Gray-Iron Threaded Fittings: ASME B16.4.
 - 4. Steel Threaded Pipe Nipples: ASTM A 733, made of ASTM A 53/A 53M or ASTM A 106, Schedule 40, seamless steel pipe hot-dip galvanized where indicated. Include ends matching joining method.
 - 5. Steel Threaded Couplings: ASTM A 865 hot-dip galvanized-steel pipe where indicated.
- B. Plain-End, Standard-Weight Steel Pipe: ASTM A 53/A 53M, ASTM A 135, or ASTM A 795.
 - 1. Steel Welding Fittings: ASTM A 234/A 234M, and ASME B16.9 or ASME B16.11.
 - 2. Steel Flanges and Flanged Fittings: ASME B16.5.
- C. Grooved-End, Standard-Weight Steel Pipe: ASTM A 53/A 53M, ASTM A 135, or ASTM A 795, hot-dip galvanized where indicated and with factory- or field-formed, roll-grooved ends.
 - 1. Grooved-Joint Piping Systems:

- a. Manufacturers:
 - 1) National Fittings, Inc.
 - 2) Victaulic Co. of America.
 - 3) Ward Manufacturing.
- b. Grooved-End Fittings: UL-listed, ASTM A 536, ductile-iron casting with OD matching steel-pipe OD.
- c. Grooved-End-Pipe Couplings: UL 213 and AWWA C606, rigid pattern, unless otherwise indicated; gasketed fitting matching steel-pipe OD. Include ductile-iron housing with keys matching steel-pipe and fitting grooves, pre-lubricated rubber gasket listed for use with housing, and steel bolts and nuts.

2.3 SPRINKLER SPECIALTY FITTINGS

- A. Sprinkler specialty fittings shall be UL listed or FMG approved, with 175-psig minimum workingpressure rating, and made of materials compatible with piping. Sprinkler specialty fittings shall have 300-psigworking-pressure rating if fittings are components of high-pressure piping system.
- B. Outlet Specialty Fittings:
 - 1. Manufacturers:
 - a. Star Pipe Products; Star Fittings Div.
 - b. Victaulic Co. of America.
 - c. Ward Manufacturing.
 - 2. Mechanical-T and -Cross Fittings: UL 213, ductile-iron housing with gaskets, bolts and nuts, and threaded, locking-lug, or grooved outlets.
- C. Sprinkler Drain and Alarm Test Fittings: Cast- or ductile-iron body; with threaded or locking-lug inlet and outlet, test valve, and orifice and sight glass.
 - 1. Manufacturers:
 - a. Tyco Sprinkler Corp.
 - b. Viking Corp.
 - c. Victaulic Co. of America.

2.4 SPRINKLERS

- A. Sprinklers shall be UL listed or FMG approved, with 175-psig minimum pressure rating. Sprinklers shall have 300-psigpressure rating if sprinklers are components of high-pressure piping system.
- B. Manufacturers:
 - 1. Tyco International, Ltd., Fire Protection Products Division
 - 2. Reliable Automatic Sprinkler Co., Inc.
 - 3. Viking Corp.
- C. Automatic Sprinklers: With heat-responsive element complying with the following:
 - 1. UL 199, for nonresidential applications.
 - 2. UL 1626, for residential applications.
 - 3. UL 1767, for early-suppression, fast-response applications.

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- D. Sprinkler Types and Categories: Nominal 1/2-inch orifice for "Ordinary" temperature classification rating, unless otherwise indicated or required by application.
 - 1. Open Sprinklers: UL 199, without heat-responsive element.
 - a. Orifice: 1/2 inch, with discharge coefficient K between 5.3 and 5.8.
- E. Sprinkler types, features, and options as follows:
 - 1. Concealed ceiling sprinklers, including cover plate.
 - 2. Pendent sprinklers.
 - 3. Quick-response sprinklers.
 - 4. Recessed sprinklers, including escutcheon.
 - 5. Sidewall sprinklers.
 - 6. Upright sprinklers.
- F. Sprinkler Finishes: Chrome plated, bronze, and painted.
- G. Sprinkler Escutcheons: Materials, types, and finishes for the following sprinkler mounting applications. Escutcheons for concealed, flush, and recessed-type sprinklers are specified with sprinklers.
 - 1. Ceiling Mounting: Chrome-plated steel, 2 piece, with 1-inchvertical adjustment.
 - 2. Sidewall Mounting: Chrome-plated steel, one piece, flat.
- H. Sprinkler Guards: Wire-cage type, including fastening device for attaching to sprinkler.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Perform fire-hydrant flow test according to NFPA 13, NFPA 14 and NFPA 291. Use results for system design calculations required in Part 1 "Quality Assurance" Article.
- B. Report test results promptly and in writing.
- 3.2 PIPING APPLICATIONS, GENERAL
 - A. Shop weld pipe joints where welded piping is indicated.
 - B. Do not use welded joints for galvanized-steel pipe.
 - C. Flanges, flanged fittings, unions, nipples, and transition and special fittings with finish and pressure ratings same as or higher than system's pressure rating may be used in aboveground applications, unless otherwise indicated.

3.3 SPRINKLER SYSTEM PIPING APPLICATIONS

- A. Standard-Pressure, Wet-Pipe Sprinkler System, 175-psig Maximum Working Pressure:
 - 1. NPS 2: Threaded-end, black, standard-weight steel pipe; cast- or malleable-iron threaded fittings; and threaded joints.

- 2. NPS 2-1/2 to NPS 3: Grooved-end, black, standard-weight steel pipe; grooved-end fittings; grooved-end-pipe couplings; and grooved joints.
- 3. NPS 4 to NPS 6: Grooved-end, black, standard-weight steel pipe; grooved-end fittings; grooved-end-pipe couplings; and grooved joints.

3.4 JOINT CONSTRUCTION

- A. Refer to Division 21 Section "Common Work Results for Fire Suppression" for basic piping joint construction.
- B. Threaded Joints: Comply with NFPA 13 for pipe thickness and threads. Do not thread pipe smaller than NPS 8 with wall thickness less than Schedule 40 unless approved by authorities having jurisdiction and threads are checked by a ring gage and comply with ASME B1.20.1.
- C. Grooved Joints: Assemble joints with listed coupling and gasket, lubricant, and bolts.
 - 1. Ductile-Iron Pipe: Radius-cut-groove ends of piping. Use grooved-end fittings and grooved-endpipe couplings.
 - 2. Steel Pipe: Groove piping as indicated. Use grooved-end fittings and rigid, grooved-end-pipe couplings, unless otherwise indicated.
- D. Dissimilar-Metal Piping Joints: Construct joints using dielectric fittings compatible with both piping materials.
 - 1. NPS 2and Smaller: Use dielectric unions, couplings, or nipples.
 - 2. NPS 2-1/2 to NPS 4: Use dielectric flanges.
 - 3. NPS 5and Larger: Use dielectric flange insulation kits.

3.5 PIPING INSTALLATION

- A. Refer to Division 21 Section "Common Work Results for Fire Suppression" for basic piping installation.
- B. Locations and Arrangements: Drawing plans, schematics, and diagrams indicate general location and arrangement of piping. Install piping as indicated, as far as practical.
 - 1. Deviations from approved working plans for piping require written approval from authorities having jurisdiction. File written approval with Architect before deviating from approved working plans.
- C. Use approved fittings to make changes in direction, branch takeoffs from mains, and reductions in pipe sizes.
- D. Install "Inspector's Test Connections" in sprinkler system piping, complete with shutoff valve, sized and located according to NFPA 13.
- E. Hangers and Supports: Comply with NFPA 13 for hanger materials.
 - 1. Install sprinkler system piping according to NFPA 13.
- F. Earthquake Protection: Install piping according to NFPA 13 to protect from earthquake damage.
- G. Install pressure gages on riser or feed main, at each sprinkler test connection, and at top of each standpipe. Include pressure gages with connection not less than NPS ¹/₄ and with soft metal seated globe

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valve, arranged for draining pipe between gage and valve. Install gages to permit removal, and install where they will not be subject to freezing.

- H. Fill wet-pipe sprinkler system piping with water.
- I. Install flexible expansion joints for piping at all points where piping crosses over existing building expansion joints.

3.6 SPRINKLER APPLICATIONS

- A. Drawings indicate sprinkler types to be used. Where specific types are not indicated, use the following sprinkler types:
 - 1. Rooms without Ceilings: Upright sprinklers.
 - 2. Rooms with Suspended Ceilings: Concealed sprinklers.
 - 3. Wall Mounting: Sidewall sprinklers.
 - 4. Sprinkler Finishes:
 - a. Upright, Pendent, and Sidewall Sprinklers: Chrome plated in finished spaces exposed to view; rough bronze in unfinished spaces not exposed to view; wax coated where exposed to acids, chemicals, or other corrosive fumes.
 - b. Concealed Sprinklers: Rough brass, with factory-painted cover plate, Color by Architect
 - c. Flush Sprinklers: Bright chrome, with painted white escutcheon.
 - d. Recessed Sprinklers: Bright chrome, with bright chrome escutcheon.

3.7 SPRINKLER INSTALLATION

- A. Install sprinklers in suspended ceilings in center of acoustical ceiling panels and tiles except as otherwise noted on drawings.
- B. Do not install pendent or sidewall, wet-type sprinklers in areas subject to freezing. Use dry-type sprinklers with water supply from heated space.

3.8 CONNECTIONS

- A. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Install piping adjacent to equipment to allow service and maintenance.
- 3.9 LABELING AND IDENTIFICATION
 - A. Install labeling and pipe markers on equipment and piping according to requirements in NFPA 13.

3.10 FIELD QUALITY CONTROL

- A. Perform the following field tests and inspections and prepare test reports:
 - 1. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
 - 2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
 - 3. Energize circuits to electrical equipment and devices.
 - 4. Flush, test, and inspect sprinkler systems according to NFPA 13, "Systems Acceptance" Chapter.
 - 5. Coordinate with fire alarm tests. Operate as required.

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- 6. Verify that equipment hose threads are same as local fire department equipment.
- B. Report test results promptly and in writing to Architect and authorities having jurisdiction.

3.11 CLEANING AND PROTECTION

- A. Clean dirt and debris from sprinklers.
- B. Remove and replace sprinklers with paint other than factory finish.
- C. Protect sprinklers from damage until Substantial Completion.

END OF SECTION 211000

SECTION 220500 COMMON WORK RESULTS FOR PLUMBING

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. Piping materials and installation instructions common to most piping systems.
 - 2. Transition fittings.
 - 3. Dielectric fittings.
 - 4. Mechanical sleeve seals.
 - 5. Sleeves.
 - 6. Escutcheons.
 - 7. Grout.
 - 8. Plumbing demolition.
 - 9. Equipment installation requirements common to equipment sections.
 - 10. Painting and finishing.
 - 11. Concrete bases.
 - 12. Supports and anchorages.

1.3 DEFINITIONS

- A. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe chases, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspaces, and tunnels.
- B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.
- C. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.
- D. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and in chases.
- E. Concealed, Exterior Installations: Concealed from view and protected from weather conditions and physical contact by building occupants but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.
- F. The following are industry abbreviations for plastic materials:
 - 1. ABS: Acrylonitrile-butadiene-styrene plastic.

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- 2. CPVC: Chlorinated polyvinyl chloride plastic.
- 3. PE: Polyethylene plastic.
- 4. PVC: Polyvinyl chloride plastic.
- G. The following are industry abbreviations for rubber materials:
 - 1. EPDM: Ethylene-propylene-diene terpolymer rubber.
 - 2. NBR: Acrylonitrile-butadiene rubber.

1.4 SUBMITTALS

- A. Product Data: For the following:
 - 1. Transition fittings.
 - 2. Dielectric fittings.
 - 3. Mechanical sleeve seals.
 - 4. Escutcheons.
- B. Welding certificates.

1.5 QUALITY ASSURANCE

- A. Steel Support Welding: Qualify processes and operators according to AWS D1.1, "Structural Welding Code--Steel."
- B. Steel Pipe Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."
 - 1. Comply with provisions in ASME B31 Series, "Code for Pressure Piping."
 - 2. Certify that each welder has passed AWS qualification tests for welding processes involved and that certification is current.
- C. Electrical Characteristics for Plumbing Equipment: Equipment of higher electrical characteristics may be furnished provided such proposed equipment is approved in writing and connecting electrical services, circuit breakers, and conduit sizes are appropriately modified. If minimum energy ratings or efficiencies are specified, equipment shall comply with requirements.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and to prevent entrance of dirt, debris, and moisture.
- B. Store plastic pipes protected from direct sunlight. Support to prevent sagging and bending.

1.7 COORDINATION

A. Arrange for pipe spaces, chases, slots, and openings in building structure during progress of construction, to allow for plumbing installations.

- B. Coordinate installation of required supporting devices and set sleeves in poured-in-place concrete and other structural components as they are constructed.
- C. Coordinate requirements for access panels and doors for plumbing items requiring access that are concealed behind finished surfaces. Access panels and doors are specified in Division 08 Section "Access Doors and Frames."

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:

2.2 PIPE, TUBE, AND FITTINGS

- A. Refer to individual Division 22 piping Sections for pipe, tube, and fitting materials and joining methods.
- B. Pipe Threads: ASME B1.20.1 for factory-threaded pipe and pipe fittings.

2.3 JOINING MATERIALS

- A. Refer to individual Division 22 piping Sections for special joining materials not listed below.
- B. Pipe-Flange Gasket Materials: Suitable for chemical and thermal conditions of piping system contents.
 - 1. ASME B16.21, nonmetallic, flat, asbestos-free, 1/8-inch maximum thickness unless thickness or specific material is indicated.
 - a. Full-Face Type: For flat-face, Class 125, cast-iron and cast-bronze flanges.
 - b. Narrow-Face Type: For raised-face, Class 250, cast-iron and steel flanges.
 - 2. AWWA C110, rubber, flat face, 1/8 inch thick, unless otherwise indicated; and full-face or ring type, unless otherwise indicated.
- C. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.
- D. Plastic, Pipe-Flange Gasket, Bolts, and Nuts: Type and material recommended by piping system manufacturer, unless otherwise indicated.
- E. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.
- F. Brazing Filler Metals: AWS A5.8, BCuP Series, copper-phosphorus alloys for general-duty brazing, unless otherwise indicated; and AWS A5.8, BAg1, silver alloy for refrigerant piping, unless otherwise indicated.
- G. Welding Filler Metals: Comply with AWS D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

- H. Solvent Cements for Joining Plastic Piping:
 - 1. ABS Piping: ASTM D 2235.
 - 2. CPVC Piping: ASTM F 493.
 - 3. PVC Piping: ASTM D 2564. Include primer according to ASTM F 656.
 - 4. PVC to ABS Piping Transition: ASTM D 3138.
- I. Fiberglass Pipe Adhesive: As furnished or recommended by pipe manufacturer.

2.4 TRANSITION FITTINGS

- A. AWWA Transition Couplings: Same size as, and with pressure rating at least equal to and with ends compatible with, piping to be joined.
 - 1. Manufacturers:
 - a. Dresser Industries, Inc.; DMD Div.
 - b. Ford Meter Box Company, Incorporated (The); Pipe Products Div.
 - c. JCM Industries.
 - 2. Underground Piping NPS 1-1/2 and Smaller: Manufactured fitting or coupling.
 - 3. Underground Piping NPS 2 and Larger: AWWA C219, metal sleeve-type coupling.
 - 4. Aboveground Pressure Piping: Pipe fitting.

2.5 DIELECTRIC FITTINGS

- A. Description: Combination fitting of copper alloy and ferrous materials with threaded, solder-joint, plain, or weld-neck end connections that match piping system materials.
- B. Insulating Material: Suitable for system fluid, pressure, and temperature.
- C. Dielectric Unions: Factory-fabricated, union assembly, for 250-psig minimum working pressure at 180 deg F.
 - 1. Manufacturers:
 - a. Epco Sales, Inc.
 - b. Watts Industries, Inc.; Water Products Div.
 - c. Zurn Industries, Inc.; Wilkins Div.
- D. Dielectric Flanges: Factory-fabricated, companion-flange assembly, for 150- or 300-psig minimum working pressure as required to suit system pressures.
 - 1. Manufacturers:
 - a. Capitol Manufacturing Co.
 - b. Epco Sales, Inc.
 - c. Watts Industries, Inc.; Water Products Div.
- E. Dielectric-Flange Kits: Companion-flange assembly for field assembly. Include flanges, full-face- or ring-type neoprene or phenolic gasket, phenolic or polyethylene bolt sleeves, phenolic washers, and steel backing washers.

- 1. Manufacturers:
 - a. Advance Products & Systems, Inc.
 - b. Calpico, Inc.
 - c. Pipeline Seal and Insulator, Inc.
- 2. Separate companion flanges and steel bolts and nuts shall have 150- or 300-psig minimum working pressure where required to suit system pressures.
- F. Dielectric Couplings: Galvanized-steel coupling with inert and noncorrosive, thermoplastic lining; threaded ends; and 300-psig minimum working pressure at 225 deg F.
 - 1. Manufacturers:
 - a. Calpico, Inc.
 - b. Lochinvar Corp.
- G. Dielectric Nipples: Electroplated steel nipple with inert and noncorrosive, thermoplastic lining; plain, threaded, or grooved ends; and 300-psig minimum working pressure at 225 deg F.
 - 1. Manufacturers:
 - a. Precision Plumbing Products, Inc.
 - b. Sioux Chief Manufacturing Co., Inc.
 - c. Victaulic Co. of America.

2.6 MECHANICAL SLEEVE SEALS

- A. Description: Modular sealing element unit, designed for field assembly, to fill annular space between pipe and sleeve.
 - 1. Manufacturers:
 - a. Thunderline
 - b. Calpico, Inc.
 - c. Metraflex Co.
 - 2. Sealing Elements: EPD Minterlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
 - 3. Pressure Plates: Plastic. Include two for each sealing element.
 - 4. Connecting Bolts and Nuts: Carbon steel with corrosion-resistant coating of length required to secure pressure plates to sealing elements. Include one for each sealing element.

2.7 SLEEVES

- A. Galvanized-Steel Sheet: 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint.
- B. Steel Pipe: ASTM A 53, Type E, Grade B, Schedule 40, galvanized, plain ends.
- C. Cast Iron: Cast or fabricated "wall pipe" equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.

- D. Stack Sleeve Fittings: Manufactured, cast-iron sleeve with integral clamping flange. Include clamping ring and bolts and nuts for membrane flashing.
 - 1. Underdeck Clamp: Clamping ring with set screws.

2.8 ESCUTCHEONS

- A. Description: Manufactured wall and ceiling escutcheons and floor plates, with an ID to closely fit around pipe, tube, and insulation of insulated piping and an OD that completely covers opening.
- B. One-Piece, Cast-Brass Type: With set screw.
 - 1. Finish: Polished chrome-plated .
- C. Split-Casting, Cast-Brass Type: With concealed hinge and set screw.
 - 1. Finish: Polished chrome-plated .
- D. One-Piece, Stamped-Steel Type: With set screw and chrome-plated finish.
- E. Split-Plate, Stamped-Steel Type: With concealed hinge, set screw, and chrome-plated finish.
- F. One-Piece, Floor-Plate Type: Cast-iron floor plate.
- G. Split-Casting, Floor-Plate Type: Cast brass with concealed hinge and set screw.

2.9 GROUT

- A. Description: ASTM C 1107, Grade B, nonshrink and nonmetallic, dry hydraulic-cement grout.
 - 1. Characteristics: Post-hardening, volume-adjusting, nonstaining, noncorrosive, nongaseous, and recommended for interior and exterior applications.
 - 2. Design Mix: 5000-psi, 28-day compressive strength.
 - 3. Packaging: Premixed and factory packaged.

PART 3 - EXECUTION

3.1 PLUMBING DEMOLITION

- A. Refer to Division 01 Section "Cutting and Patching" and Division 02 Section "Selective Structure Demolition" for general demolition requirements and procedures.
- B. Disconnect, demolish, and remove plumbing systems, equipment, and components indicated to be removed.
 - 1. Piping to Be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material.
 - 2. Piping to Be Abandoned in Place: Drain piping and cap or plug piping with same or compatible piping material.

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- 3. Equipment to Be Removed: Disconnect and cap services and remove equipment.
- 4. Equipment to Be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make equipment operational.
- 5. Equipment to Be Removed and Salvaged: Disconnect and cap services and remove equipment and deliver to Owner.
- C. If pipe, insulation, or equipment to remain is damaged in appearance or is unserviceable, remove damaged or unserviceable portions and replace with new products of equal capacity and quality.

3.2 PIPING SYSTEMS - COMMON REQUIREMENTS

- A. Install piping according to the following requirements and Division 22 Sections specifying piping systems.
- B. 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 Coordination Drawings.
- 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 to permit valve servicing.
- G. Install piping at indicated slopes.
- H. Install piping free of sags and bends.
- I. Install fittings for changes in direction and branch connections.
- J. Install piping to allow application of insulation.
- K. Select system components with pressure rating equal to or greater than system operating pressure.
- L. Install escutcheons for penetrations of walls, ceilings, and floors according to the following:
 - 1. New Piping:
 - a. Piping with Fitting or Sleeve Protruding from Wall: One-piece cast-brass type.
 - b. Chrome-Plated Piping: One-piece, cast-brass type with polished chrome-plated finish.
 - c. Insulated Piping: One-piece, stamped-steel type with spring clips.
 - d. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, cast-brass type with polished chrome-plated finish.
 - e. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece, cast-brass type with polished chrome-plated finish.
 - f. Bare Piping in Unfinished Service Spaces: One-piece, cast-brass type with polished chrome-plated finish.

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- g. Bare Piping in Equipment Rooms: One-piece, cast-brass type.
- h. Bare Piping at Floor Penetrations in Equipment Rooms: One-piece, floor-plate type.
- 2. Existing Piping: Use the following:
 - a. Chrome-Plated Piping: Split-casting, cast-brass type with chrome-plated finish.
 - b. Insulated Piping: Split-plate, stamped-steel type with concealed hinge and spring clips.
 - c. Bare Piping at Wall and Floor Penetrations in Finished Spaces: Split-casting, cast-brass type with chrome-plated finish.
 - d. Bare Piping at Ceiling Penetrations in Finished Spaces: Split-casting, cast-brass type with chrome-plated finish.
 - e. Bare Piping in Unfinished Service Spaces: Split-casting, cast-brass type with polished chrome-plated finish.
 - f. Bare Piping in Equipment Rooms: Split-casting, cast-brass type.
 - g. Bare Piping at Floor Penetrations in Equipment Rooms: Split-casting, floor-plate type.
- M. Sleeves are not required for core-drilled holes.
- N. Permanent sleeves are not required for holes formed by removable PE sleeves.
- O. Install sleeves for pipes passing through concrete and masonry walls and concrete floor and roof slabs.
- P. Install sleeves for pipes passing through concrete and masonry walls, gypsum-board partitions, and concrete floor and roof slabs.
 - 1. Cut sleeves to length for mounting flush with both surfaces.
 - a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches above finished floor level. Extend cast-iron sleeve fittings below floor slab as required to secure clamping ring if ring is specified.
 - 2. Install sleeves in new walls and slabs as new walls and slabs are constructed.
 - 3. Install sleeves that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation. Use the following sleeve materials:
 - a. Steel Pipe Sleeves: For pipes smaller than NPS 6.
 - b. Steel Sheet Sleeves: For pipes NPS 6 and larger, penetrating gypsum-board partitions.
 - c. Stack Sleeve Fittings: For pipes penetrating floors with membrane waterproofing. Secure flashing between clamping flanges. Install section of cast-iron soil pipe to extend sleeve to 2 inches above finished floor level. Refer to Division 07 Section "Sheet Metal Flashing and Trim" for flashing.
 - 1) Seal space outside of sleeve fittings with grout.
 - 4. Except for underground wall penetrations, seal annular space between sleeve and pipe or pipe insulation, using joint sealants appropriate for size, depth, and location of joint. Refer to Division 07 Section "Joint Sealants" for materials and installation.
- Q. Aboveground, Exterior-Wall Pipe Penetrations: Seal penetrations using 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.
 - 1. Install steel pipe for sleeves smaller than 6 inches in diameter.

- 2. Install cast-iron "wall pipes" for sleeves 6 inches and larger in diameter.
- 3. Mechanical Sleeve Seal Installation: Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.
- R. Underground, Exterior-Wall Pipe Penetrations: Install cast-iron "wall pipes" for sleeves. Seal pipe penetrations using mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.
 - 1. Mechanical Sleeve Seal Installation: Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.
- S. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Refer to Division 07 Section "Penetration Firestopping" for materials.
- T. Verify final equipment locations for roughing-in.
- U. Refer to equipment specifications in other Sections of these Specifications for roughing-in requirements.

3.3 PIPING JOINT CONSTRUCTION

- A. Join pipe and fittings according to the following requirements and Division 22 Sections specifying piping systems.
- B. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
- C. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
- D. Soldered Joints: Apply ASTM B 813, water-flushable flux, unless otherwise indicated, to tube end. Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook," using lead-free solder alloy complying with ASTM B 32.
- E. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter, using copper-phosphorus brazing filler metal complying with AWS A5.8.
- F. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
 - 1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
 - 2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.
- G. Welded Joints: Construct joints according to AWS D10.12, using qualified processes and welding operators according to Part 1 "Quality Assurance" Article.

- H. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.
- I. Plastic Piping Solvent-Cement Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:
 - 1. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements.
 - 2. ABS Piping: Join according to ASTM D 2235 and ASTM D 2661 Appendixes.
 - 3. CPVC Piping: Join according to ASTM D 2846/D 2846M Appendix.
 - 4. PVC Pressure Piping: Join schedule number ASTM D 1785, PVC pipe and PVC socket fittings according to ASTM D 2672. Join other-than-schedule-number PVC pipe and socket fittings according to ASTM D 2855.
 - 5. PVC Nonpressure Piping: Join according to ASTM D 2855.
 - 6. PVC to ABS Nonpressure Transition Fittings: Join according to ASTM D 3138 Appendix.
- J. Plastic Pressure Piping Gasketed Joints: Join according to ASTM D 3139.
- K. Plastic Nonpressure Piping Gasketed Joints: Join according to ASTM D 3212.
- L. PE Piping Heat-Fusion Joints: Clean and dry joining surfaces by wiping with clean cloth or paper towels. Join according to ASTM D 2657.
 - 1. Plain-End Pipe and Fittings: Use butt fusion.
 - 2. Plain-End Pipe and Socket Fittings: Use socket fusion.
- M. Fiberglass Bonded Joints: Prepare pipe ends and fittings, apply adhesive, and join according to pipe manufacturer's written instructions.

3.4 PIPING CONNECTIONS

- A. Make connections according to the following, unless otherwise indicated:
 - 1. Install unions, in piping NPS 2 and smaller, adjacent to each valve and at final connection to each piece of equipment.
 - 2. Install flanges, in piping NPS 2-1/2 and larger, adjacent to flanged valves and at final connection to each piece of equipment.
 - 3. Dry Piping Systems: Install dielectric unions and flanges to connect piping materials of dissimilar metals.
 - 4. Wet Piping Systems: Install dielectric coupling and nipple fittings to connect piping materials of dissimilar metals.

3.5 EQUIPMENT INSTALLATION - COMMON REQUIREMENTS

- A. Install equipment to allow maximum possible headroom unless specific mounting heights are not indicated.
- B. Install equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, unless otherwise indicated.

- C. Install plumbing equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference to other installations. Extend grease fittings to accessible locations.
- D. Install equipment to allow right of way for piping installed at required slope.

3.6 PAINTING

- A. Painting of plumbing systems, equipment, and components is specified in Division 09 Sections "Interior Painting" and "Exterior Painting."
- B. Damage and Touchup: Repair marred and damaged factory-painted finishes with materials and procedures to match original factory finish.

3.7 CONCRETE BASES

- A. Concrete Bases: Anchor equipment to concrete base according to equipment manufacturer's written instructions and according to seismic codes at Project.
 - 1. Construct concrete bases of dimensions indicated, but not less than 4 inches larger in both directions than supported unit.
 - 2. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around the full perimeter of the base.
 - 3. Install epoxy-coated anchor bolts for supported equipment that extend through concrete base, and anchor into structural concrete floor.
 - 4. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 - 5. Install anchor bolts to elevations required for proper attachment to supported equipment.
 - 6. Install anchor bolts according to anchor-bolt manufacturer's written instructions.
 - 7. Use 3000-psi 28-day compressive-strength concrete and reinforcement as specified in Division 03 Section "

3.8 ERECTION OF METAL SUPPORTS AND ANCHORAGES

- A. Refer to Division 05 Section "Metal Fabrications" for structural steel.
- B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor plumbing materials and equipment.
- C. Field Welding: Comply with AWS D1.1.

3.9 ERECTION OF WOOD SUPPORTS AND ANCHORAGES

- A. Cut, fit, and place wood grounds, nailers, blocking, and anchorages to support, and anchor plumbing materials and equipment.
- B. Select fastener sizes that will not penetrate members if opposite side will be exposed to view or will receive finish materials. Tighten connections between members. Install fasteners without splitting wood members.

C. Attach to substrates as required to support applied loads.

3.10 GROUTING

- A. Mix and install grout for plumbing equipment base bearing surfaces, pump and other equipment base plates, and anchors.
- B. Clean surfaces that will come into contact with grout.
- C. Provide forms as required for placement of grout.
- D. Avoid air entrapment during placement of grout.
- E. Place grout, completely filling equipment bases.
- F. Place grout on concrete bases and provide smooth bearing surface for equipment.
- G. Place grout around anchors.
- H. Cure placed grout.

END OF SECTION 220500

SECTION 220523 GENERAL-DUTY VALVES FOR PLUMBING PIPING

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. Bronze ball valves.
 - 2. Bronze swing check valves.
 - 3. Bronze gate valves.
- B. Related Sections:
 - 1. Division 22 plumbing piping Sections for specialty valves applicable to those Sections only.
 - 2. Division 22 Section "Identification for Plumbing Piping and Equipment" for valve tags and schedules.
 - 3. Division 33 water distribution piping Sections for general-duty and specialty valves for site construction piping.

1.3 DEFINITIONS

- A. CWP: Cold working pressure.
- B. EPDM: Ethylene propylene copolymer rubber.
- C. NBR: Acrylonitrile-butadiene, Buna-N, or nitrile rubber.
- D. NRS: Nonrising stem.
- E. OS&Y: Outside screw and yoke.
- F. RS: Rising stem.
- G. SWP: Steam working pressure.

1.4 SUBMITTALS

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

1.5 QUALITY ASSURANCE

- A. Source Limitations for Valves: Obtain each type of valve from single source from single manufacturer.
- B. ASME Compliance:
 - 1. ASME B16.10 and ASME B16.34 for ferrous valve dimensions and design criteria.
 - 2. ASME B31.1 for power piping valves.
 - 3. ASME B31.9 for building services piping valves.
- C. NSF Compliance: NSF 61 for valve materials for potable-water service.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Prepare valves for shipping as follows:
 - 1. Protect internal parts against rust and corrosion.
 - 2. Protect threads, flange faces, grooves, and weld ends.
 - 3. Set angle, gate, and globe valves closed to prevent rattling.
 - 4. Set ball and plug valves open to minimize exposure of functional surfaces.
 - 5. Block check valves in either closed or open position.
- B. Use the following precautions during storage:
 - 1. Maintain valve end protection.
 - 2. Store valves indoors and maintain at higher than ambient dew point temperature. If outdoor storage is necessary, store valves off the ground in watertight enclosures.
- C. Use sling to handle large valves; rig sling to avoid damage to exposed parts. Do not use handwheels or stems as lifting or rigging points.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR VALVES

- A. Refer to valve schedule articles for applications of valves.
- B. Valve Pressure and Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.
- C. Valve Sizes: Same as upstream piping unless otherwise indicated.
- D. Valve Actuator Types:
 - 1. Handwheel: For valves other than quarter-turn types.
 - 2. Handlever: For quarter-turn valves NPS 6 and smaller.
- E. Valves in Insulated Piping: With 2-inch stem extensions and the following features:
 - 1. Gate Valves: With rising stem.
 - 2. Ball Valves: With extended operating handle of non-thermal-conductive material, and protective sleeve that allows operation of valve without breaking the vapor seal or disturbing insulation.

F. Valve-End Connections:

- 1. Flanged: With flanges according to ASME B16.1 for iron valves.
- 2. Grooved: With grooves according to AWWA C606.
- 3. Solder Joint: With sockets according to ASME B16.18.
- 4. Threaded: With threads according to ASME B1.20.1.
- G. Valve Bypass and Drain Connections: MSS SP-45.
- H. All valves intended for use in domestic water systems are to be NSF 61/NSF 372 certified lead free.

2.2 BRONZE BALL VALVES

- A. Two-Piece, Full-Port, Lead-Free Bronze Ball Valves with Bronze Trim:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Conbraco Industries, Inc.; Apollo Valves.
 - b. Hammond Valve.
 - c. Milwaukee Valve Company.
 - 2. Description:
 - a. Standard: MSS SP-110.
 - b. SWP Rating: 150 psig.
 - c. CWP Rating: 600 psig.
 - d. Body Design: Two piece.
 - e. Body Material: Lead-Free Bronze.
 - f. Ends: Soldered or Threaded.
 - g. Seats: PTFE or TFE.
 - h. Stem: Bronze.
 - i. Ball: Chrome-plated brass.
 - j. Port: Full.

2.3 BRONZE SWING CHECK VALVES

- A. Class 125, Lead-Free Bronze Swing Check Valves with Nonmetallic Disc:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Conbraco Industries, Inc.; Apollo Valves.
 - b. Hammond Valve.
 - c. Milwaukee Valve Company.
 - 2. Description:
 - a. Standard: MSS SP-80, Type 4.
 - b. CWP Rating: 200 psig.
 - c. Body Design: Horizontal flow.

- d. Body Material: ASTM B 62, bronze.
- e. Ends: Soldered or Threaded.
- f. Disc: PTFE or TFE.
- B. Class 150, Lead-Free Bronze Swing Check Valves with Nonmetallic Disc:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Conbraco Industries, Inc.; Apollo Valves.
 - b. Hammond Valve.
 - c. Milwaukee Valve Company.
 - 2. Description:
 - a. Standard: MSS SP-80, Type 4.
 - b. CWP Rating: 300 psig.
 - c. Body Design: Horizontal flow.
 - d. Body Material: ASTM B 62, bronze.
 - e. Ends: Soldered or Threaded.
 - f. Disc: PTFE or TFE.

2.4 BRONZE GATE VALVES

- A. Class 125, Rising Stem, Lead-Free Bronze Gate Valves:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Conbraco Industries, Inc.; Apollo Valves.
 - b. Hammond Valve.
 - c. Milwaukee Valve Company.
 - 2. Description:
 - a. Standard: MSS SP-80, Type 2.
 - b. CWP Rating: 200 psig.
 - c. Body Material: ASTM B 62, bronze with integral seat and screw-in bonnet.
 - d. Ends: Threaded or solder joint.
 - e. Stem: Bronze.
 - f. Disc: Solid wedge; bronze.
 - g. Packing: Asbestos free.
 - h. Handwheel: Malleable iron, bronze, or aluminum.
- B. Class 150, Rising Stem, Lead-Free Bronze Gate Valves:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Conbraco Industries, Inc.; Apollo Valves.
 - b. Hammond Valve.
 - c. Milwaukee Valve Company.

- 2. Description:
 - a. Standard: MSS SP-80, Type 2.
 - b. CWP Rating: 300 psig.
 - c. Body Material: ASTM B 62, bronze with integral seat and union-ring bonnet.
 - d. Ends: Soldered or Threaded.
 - e. Stem: Bronze.
 - f. Disc: Solid wedge; bronze.
 - g. Packing: Asbestos free.
 - h. Handwheel: Malleable iron.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine valve interior for cleanliness, freedom from foreign matter, and corrosion. Remove special packing materials, such as blocks, used to prevent disc movement during shipping and handling.
- B. Operate valves in positions from fully open to fully closed. Examine guides and seats made accessible by such operations.
- C. Examine threads on valve and mating pipe for form and cleanliness.
- D. Examine mating flange faces for conditions that might cause leakage. Check bolting for proper size, length, and material. Verify that gasket is of proper size, that its material composition is suitable for service, and that it is free from defects and damage.
- E. Do not attempt to repair defective valves; replace with new valves.

3.2 VALVE INSTALLATION

- A. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.
- B. Locate valves for easy access and provide separate support where necessary.
- C. Install valves in horizontal piping with stem at or above center of pipe.
- D. Install valves in position to allow full stem movement.
- E. Install check valves for proper direction of flow and as follows:
 - 1. Swing Check Valves: In horizontal position with hinge pin level.

3.3 ADJUSTING

A. Adjust or replace valve packing after piping systems have been tested and put into service but before final adjusting and balancing. Replace valves if persistent leaking occurs.

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3.4 GENERAL REQUIREMENTS FOR VALVE APPLICATIONS

- A. If valve applications are not indicated, use the following:
 - 1. Shutoff Service: Ball or gate valves.
- B. If valves with specified SWP classes or CWP ratings are not available, the same types of valves with higher SWP classes or CWP ratings may be substituted.
- C. Select valves, except wafer types, with the following end connections:
 - 1. For Copper Tubing, NPS 2 and Smaller: Threaded ends except where solder-joint valve-end option is indicated in valve schedules below.
 - 2. For Copper Tubing, NPS 2-1/2 to NPS 4: Threaded ends.

3.5 DOMESTIC, HOT- AND COLD-WATER VALVE SCHEDULE

- A. Pipe NPS 3 and Smaller:
 - 1. Bronze Valves: May be provided with solder-joint ends instead of threaded ends.
 - 2. Bronze Angle Valves: Class 150, nonmetallic disc.
 - 3. Ball Valves: Two piece, full port, bronze with stainless-steel trim.
 - 4. Bronze Swing Check Valves: Class 150, nonmetallic disc.
 - 5. Bronze Gate Valves: Class 150, RS.
 - 6. Bronze Globe Valves: Class 150, nonmetallic disc.

END OF SECTION 220523

GREENWICH PUBLIC SCHOOLS GREENWICH HIGH SCHOOL LOCKER ROOM RENOVATIONS PHASE II HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT

SECTION 220529 HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT

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 hangers and supports for plumbing system piping and equipment:
 - 1. Steel pipe hangers and supports.
 - 2. Trapeze pipe hangers.
 - 3. Metal framing systems.
 - 4. Thermal-hanger shield inserts.
 - 5. Fastener systems.
 - 6. Pipe positioning systems.
 - 7. Equipment supports.
- B. Related Sections include the following:
 - 1. Division 05 Section "Metal Fabrications" for structural-steel shapes and plates for trapeze hangers for pipe and equipment supports.
 - 2. Division 21 Section "Water-Based Fire-Suppression Systems" for pipe hangers for firesuppression piping.
 - 3. Division 22 Section "Vibration and Seismic Controls for Plumbing Piping and Equipment" for vibration isolation devices.

1.3 DEFINITIONS

- A. MSS: Manufacturers Standardization Society for The Valve and Fittings Industry Inc.
- B. Terminology: As defined in MSS SP-90, "Guidelines on Terminology for Pipe Hangers and Supports."

1.4 PERFORMANCE REQUIREMENTS

- A. Design supports for multiple pipes, including pipe stands, capable of supporting combined weight of supported systems, system contents, and test water.
- B. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.
- C. Design seismic-restraint hangers and supports for piping and equipment.

1.5 SUBMITTALS

- A. Product Data: For the following:
 - 1. Steel pipe hangers and supports.
 - 2. Thermal-hanger shield inserts.
 - 3. Powder-actuated fastener systems.
 - 4. Pipe positioning systems.
- B. Shop Drawings: Show fabrication and installation details and include calculations for the following:
 - 1. Trapeze pipe hangers. Include Product Data for components.
 - 2. Metal framing systems. Include Product Data for components.
 - 3. Equipment supports.
- C. Welding certificates.

1.6 QUALITY ASSURANCE

- A. Welding: Qualify procedures and personnel according to AWS D1.1, "Structural Welding Code--Steel."
- B. Welding: Qualify procedures and personnel according to the following:
 - 1. AWS D1.1, "Structural Welding Code--Steel."
 - 2. AWS D1.2, "Structural Welding Code--Aluminum."
 - 3. AWS D1.4, "Structural Welding Code--Reinforcing Steel."
 - 4. ASME Boiler and Pressure Vessel Code: Section IX.

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. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.
 - 2. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 STEEL PIPE HANGERS AND SUPPORTS

- A. Description: MSS SP-58, Types 1 through 58, factory-fabricated components. Refer to Part 3 "Hanger and Support Applications" Article for where to use specific hanger and support types.
- B. Manufacturers:

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- 1. B-Line Systems, Inc.; a division of Cooper Industries.
- 2. ERICO/Michigan Hanger Co.
- 3. Grinnell Corp.
- 4. Tolco Inc.
- C. Galvanized, Metallic Coatings: Pregalvanized or hot dipped.
- D. Nonmetallic Coatings: Plastic coating, jacket, or liner.
- E. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion for support of bearing surface of piping.

2.3 TRAPEZE PIPE HANGERS

A. Description: MSS SP-69, Type 59, shop- or field-fabricated pipe-support assembly made from structuralsteel shapes with MSS SP-58 hanger rods, nuts, saddles, and U-bolts.

2.4 METAL FRAMING SYSTEMS

- A. Description: MFMA-3, shop- or field-fabricated pipe-support assembly made of steel channels and other components.
- B. Manufacturers:
 - 1. B-Line Systems, Inc.; a division of Cooper Industries.
 - 2. ERICO/Michigan Hanger Co.; ERISTRUT Div.
 - 3. Tolco Inc.
 - 4. Unistrut Corp.; Tyco International, Ltd.
- C. Coatings: Manufacturer's standard finish unless bare metal surfaces are indicated.
- D. Nonmetallic Coatings: Plastic coating, jacket, or liner.

2.5 THERMAL-HANGER SHIELD INSERTS

- A. Description: 100-psig-minimum, compressive-strength insulation insert encased in sheet metal shield.
- B. Manufacturers:
 - 1. Carpenter & Paterson, Inc.
 - 2. ERICO/Michigan Hanger Co.
 - 3. Rilco Manufacturing Company, Inc.
- C. Insulation-Insert Material for Cold Piping: Water-repellent treated, ASTM C 533, Type I calcium silicate with vapor barrier.
- D. Insulation-Insert Material for Hot Piping: Water-repellent treated, ASTM C 533, Type I calcium silicate.
- E. For Trapeze or Clamped Systems: Insert and shield shall cover entire circumference of pipe.

- F. For Clevis or Band Hangers: Insert and shield shall cover lower 180 degrees of pipe.
- G. Insert Length: Extend 2 inches beyond sheet metal shield for piping operating below ambient air temperature.

2.6 FASTENER SYSTEMS

- A. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete with pullout, tension, and shear capacities appropriate for supported loads and building materials where used.
 - 1. Manufacturers:
 - a. Hilti, Inc.
 - b. Masterset Fastening Systems, Inc.
 - c. Powers Fasteners.
- B. Mechanical-Expansion Anchors: Insert-wedge-type zinc-coated steel, for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.
 - 1. Manufacturers:
 - a. B-Line Systems, Inc.; a division of Cooper Industries.
 - b. Hilti, Inc.
 - c. Powers Fasteners.

2.7 PIPE POSITIONING SYSTEMS

- A. Description: IAPMO PS 42, system of metal brackets, clips, and straps for positioning piping in pipe spaces for plumbing fixtures for commercial applications.
- B. Manufacturers:
 - 1. C & S Mfg. Corp.
 - 2. HOLDRITE Corp.; Hubbard Enterprises.
 - 3. Samco Stamping, Inc.

2.8 EQUIPMENT SUPPORTS

A. Description: Welded, shop- or field-fabricated equipment support made from structural-steel shapes.

2.9 MISCELLANEOUS MATERIALS

- A. Structural Steel: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.
- B. Grout: ASTM C 1107, factory-mixed and -packaged, dry, hydraulic-cement, nonshrink and nonmetallic grout; suitable for interior and exterior applications.
 - 1. Properties: Nonstaining, noncorrosive, and nongaseous.

2. Design Mix: 5000-psi, 28-day compressive strength.

PART 3 - EXECUTION

3.1 HANGER AND SUPPORT APPLICATIONS

- A. Specific hanger and support requirements are specified in Sections specifying piping systems and equipment.
- B. Comply with MSS SP-69 for pipe hanger selections and applications that are not specified in piping system Sections.
- C. Use hangers and supports with galvanized, metallic coatings for piping and equipment that will not have field-applied finish.
- D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.
- E. Use padded hangers for piping that is subject to scratching.
- F. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
 - 1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated stationary pipes, NPS 1/2 to NPS 30.
 - 2. Pipe Hangers (MSS Type 5): For suspension of pipes, NPS 1/2 to NPS 4, to allow off-center closure for hanger installation before pipe erection.
 - 3. Adjustable, Steel Band Hangers (MSS Type 7): For suspension of noninsulated stationary pipes, NPS 1/2 to NPS 8.
 - 4. Adjustable Band Hangers (MSS Type 9): For suspension of noninsulated stationary pipes, NPS 1/2 to NPS 8.
 - 5. Adjustable, Swivel-Ring Band Hangers (MSS Type 10): For suspension of noninsulated stationary pipes, NPS 1/2 to NPS 2.
 - 6. U-Bolts (MSS Type 24): For support of heavy pipes, NPS 1/2 to NPS 30.
 - 7. Clips (MSS Type 26): For support of insulated pipes not subject to expansion or contraction.
- G. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
 - 1. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers, NPS 3/4 to NPS 20, if longer ends are required for riser clamps.
- H. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
 - 1. Steel Turnbuckles (MSS Type 13): For adjustment up to 6 inches for heavy loads.
 - 2. Steel Clevises (MSS Type 14): For 120 to 450 deg F piping installations.
 - 3. Malleable-Iron Sockets (MSS Type 16): For attaching hanger rods to various types of building attachments.
 - 4. Steel Weldless Eye Nuts (MSS Type 17): For 120 to 450 deg F piping installations.

- I. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
 - 1. Steel or Malleable Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.
 - 2. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joist construction to attach to top flange of structural shape.
 - 3. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.
 - 4. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.
 - 5. Welded Beam Attachments (MSS Type 22): For attaching to bottom of beams if loads are considerable and rod sizes are large.
 - 6. C-Clamps (MSS Type 23): For structural shapes.
 - 7. Top-Beam Clamps (MSS Type 25): For top of beams if hanger rod is required tangent to flange edge.
 - 8. Side-Beam Clamps (MSS Type 27): For bottom of steel I-beams.
 - 9. Steel-Beam Clamps with Eye Nuts (MSS Type 28): For attaching to bottom of steel I-beams for heavy loads.
 - 10. Linked-Steel Clamps with Eye Nuts (MSS Type 29): For attaching to bottom of steel I-beams for heavy loads, with link extensions.
 - 11. Malleable Beam Clamps with Extension Pieces (MSS Type 30): For attaching to structural steel.
 - 12. Welded-Steel Brackets: For support of pipes from below, or for suspending from above by using clip and rod. Use one of the following for indicated loads:
 - a. Light (MSS Type 31): 750 lb.
 - b. Medium (MSS Type 32): 1500 lb.
 - c. Heavy (MSS Type 33): 3000 lb.
 - 13. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.
 - 14. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.
 - 15. Horizontal Travelers (MSS Type 58): For supporting piping systems subject to linear horizontal movement where headroom is limited.
- J. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
 - 1. Steel Pipe-Covering Protection Saddles (MSS Type 39): To fill interior voids with insulation that matches adjoining insulation.
 - 2. Protection Shields (MSS Type 40): Of length recommended in writing by manufacturer to prevent crushing insulation.
 - 3. Thermal-Hanger Shield Inserts: For supporting insulated pipe.
- K. Spring Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
 - 1. Restraint-Control Devices (MSS Type 47): Where indicated to control piping movement.
 - 2. Spring Cushions (MSS Type 48): For light loads if vertical movement does not exceed 1-1/4 inches.
 - 3. Spring-Cushion Roll Hangers (MSS Type 49): For equipping Type 41 roll hanger with springs.
 - 4. Spring Sway Braces (MSS Type 50): To retard sway, shock, vibration, or thermal expansion in piping systems.
 - 5. Variable-Spring Hangers (MSS Type 51): Preset to indicated load and limit variability factor to 25 percent to absorb expansion and contraction of piping system from hanger.

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- 6. Variable-Spring Base Supports (MSS Type 52): Preset to indicated load and limit variability factor to 25 percent to absorb expansion and contraction of piping system from base support.
- 7. Variable-Spring Trapeze Hangers (MSS Type 53): Preset to indicated load and limit variability factor to 25 percent to absorb expansion and contraction of piping system from trapeze support.
- 8. Constant Supports: For critical piping stress and if necessary to avoid transfer of stress from one support to another support, critical terminal, or connected equipment. Include auxiliary stops for erection, hydrostatic test, and load-adjustment capability. These supports include the following types:
 - a. Horizontal (MSS Type 54): Mounted horizontally.
 - b. Vertical (MSS Type 55): Mounted vertically.
 - c. Trapeze (MSS Type 56): Two vertical-type supports and one trapeze member.
- L. Comply with MSS SP-69 for trapeze pipe hanger selections and applications that are not specified in piping system Sections.
- M. Comply with MFMA-102 for metal framing system selections and applications that are not specified in piping system Sections.
- N. Use mechanical-expansion anchors instead of building attachments where required in concrete construction.
- O. Use pipe positioning systems in pipe spaces behind plumbing fixtures to support supply and waste piping for plumbing fixtures.

3.2 HANGER AND SUPPORT INSTALLATION

- A. Steel Pipe Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from building structure.
- B. Trapeze Pipe Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Arrange for grouping of parallel runs of horizontal piping and support together on field-fabricated trapeze pipe hangers.
 - 1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified above for individual pipe hangers.
 - 2. Field fabricate from ASTM A 36/A 36M, steel shapes selected for loads being supported. Weld steel according to AWS D1.1.
- C. Metal Framing System Installation: Arrange for grouping of parallel runs of piping and support together on field-assembled metal framing systems.
- D. Thermal-Hanger Shield Installation: Install in pipe hanger or shield for insulated piping.
- E. Fastener System Installation:
 - 1. Install powder-actuated fasteners for use in lightweight concrete or concrete slabs less than 4 inches thick in concrete after concrete is placed and completely cured. Use operators that are licensed by powder-actuated tool manufacturer. Install fasteners according to powder-actuated tool manufacturer's operating manual.
 - 2. Install mechanical-expansion anchors in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.

- F. Pipe Positioning System Installation: Install support devices to make rigid supply and waste piping connections to each plumbing fixture. Refer to Division 22 Section "Plumbing Fixtures" for plumbing fixtures.
- G. Install hangers and supports complete with necessary inserts, bolts, rods, nuts, washers, and other accessories.
- H. Equipment Support Installation: Fabricate from welded-structural-steel shapes.
- I. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.
- J. Install lateral bracing with pipe hangers and supports to prevent swaying.
- K. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, NPS 2-1/2 and larger and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.
- L. Load Distribution: Install hangers and supports so piping live and dead loads and stresses from movement will not be transmitted to connected equipment.
- M. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and so maximum pipe deflections allowed by ASME B31.9 (for building services piping) are not exceeded.
- N. Insulated Piping: Comply with the following:
 - 1. Attach clamps and spacers to piping.
 - a. Piping Operating above Ambient Air Temperature: Clamp may project through insulation.
 - b. Piping Operating below Ambient Air Temperature: Use thermal-hanger shield insert with clamp sized to match OD of insert.
 - c. Do not exceed pipe stress limits according to ASME B31.9 for building services piping.
 - 2. Install MSS SP-58, Type 39, protection saddles if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.
 - a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.
 - 3. Install MSS SP-58, Type 40, protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees.
 - a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.
 - 4. Shield Dimensions for Pipe: Not less than the following:
 - a. NPS 1/4 to NPS 3-1/2: 12 inches long and 0.048 inch thick.
 - b. NPS 4: 12 inches long and 0.06 inch thick.
 - c. NPS 5 and NPS 6: 18 inches long and 0.06 inch thick.
 - d. NPS 8 to NPS 14: 24 inches long and 0.075 inch thick.

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- e. NPS 16 to NPS 24: 24 inches long and 0.105 inch thick.
- 5. Pipes NPS 8 and Larger: Include wood inserts.
- 6. Insert Material: Length at least as long as protective shield.
- 7. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.

3.3 EQUIPMENT SUPPORTS

- A. Fabricate structural-steel stands to suspend equipment from structure overhead or to support equipment above floor.
- B. Grouting: Place grout under supports for equipment and make smooth bearing surface.
- C. Provide lateral bracing, to prevent swaying, for equipment supports.

3.4 METAL FABRICATIONS

- A. Cut, drill, and fit miscellaneous metal fabrications for trapeze pipe hangers and equipment supports.
- B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.
- C. Field Welding: Comply with AWS D1.1 procedures for shielded metal arc welding, appearance and quality of welds, and methods used in correcting welding work, and with the following:
 - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 - 2. Obtain fusion without undercut or overlap.
 - 3. Remove welding flux immediately.
 - 4. Finish welds at exposed connections so no roughness shows after finishing and contours of welded surfaces match adjacent contours.

3.5 ADJUSTING

- A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.
- B. Trim excess length of continuous-thread hanger and support rods to 1-1/2 inches.

3.6 PAINTING

- A. Touch Up: 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. Touch Up: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal are specified in Division 09 painting Sections.

C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

END OF SECTION 220529

GREENWICH PUBLIC SCHOOLS GREENWICH HIGH SCHOOL LOCKER ROOM RENOVATIONS PHASE II IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT

SECTION 220553 IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT

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. Equipment labels.
- 2. Warning signs and labels.
- 3. Pipe labels.
- 4. Stencils.
- 5. Valve tags.
- 6. Warning tags.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Samples: For color, letter style, and graphic representation required for each identification material and device.
- C. Equipment Label Schedule: Include a listing of all equipment to be labeled with the proposed content for each label.
- D. Valve numbering scheme.
- E. Valve Schedules: For each piping system to include in maintenance manuals.

1.4 COORDINATION

- A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.
- B. Coordinate installation of identifying devices with locations of access panels and doors.
- C. Install identifying devices before installing acoustical ceilings and similar concealment.

PART 2 - PRODUCTS

2.1 EQUIPMENT LABELS

- A. Plastic Labels for Equipment:
 - 1. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch thick, and having predrilled holes for attachment hardware.
 - 2. Letter Color: White.
 - 3. Background Color: Black.
 - 4. Maximum Temperature: Able to withstand temperatures up to 160 deg F.
 - 5. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
 - 6. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
 - 7. Fasteners: Stainless-steel rivets or self-tapping screws.
 - 8. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.
- B. Label Content: Include equipment's Drawing designation or unique equipment number, Drawing numbers where equipment is indicated (plans, details, and schedules), plus the Specification Section number and title where equipment is specified.
- C. Equipment Label Schedule: For each item of equipment to be labeled, on 8-1/2-by-11-inch bond paper. Tabulate equipment identification number and identify Drawing numbers where equipment is indicated (plans, details, and schedules), plus the Specification Section number and title where equipment is specified. Equipment schedule shall be included in operation and maintenance data.

2.2 WARNING SIGNS AND LABELS

- A. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch thick, and having predrilled holes for attachment hardware.
- B. Letter Color: White.
- C. Background Color: Red.
- D. Maximum Temperature: Able to withstand temperatures up to 160 deg F.
- E. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
- F. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
- G. Fasteners: Stainless-steel rivets or self-tapping screws.
- H. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.
- I. Label Content: Include caution and warning information, plus emergency notification instructions.

2.3 PIPE LABELS

- A. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service, and showing flow direction.
- B. Pretensioned Pipe Labels: Precoiled, semirigid plastic formed to cover full circumference of pipe and to attach to pipe without fasteners or adhesive.
- C. Self-Adhesive Pipe Labels: Printed plastic with contact-type, permanent-adhesive backing.
- D. Pipe Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings, pipe size, and an arrow indicating flow direction.
 - 1. Flow-Direction Arrows: Integral with piping system service lettering to accommodate both directions, or as separate unit on each pipe label to indicate flow direction.
 - 2. Lettering Size: At least 1-1/2 inches high.

2.4 STENCILS

- A. Stencils: Prepared with letter sizes according to ASME A13.1 for piping; and minimum letter height of 3/4 inch for access panel and door labels, equipment labels, and similar operational instructions.
 - 1. Stencil Material: Fiberboard or metal.
 - 2. Stencil Paint: Exterior, gloss, alkyd enamel black unless otherwise indicated. Paint may be in pressurized spray-can form.
 - 3. Identification Paint: Exterior, alkyd enamel in colors according to ASME A13.1 unless otherwise indicated.

2.5 VALVE TAGS

- A. Valve Tags: Stamped or engraved with 1/4-inch letters for piping system abbreviation and 1/2-inch numbers.
 - 1. Tag Material: Brass, 0.032-inch minimum thickness, and having predrilled or stamped holes for attachment hardware.
 - 2. Fasteners: Brass wire-link or beaded chain; or S-hook .
- B. Valve Schedules: For each piping system, on 8-1/2-by-11-inch bond paper. Tabulate valve number, piping system, system abbreviation (as shown on valve tag), location of valve (room or space), normal-operating position (open, closed, or modulating), and variations for identification. Mark valves for emergency shutoff and similar special uses.
 - 1. Valve-tag schedule shall be included in operation and maintenance data.
 - 2. Valve-tag schedule(s) shall be mounted in locations to be directed by Owner. Mountings shall be in a metal frame with plexi-glass (clear) cover.

PART 3 - EXECUTION

3.1 PREPARATION

A. Clean piping and equipment surfaces of substances that could impair bond of identification devices, including dirt, oil, grease, release agents, and incompatible primers, paints, and encapsulants.

3.2 EQUIPMENT LABEL INSTALLATION

- A. Install or permanently fasten labels on each major item of mechanical equipment.
- B. Locate equipment labels where accessible and visible.

3.3 PIPE LABEL INSTALLATION

- A. Piping Color-Coding: Painting of piping is specified in Division 09 Section "Interior Painting".
- B. Stenciled Pipe Label Option: Stenciled labels may be provided instead of manufactured pipe labels, at Installer's option. Install stenciled pipe labels with painted, color-coded bands or rectangles, complying with ASME A13.1, on each piping system.
 - 1. Identification Paint: Use for contrasting background.
 - 2. Stencil Paint: Use for pipe marking.
- C. Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows:
 - 1. Near each valve and control device.
 - 2. Near each branch connection, excluding short takeoffs for fixtures and terminal units. Where flow pattern is not obvious, mark each pipe at branch.
 - 3. Near penetrations through walls, floors, ceilings, and inaccessible enclosures.
 - 4. At access doors, manholes, and similar access points that permit view of concealed piping.
 - 5. Near major equipment items and other points of origination and termination.
 - 6. Spaced at maximum intervals of 50 feet along each run. Reduce intervals to 25 feet in areas of congested piping and equipment.
 - 7. On piping above removable acoustical ceilings. Omit intermediately spaced labels.
- D. Pipe Label Color Schedule:
 - 1. Domestic Water Piping:
 - a. Background Color: White.
 - b. Letter Color: Green.
 - 2. Sanitary Waste and Storm Drainage Piping:
 - a. Background Color: Yellow.
 - b. Letter Color: Black.

3.4 VALVE-TAG INSTALLATION

- A. Install tags on valves and control devices in piping systems, except check valves; valves within factoryfabricated equipment units; shutoff valves; faucets; convenience and lawn-watering hose connections; and similar roughing-in connections of end-use fixtures and units. List tagged valves in a valve schedule.
- B. Valve-Tag Application Schedule: Tag valves according to size, shape, and color scheme and with captions similar to those indicated in the following subparagraphs:
 - 1. Valve-Tag Size and Shape:
 - a. Cold Water: 2 inches (50 mm), round.
 - b. Hot Water: 2 inches (50 mm), round.
 - c. Low-Pressure Compressed Air: 2 inches (50 mm), square.
 - d. High-Pressure Compressed Air: 2 inches (50 mm), square.
 - 2. Valve-Tag Color:
 - a. Cold Water: Natural.
 - b. Hot Water: Natural.
 - c. Low-Pressure Compressed Air: Natural.
 - d. High-Pressure Compressed Air: Natural.
 - 3. Letter Color:
 - a. Cold Water: Black.
 - b. Hot Water: Black.
 - c. Low-Pressure Compressed Air: Black.
 - d. High-Pressure Compressed Air: Black.

END OF SECTION 220553

SECTION 220700 PLUMBING 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. Insulation Materials:
 - a. Mineral fiber.
 - 2. Insulating cements.
 - 3. Adhesives.
 - 4. Sealants.
 - 5. Factory-applied jackets.
 - 6. Field-applied jackets.
 - 7. Tapes.
 - 8. Securements.
 - 9. Corner angles.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated. Include thermal conductivity, thickness, and jackets (both factory and field applied, if any).
- B. Shop Drawings:
 - 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, equipment connections, and access panels.
 - 6. Detail application of field-applied jackets.
 - 7. Detail field application for each equipment type.
- C. Samples: For each type of insulation and jacket indicated. Identify each Sample, describing product and intended use. Sample sizes are as follows:

- 1. Sample Sizes:
 - a. Preformed Pipe Insulation Materials: 12 inches long by NPS 2.
 - b. Sheet Form Insulation Materials: 12 inches square.
 - c. Jacket Materials for Pipe: 12 inches long by NPS 2.
 - d. Sheet Jacket Materials: 12 inches square.
 - e. Manufacturer's Color Charts: For products where color is specified, show the full range of colors available for each type of finish material.
- D. Qualification Data: For qualified Installer.
- E. Material Test Reports: From a qualified testing agency acceptable to authorities having jurisdiction indicating, interpreting, and certifying test results for compliance of insulation materials, sealers, attachments, cements, and jackets, with requirements indicated. Include dates of tests and test methods employed.
- F. Field quality-control reports.

1.4 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. Fire-Test-Response Characteristics: Insulation and related materials shall have fire-test-response characteristics indicated, as determined by testing identical products per 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 and inspecting agency.
 - 1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Packaging: Insulation material containers shall be marked by manufacturer with appropriate ASTM standard designation, type and grade, and maximum use temperature.

1.6 COORDINATION

- A. Coordinate size and location of supports, hangers, and insulation shields specified in Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment."
- B. Coordinate clearance requirements with piping Installer for piping insulation application and equipment Installer for equipment 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.

1.7 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 INSULATION MATERIALS

- A. Comply with requirements in Part 3 schedule articles for where insulating materials shall be applied.
- B. Products shall not contain asbestos, lead, mercury, or mercury compounds.
- C. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871.
- D. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.
- E. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.
- F. Mineral-Fiber Blanket Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 553, Type II and ASTM C 1290, Type I. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Johns Manville; Microlite.
 - b. Knauf Insulation; Duct Wrap.
 - c. Owens Corning; All-Service Duct Wrap.
- G. High-Temperature, Mineral-Fiber Blanket Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 553, Type V, without factory-applied jacket.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Johns Manville; HTB 23 Spin-Glas.
 - b. Owens Corning; High Temperature Flexible Batt Insulations.
- H. Mineral-Fiber, Preformed Pipe Insulation:
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Johns Manville; Micro-Lok.
 - b. Knauf Insulation; 1000(Pipe Insulation.
 - c. Owens Corning; Fiberglas Pipe Insulation.

- 2. Type I, 850 deg F Materials: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 547, Type I, Grade A, with factory-applied ASJ-SSL. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.
- I. Mineral-Fiber, Pipe and Tank Insulation: Mineral or glass fibers bonded with a thermosetting resin. Semirigid board material with factory-applied ASJcomplying with ASTM C 1393, Type II or Type IIIA Category 2, or with properties similar to ASTM C 612, Type IB. Nominal density is 2.5 lb/cu. ft. or more. Thermal conductivity (k-value) at 120 deg F is 0.27 Btu x in./h x sq. ft. x deg F or less. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Johns Manville; MicroFlex.
 - b. Knauf Insulation; Pipe and Tank Insulation.
 - c. Owens Corning; Fiberglas Pipe and Tank Insulation.

2.2 INSULATING CEMENTS

- A. Mineral-Fiber Insulating Cement: Comply with ASTM C 195.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Insulco, Division of MFS, Inc.; Triple I.
 - b. P. K. Insulation Mfg. Co., Inc.; Super-Stik.

2.3 ADHESIVES

- A. 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.
- B. Flexible Elastomeric and Polyolefin Adhesive: Comply with MIL-A-24179A, Type II, Class I.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Aeroflex USA Inc.; Aeroseal.
 - b. Armacell LCC; 520 Adhesive.
 - c. RBX Corporation; Rubatex Contact Adhesive.
- C. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Childers Products, Division of ITW; CP-82.
 - b. Foster Products Corporation, H. B. Fuller Company; 85-20.
 - c. ITW TACC, Division of Illinois Tool Works; S-90/80.
 - d. Marathon Industries, Inc.; 225.
 - e. Mon-Eco Industries, Inc.; 22-25.
- D. ASJ Adhesive, and FSK and PVDC Jacket Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.

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- 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Childers Products, Division of ITW; CP-82.
 - b. Foster Products Corporation, H. B. Fuller Company; 85-20.
 - c. ITW TACC, Division of Illinois Tool Works; S-90/80.
 - d. Marathon Industries, Inc.; 225.
 - e. Mon-Eco Industries, Inc.; 22-25.
- E. PVC Jacket Adhesive: Compatible with PVC jacket.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Dow Chemical Company (The); 739, Dow Silicone.
 - b. Johns-Manville; Zeston Perma-Weld, CEEL-TITE Solvent Welding Adhesive.
 - c. P.I.C. Plastics, Inc.; Welding Adhesive.
 - d. Red Devil, Inc.; Celulon Ultra Clear.
 - e. Speedline Corporation; Speedline Vinyl Adhesive.

2.4 SEALANTS

- A. ASJ Flashing Sealants, and Vinyl, PVDC, and PVC Jacket Flashing Sealants:
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Childers Products, Division of ITW; CP-76.
 - b. Insert manufacturer's name; product name or designation.
 - 2. Materials shall be compatible with insulation materials, jackets, and substrates.
 - 3. Fire- and water-resistant, flexible, elastomeric sealant.
 - 4. Service Temperature Range: Minus 40 to plus 250 deg F.
 - 5. Color: White.

2.5 FACTORY-APPLIED JACKETS

- A. Insulation system schedules indicate factory-applied jackets on various applications. When factoryapplied jackets are indicated, comply with the following:
 - 1. ASJ: White, kraft-paper, fiberglass-reinforced scrim with aluminum-foil backing; complying with ASTM C 1136, Type I.
 - 2. ASJ-SSL: ASJ with self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip; complying with ASTM C 1136, Type I.
 - 3. PVDC Jacket for Indoor Applications: 4-mil- thick, white PVDC biaxially oriented barrier film with a permeance at 0.02 perms when tested according to ASTM E 96 and with a flame-spread index of 5 and a smoke-developed index of 20 when tested according to ASTM E 84.

2.6 FIELD-APPLIED JACKETS

A. Field-applied jackets shall comply with ASTM C 921, Type I, unless otherwise indicated.

- B. PVC Jacket: High-impact-resistant, UV-resistant PVC complying with ASTM D 1784, Class 16354-C; thickness as scheduled; roll stock ready for shop or field cutting and forming. Thickness is indicated in field-applied jacket schedules.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Johns Manville; Zeston.
 - b. P.I.C. Plastics, Inc.; FG Series.
 - c. Proto PVC Corporation; LoSmoke.
 - d. Speedline Corporation; SmokeSafe.
 - 2. Adhesive: As recommended by jacket material manufacturer.
 - 3. Color: White.
 - 4. Factory-fabricated fitting covers to match jacket if available; otherwise, field fabricate.
 - a. Shapes: 45- and 90-degree, short- and long-radius elbows, tees, valves, flanges, unions, reducers, end caps, soil-pipe hubs, traps, mechanical joints, and P-trap and supply covers for lavatories.
 - 5. Factory-fabricated tank heads and tank side panels.

2.7 TAPES

- A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C 1136.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0835.
 - b. Compac Corp.; 104 and 105.
 - c. Ideal Tape Co., Inc., an American Biltrite Company; 428 AWF ASJ.
 - d. Venture Tape; 1540 CW Plus, 1542 CW Plus, and 1542 CW Plus/SQ.
 - 2. Width: 3 inches.
 - 3. Thickness: 11.5 mils.
 - 4. Adhesion: 90 ounces force/inch in width.
 - 5. Elongation: 2 percent.
 - 6. Tensile Strength: 40 lbf/inch in width.
 - 7. ASJ Tape Disks and Squares: Precut disks or squares of ASJ tape.
- B. PVC Tape: White vapor-retarder tape matching field-applied PVC jacket with acrylic adhesive. Suitable for indoor and outdoor applications.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0555.
 - b. Compac Corp.; 130.
 - c. Ideal Tape Co., Inc., an American Biltrite Company; 370 White PVC tape.
 - d. Venture Tape; 1506 CW NS.
 - 2. Width: 2 inches.

- 3. Thickness: 6 mils.
- 4. Adhesion: 64 ounces force/inch in width.
- 5. Elongation: 500 percent.
- 6. Tensile Strength: 18 lbf/inch in width.

2.8 SECUREMENTS

- A. Bands:
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Childers Products; Bands.
 - b. PABCO Metals Corporation; Bands.
 - c. RPR Products, Inc.; Bands.
 - 2. Stainless Steel: ASTM A 167 or ASTM A 240/A 240M, Type 304; 0.015 inch thick, 1/2 inch wide with wing or closed seal.
- B. Insulation Pins and Hangers:
 - 1. Metal, Adhesively Attached, Perforated-Base Insulation Hangers: Baseplate welded to projecting spindle that is capable of holding insulation, of thickness indicated, securely in position indicated when self-locking washer is in place. Comply with the following requirements:
 - a. Products: Subject to compliance with requirements, provide one of the following:
 - 1) AGM Industries, Inc.; Tactoo Insul-Hangers, Series T.
 - 2) GEMCO; Perforated Base.
 - 3) Midwest Fasteners, Inc.; Spindle.
 - b. Baseplate: Perforated, galvanized carbon-steel sheet, 0.030 inch thick by 2 inches square.
 - c. Spindle: Aluminum, fully annealed, 0.106-inch- diameter shank, length to suit depth of insulation indicated.
 - d. Adhesive: Recommended by hanger manufacturer. Product with demonstrated capability to bond insulation hanger securely to substrates indicated without damaging insulation, hangers, and substrates.
 - 2. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch-thick, aluminumsheet, with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches in diameter.
 - a. Products: Subject to compliance with requirements, provide one of the following:
 - 1) AGM Industries, Inc.; RC-150.
 - 2) GEMCO; R-150.
 - 3) Midwest Fasteners, Inc.; WA-150.
 - 4) Nelson Stud Welding; Speed Clips.
 - b. Protect ends with capped self-locking washers incorporating a spring steel insert to ensure permanent retention of cap in exposed locations.
- C. Staples: Outward-clinching insulation staples, nominal 3/4-inch-wide, stainless steel or Monel.

- D. Wire: 0.062-inch soft-annealed, stainless steel.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. C & F Wire.
 - b. Childers Products.
 - c. PABCO Metals Corporation.
 - d. RPR Products, Inc.

2.9 FIRE WRAP

A. Provide 3µ fire wrap for all piping required to meet fire resistance rating.

2.10 PLENUM WRAP

A. Provide 3µ Plenum wrap for all piping required to meet fire smoke density requirements.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions for compliance with requirements for installation and other conditions affecting performance of insulation application.
 - 1. Verify that systems and equipment to be insulated have been tested and are free of defects.
 - 2. Verify that surfaces to be insulated are clean and dry.
 - 3. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.
- B. Surface Preparation: Clean and prepare surfaces to be insulated. Before insulating, apply a corrosion coating to insulated surfaces as follows:
 - 1. Stainless Steel: Coat 300 series stainless steel with an epoxy primer 5 mils thick and an epoxy finish 5 mils thick if operating in a temperature range between 140 and 300 deg F. Consult coating manufacturer for appropriate coating materials and application methods for operating temperature range.
 - 2. Carbon Steel: Coat carbon steel operating at a service temperature between 32 and 300 deg F with an epoxy coating. Consult coating manufacturer for appropriate coating materials and application methods for operating temperature range.
- C. Coordinate insulation installation with the trade installing heat tracing. Comply with requirements for heat tracing that apply to insulation.

D. Mix insulating cements with clean potable water; if insulating cements are to be in contact with stainlesssteel surfaces, use demineralized water.

3.3 GENERAL INSTALLATION REQUIREMENTS

- A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of equipment and piping including fittings, valves, and specialties.
- B. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of equipment and pipe system as specified in insulation system schedules.
- C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.
- D. Install insulation with longitudinal seams at top and bottom of horizontal runs.
- E. Install multiple layers of insulation with longitudinal and end seams staggered.
- F. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.
- G. Keep insulation materials dry during application and finishing.
- H. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.
- I. Install insulation with least number of joints practical.
- J. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.
 - 1. Install insulation continuously through hangers and around anchor attachments.
 - 2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
 - 3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
 - 4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.
- K. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.
- L. Install insulation with factory-applied jackets as follows:
 - 1. Draw jacket tight and smooth.
 - 2. Cover circumferential joints with 3-inch-wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches o.c.
 - 3. Overlap jacket longitudinal seams at least 1-1/2 inches. Install insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 2 inches o.c.
 - a. For below ambient services, apply vapor-barrier mastic over staples.

- 4. Cover joints and seams with tape as recommended by insulation material manufacturer to maintain vapor seal.
- 5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to pipe flanges and fittings.
- M. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.
- N. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.
- O. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.
- P. For above ambient services, do not install insulation to the following:
 - 1. Vibration-control devices.
 - 2. Testing agency labels and stamps.
 - 3. Nameplates and data plates.
 - 4. Manholes.
 - 5. Handholes.
 - 6. Cleanouts.

3.4 PENETRATIONS

- A. Insulation Installation at Roof Penetrations: Install insulation continuously through roof penetrations.
 - 1. Seal penetrations with flashing sealant.
 - 2. For applications requiring only indoor insulation, terminate insulation above roof surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
 - 3. Extend jacket of outdoor insulation outside roof flashing at least 2 inches below top of roof flashing.
 - 4. Seal jacket to roof flashing with flashing sealant.
- B. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.
- C. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Install insulation continuously through penetrations of fire-rated walls and partitions.
 - 1. Comply with requirements in Division 07 Section "Penetration Firestopping" firestopping and fireresistive joint sealers.
- D. Insulation Installation at Floor Penetrations:
 - 1. Pipe: Install insulation continuously through floor penetrations.
 - 2. Seal penetrations through fire-rated assemblies. Comply with requirements in Division 07 Section "Penetration Firestopping."

3.5 EQUIPMENT, TANK, AND VESSEL INSULATION INSTALLATION

- A. Mineral Fiber, Pipe and Tank Insulation Installation for Tanks and Vessels: Secure insulation with adhesive and anchor pins and speed washers.
 - 1. Apply adhesives according to manufacturer's recommended coverage rates per unit area, for 100percent coverage of tank and vessel surfaces.
 - 2. Groove and score insulation materials to fit as closely as possible to equipment, including contours. Bevel insulation edges for cylindrical surfaces for tight joints. Stagger end joints.
 - 3. Protect exposed corners with secured corner angles.
 - 4. Install adhesively attached or self-sticking insulation hangers and speed washers on sides of tanks and vessels as follows:
 - a. Do not weld anchor pins to ASME-labeled pressure vessels.
 - b. Select insulation hangers and adhesive that are compatible with service temperature and with substrate.
 - c. On tanks and vessels, maximum anchor-pin spacing is 3 inches from insulation end joints, and 16 inches o.c. in both directions.
 - d. Do not overcompress insulation during installation.
 - e. Cut and miter insulation segments to fit curved sides and domed heads of tanks and vessels.
 - f. Impale insulation over anchor pins and attach speed washers.
 - g. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.
 - 5. Secure each layer of insulation with stainless-steel or aluminum bands. Select band material compatible with insulation materials.
 - 6. Where insulation hangers on equipment and vessels are not permitted or practical and where insulation support rings are not provided, install a girdle network for securing insulation. Stretch prestressed aircraft cable around the diameter of vessel and make taut with clamps, turnbuckles, or breather springs. Place one circumferential girdle around equipment approximately 6 inches from each end. Install wire or cable between two circumferential girdles 12 inches o.c. Install a wire ring around each end and around outer periphery of center openings, and stretch prestressed aircraft cable radially from the wire ring to nearest circumferential girdle. Install additional circumferential girdles along the body of equipment or tank at a minimum spacing of 48 inches o.c. Use this network for securing insulation with tie wire or bands.
 - 7. Stagger joints between insulation layers at least 3 inches.
 - 8. Install insulation in removable segments on equipment access doors, manholes, handholes, and other elements that require frequent removal for service and inspection.
 - 9. Bevel and seal insulation ends around manholes, handholes, ASME stamps, and nameplates.
 - 10. For equipment with surface temperatures below ambient, apply mastic to open ends, joints, seams, breaks, and punctures in insulation.
- B. Flexible Elastomeric Thermal Insulation Installation for Tanks and Vessels: Install insulation over entire surface of tanks and vessels.
 - 1. Apply 100 percent coverage of adhesive to surface with manufacturer's recommended adhesive.
 - 2. Seal longitudinal seams and end joints.

3.6 GENERAL PIPE INSULATION INSTALLATION

A. Requirements in this article generally apply to all insulation materials except where more specific requirements are specified in various pipe insulation material installation articles.

B. Insulation Installation on Fittings, Valves, Strainers, Flanges, and Unions:

- 1. Install insulation over fittings, valves, strainers, flanges, unions, and other specialties with continuous thermal and vapor-retarder integrity, unless otherwise indicated.
- 2. Insulate pipe elbows using preformed fitting insulation or mitered fittings made from same material and density as adjacent pipe insulation. Each piece shall be butted tightly against adjoining piece and bonded with adhesive. Fill joints, seams, voids, and irregular surfaces with insulating cement finished to a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation.
- 3. Insulate tee fittings with preformed fitting insulation or sectional pipe insulation of same material and thickness as used for adjacent pipe. Cut sectional pipe insulation to fit. Butt each section closely to the next and hold in place with tie wire. Bond pieces with adhesive.
- 4. Insulate valves using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. For valves, insulate up to and including the bonnets, valve stuffing-box studs, bolts, and nuts. Fill joints, seams, and irregular surfaces with insulating cement.
- 5. Insulate strainers using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Fill joints, seams, and irregular surfaces with insulating cement. Insulate strainers so strainer basket flange or plug can be easily removed and replaced without damaging the insulation and jacket. Provide a removable reusable insulation cover. For below ambient services, provide a design that maintains vapor barrier.
- 6. Insulate flanges and unions using a section of oversized preformed pipe insulation. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker.
- 7. Cover segmented insulated surfaces with a layer of finishing cement and coat with a mastic. Install vapor-barrier mastic for below ambient services and a breather mastic for above ambient services. Reinforce the mastic with fabric-reinforcing mesh. Trowel the mastic to a smooth and well-shaped contour.
- 8. For services not specified to receive a field-applied jacket except for flexible elastomeric and polyolefin, install fitted PVC cover over elbows, tees, strainers, valves, flanges, and unions. Terminate ends with PVC end caps. Tape PVC covers to adjoining insulation facing using PVC tape.
- 9. Stencil or label the outside insulation jacket of each union with the word "UNION." Match size and color of pipe labels.
- C. Insulate instrument connections for thermometers, pressure gages, pressure temperature taps, test connections, flow meters, sensors, switches, and transmitters on insulated pipes, vessels, and equipment. Shape insulation at these connections by tapering it to and around the connection with insulating cement and finish with finishing cement, mastic, and flashing sealant.
- D. Install removable insulation covers at locations indicated. Installation shall conform to the following:
 - 1. Make removable flange and union insulation from sectional pipe insulation of same thickness as that on adjoining pipe. Install same insulation jacket as adjoining pipe insulation.
 - 2. When flange and union covers are made from sectional pipe insulation, extend insulation from flanges or union long at least two times the insulation thickness over adjacent pipe insulation on each side of flange or union. Secure flange cover in place with stainless-steel or aluminum bands. Select band material compatible with insulation and jacket.
 - 3. Construct removable valve insulation covers in same manner as for flanges except divide the twopart section on the vertical center line of valve body.

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- 4. When covers are made from block insulation, make two halves, each consisting of mitered blocks wired to stainless-steel fabric. Secure this wire frame, with its attached insulation, to flanges with tie wire. Extend insulation at least 2 inches over adjacent pipe insulation on each side of valve. Fill space between flange or union cover and pipe insulation with insulating cement. Finish cover assembly with insulating cement applied in two coats. After first coat is dry, apply and trowel second coat to a smooth finish.
- 5. Unless a PVC jacket is indicated in field-applied jacket schedules, finish exposed surfaces with a metal jacket.

3.7 MINERAL-FIBER INSULATION INSTALLATION

- A. Insulation Installation on Straight Pipes and Tubes:
 - 1. Secure each layer of preformed pipe insulation to pipe with wire or bands and tighten bands without deforming insulation materials.
 - 2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
 - 3. For insulation with factory-applied jackets on above ambient surfaces, secure laps with outward clinched staples at 6 inches o.c.
 - 4. For insulation with factory-applied jackets on below ambient surfaces, do not staple longitudinal tabs but secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.
- B. Insulation Installation on Pipe Flanges:
 - 1. Install preformed pipe insulation to outer diameter of pipe flange.
 - 2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
 - 3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with mineral-fiber blanket insulation.
 - 4. Install jacket material with manufacturer's recommended adhesive, overlap seams at least 1 inch, and seal joints with flashing sealant.
- C. Insulation Installation on Pipe Fittings and Elbows:
 - 1. Install preformed sections of same material as straight segments of pipe insulation when available.
 - 2. When preformed insulation elbows and fittings are not available, install mitered sections of pipe insulation, to a thickness equal to adjoining pipe insulation. Secure insulation materials with wire or bands.
- D. Insulation Installation on Valves and Pipe Specialties:
 - 1. Install preformed sections of same material as straight segments of pipe insulation when available.
 - 2. When preformed sections are not available, install mitered sections of pipe insulation to valve body.
 - 3. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
 - 4. Install insulation to flanges as specified for flange insulation application.

3.8 FIELD-APPLIED JACKET INSTALLATION

- A. Where PVC jackets are indicated, install with 1-inch overlap at longitudinal seams and end joints; for horizontal applications, install with longitudinal seams along top and bottom of tanks and vessels. Seal with manufacturer's recommended adhesive.
 - 1. Apply two continuous beads of adhesive to seams and joints, one bead under lap and the finish bead along seam and joint edge.

3.9 FINISHES

- A. Equipment and Pipe Insulation with ASJ, or Other Paintable Jacket Material: Paint jacket with paint system identified below and as specified in Division 09 painting Sections.
 - 1. Flat Acrylic Finish: Twofinish coats over a primer that is compatible with jacket material and finish coat paint. Add fungicidal agent to render fabric mildew proof.
 - a. Finish Coat Material: Interior, flat, latex-emulsion size.
- B. Flexible Elastomeric Thermal Insulation: After adhesive has fully cured, apply two coats of insulation manufacturer's recommended protective coating.
- C. Color: Final color as selected by Architect. Vary first and second coats to allow visual inspection of the completed Work.
- D. Do not field paint aluminum or stainless-steel jackets.

3.10 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
- B. Perform tests and inspections.
- C. Tests and Inspections:
 - 1. Inspect field-insulated equipment, randomly selected by Architect, by removing field-applied jacket and insulation in layers in reverse order of their installation. Extent of inspection shall be limited to one location(s) for each type of equipment defined in the "Equipment Insulation Schedule" Article. For large equipment, remove only a portion adequate to determine compliance.
 - 2. Inspect pipe, fittings, strainers, and valves, randomly selected by Architect, by removing fieldapplied jacket and insulation in layers in reverse order of their installation. Extent of inspection shall be limited to three locations of straight pipe, three locations of threaded fittings, three locations of welded fittings, locations of threaded strainers, locations of welded strainers, three locations of threaded valves, and three locations of flanged valves for each pipe service defined in the "Piping Insulation Schedule, General" Article.
- D. All insulation applications will be considered defective Work if sample inspection reveals noncompliance with requirements.

3.11 EQUIPMENT INSULATION SCHEDULE

- A. Insulation materials and thicknesses are identified below. If more than one material is listed for a type of equipment, selection from materials listed is Contractor's option.
- B. Insulate indoor and outdoor equipment in paragraphs below that is not factory insulated.
- C. Domestic hot-water hydropneumatic tank insulation shall be the following:
 - 1. Mineral-Fiber Pipe and Tank: 1 inch thick.

3.12 PIPING INSULATION SCHEDULE, GENERAL

- A. Acceptable preformed pipe and tubular insulation materials and thicknesses are identified for each piping system and pipe size range. If more than one material is listed for a piping system, selection from materials listed is Contractor's option.
- B. Items Not Insulated: Unless otherwise indicated, do not install insulation on the following:
 - 1. Drainage piping located in crawl spaces.
 - 2. Underground piping.
 - 3. Chrome-plated pipes and fittings unless there is a potential for personnel injury.

3.13 INDOOR PIPING INSULATION SCHEDULE

- A. Domestic Cold Water:
 - 1. NPS 1 and Smaller: Insulation shall be the following:
 - a. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1/2 inch thick.
 - 2. NPS 1-1/4 and Larger: Insulation shall be the following:
 - a. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.
- B. Domestic Hot and Recirculated Hot Water:
 - NPS 1-1/4 and Smaller: Insulation shall be the following:
 a. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.
 - 2. NPS 1-1/2 and Larger: Insulation shall be the following:
 - a. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1-1/2 inch thick.

3.14 INDOOR, FIELD-APPLIED JACKET SCHEDULE

A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.

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- B. If more than one material is listed, selection from materials listed is Contractor's option.
- C. Piping, Exposed:
 - 1. None.
 - 2. PVC: 20 mils thick.

END OF SECTION 220700

SECTION 221116 DOMESTIC WATER PIPING

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. Under-building slab and aboveground domestic water pipes, tubes, fittings, and specialties inside the building.
 - 2. Encasement for piping.
 - 3. Specialty valves.
 - 4. Flexible connectors.
 - 5. Escutcheons.
 - 6. Sleeves and sleeve seals.
 - 7. Wall penetration systems.

1.3 PERFORMANCE REQUIREMENTS

A. Seismic Performance: Domestic water piping and support and installation shall withstand effects of earthquake motions determined according to SEI/ASCE 7.

1.4 SUBMITTALS

- A. Product Data: For the following products:
 - 1. Specialty valves.
 - 2. Transition fittings.
 - 3. Dielectric fittings.
 - 4. Flexible connectors.
 - 5. Escutcheons.
 - 6. Sleeves and sleeve seals.
 - 7. Water penetration systems.
- B. Water Samples: Specified in "Cleaning" Article.
- C. Coordination Drawings: For piping in equipment rooms and other congested areas, drawn to scale, on which the following items are shown and coordinated with each other, using input from Installers of the items involved:
 - 1. Fire-suppression-water piping.

- 2. Domestic water piping.
- 3. HVAC hydronic piping.
- D. Field quality-control reports.

1.5 QUALITY ASSURANCE

- A. Piping materials shall bear label, stamp, or other markings of specified testing agency.
- B. Comply with NSF 61 for potable domestic water piping and components.

1.6 PROJECT CONDITIONS

- A. Interruption of Existing Water Service: Do not interrupt water service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary water service according to requirements indicated:
 - 1. Notify Owner, no fewer than five days in advance of proposed interruption of water service.
 - 2. Do not proceed with interruption of water service without Owner's written permission.

1.7 COORDINATION

A. Coordinate sizes and locations of concrete bases with actual equipment provided.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

- A. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, fitting materials, and joining methods for specific services, service locations, and pipe sizes.
- B. Certified NSF 61/NSF 372 'Lead-Free' pipe, fittings and valves for use on domestic water systems.

2.2 COPPER TUBE AND FITTINGS

- A. Hard Copper Tube: ASTM B 88, Type L water tube, drawn temper, NSF 61/NSF 372.
 - 1. Cast-Copper Solder-Joint Fittings: ASME B16.18, pressure fittings.
 - 2. Wrought-Copper Solder-Joint Fittings: ASME B16.22, wrought-copper pressure fittings.
 - 3. Bronze Flanges: ASME B16.24, Class 150, with solder-joint ends.
 - 4. Copper Unions: MSS SP-123, cast-copper-alloy, hexagonal-stock body, with ball-and-socket, metal-to-metal seating surfaces, and solder-joint or threaded ends.
- B. Soft Copper Tube: ASTM B 88, Type K water tube, annealed temper, NSF 61/NSF 372.
 - 1. Copper Solder-Joint Fittings: ASME B16.22, wrought-copper pressure fittings.

2.3 PIPING JOINING MATERIALS

- A. Pipe-Flange Gasket Materials: AWWA C110, rubber, flat face, 1/8 inch (3.2 mm) thick or ASME B16.21, nonmetallic and asbestos free, unless otherwise indicated; full-face or ring type unless otherwise indicated.
- B. Metal, Pipe-Flange Bolts and Nuts: ASME B18.2.1, carbon steel unless otherwise indicated.
- C. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.
- D. Brazing Filler Metals: AWS A5.8/A5.8M, BCuP Series, copper-phosphorus alloys for general-duty brazing unless otherwise indicated.

2.4 ENCASEMENT FOR PIPING

- A. Standard: ASTM A 674 or AWWA C105.
- B. Form: Sheet or Tube.
- C. Material: High-density, cross-laminated PE film of 0.004-inch minimum thickness.
- D. Color: Black.

2.5 SPECIALTY VALVES

- A. Comply with requirements in Division 22 Section "General-Duty Valves for Plumbing Piping" for general-duty metal valves.
- B. Comply with requirements in Division 22 Section "Domestic Water Piping Specialties" for balancing valves, drain valves, backflow preventers, and vacuum breakers.

2.6 TRANSITION FITTINGS

- A. General Requirements:
 - 1. Same size as pipes to be joined.
 - 2. Pressure rating at least equal to pipes to be joined.
 - 3. End connections compatible with pipes to be joined.
- B. Fitting-Type Transition Couplings: Manufactured piping coupling or specified piping system fitting.
- C. Sleeve-Type Transition Coupling: AWWA C219.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Dresser, Inc.; Dresser Piping Specialties.
 - b. Ford Meter Box Company, Inc. (The).
 - c. Viking Johnson; c/o Mueller Co.

2.7 DIELECTRIC FITTINGS

- A. General Requirements: Assembly of copper alloy and ferrous materials or ferrous material body with separating nonconductive insulating material suitable for system fluid, pressure, and temperature.
- B. Dielectric Unions:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
 - b. Zurn Plumbing Products Group; Wilkins Water Control Products.
 - 2. Description:
 - a. Pressure Rating: 150 psig at 180 deg F.
 - b. End Connections: Solder-joint copper alloy and threaded ferrous.
- C. Dielectric Flanges:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
 - 2. Description:
 - a. Factory-fabricated, bolted, companion-flange assembly.
 - b. Pressure Rating: 150 psig minimum.
 - c. End Connections: Solder-joint copper alloy and threaded ferrous; threaded solder-joint copper alloy and threaded ferrous.
- D. Dielectric-Flange Kits:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Calpico, Inc.
 - 2. Description:
 - a. Nonconducting materials for field assembly of companion flanges.
 - b. Pressure Rating: 150 psig.
 - c. Gasket: Neoprene or phenolic.
 - d. Bolt Sleeves: Phenolic or polyethylene.
 - e. Washers: Phenolic with steel backing washers.
- E. Dielectric Couplings:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Calpico, Inc.

- b. Lochinvar Corporation.
- 2. Description:
 - a. Galvanized-steel coupling.
 - b. Pressure Rating: 300 psig at 225 deg F.
 - c. End Connections: Female threaded.
 - d. Lining: Inert and noncorrosive, thermoplastic.
- F. Dielectric Nipples:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Precision Plumbing Products, Inc.
 - b. Victaulic Company.
 - 2. Description:
 - a. Electroplated steel nipple complying with ASTM F 1545.
 - b. Pressure Rating: 300 psig at 225 deg F.
 - c. End Connections: Male threaded or grooved.
 - d. Lining: Inert and noncorrosive, propylene.

2.8 FLEXIBLE CONNECTORS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Mercer Rubber Co.
 - 2. Metraflex, Inc.
 - 3. Universal Metal Hose; a Hyspan company
- B. Bronze-Hose Flexible Connectors: Corrugated-bronze tubing with bronze wire-braid covering and ends brazed to inner tubing.
 - 1. Working-Pressure Rating: Minimum 200 psig.
 - 2. End Connections NPS 2 and Smaller: Threaded copper pipe or plain-end copper tube.
 - 3. End Connections NPS 2-1/2 and Larger: Flanged copper alloy.
- C. Stainless-Steel-Hose Flexible Connectors: Corrugated-stainless-steel tubing with stainless-steel wirebraid covering and ends welded to inner tubing.
 - 1. Working-Pressure Rating: Minimum 200 psig.
 - 2. End Connections NPS 2 and Smaller: Threaded steel-pipe nipple.
 - 3. End Connections NPS 2-1/2 and Larger: Flanged steel nipple.

2.9 ESCUTCHEONS

- A. General: Manufactured ceiling, floor, and wall escutcheons and floor plates.
- B. One Piece, Cast Brass: Polished, chrome-plated finish with setscrews.

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- C. One Piece, Deep Pattern: Deep-drawn, box-shaped brass with chrome-plated finish.
- D. Split Casting, Cast Brass: Polished, chrome-plated finish with concealed hinge and setscrew.
- E. One-Piece Floor Plates: Cast-iron flange with holes for fasteners.
- F. Split-Casting Floor Plates: Cast brass with concealed hinge.

2.10 SLEEVES

- A. Cast-Iron Wall Pipes: Fabricated of cast iron, and equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop unless otherwise indicated.
- B. Galvanized-Steel-Sheet Sleeves: 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint.
- C. Molded-PE Sleeves: Reusable, PE, tapered-cup shaped, and smooth outer surface with nailing flange for attaching to wooden forms.
- D. Galvanized-Steel-Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, zinc-coated, with plain ends.
- E. Stack Sleeve Fittings: Manufactured, cast-iron sleeve with integral clamping flange. Include clamping ring and bolts and nuts for membrane flashing.
 - 1. Underdeck Clamp: Clamping ring with setscrews.

2.11 SLEEVE SEALS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Calpico, Inc.
 - 2. Metraflex, Inc.
 - 3. Thunderline.
- B. Description: Modular sealing element unit, designed for field assembly, used to fill annular space between pipe and sleeve.
 - 1. Sealing Elements: EPDM-rubber interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
 - 2. Pressure Plates: Plastic.
 - 3. Connecting Bolts and Nuts: Carbon steel, with corrosion-resistant coating, of length required to secure pressure plates to sealing elements.

2.12 GROUT

- A. Standard: ASTM C 1107, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.
- B. Characteristics: Nonshrink; recommended for interior and exterior applications.

- C. Design Mix: 5000-psi, 28-day compressive strength.
- D. Packaging: Premixed and factory packaged.

PART 3 - EXECUTION

3.1 EARTHWORK

A. Comply with requirements in Division 31 Section "Earth Moving" for excavating, trenching, and backfilling.

3.2 PIPING INSTALLATION

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of domestic water piping. Indicated locations and arrangements are used to size pipe and calculate friction loss, expansion, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.
- B. Install copper tubing under building slab according to CDA's "Copper Tube Handbook."
- C. Install ductile-iron piping under building slab with restrained joints according to AWWA C600 and AWWA M41.
- D. Install underground copper tube and ductile-iron pipe in PE encasement according to ASTM A 674 or AWWA C105.
- E. Install shutoff valve, hose-end drain valve, strainer, pressure gage, and test tee with valve, inside the building at each domestic water service entrance. Comply with requirements in Division 22 Section "Meters and Gages for Plumbing Piping" for pressure gages and Division 22 Section "Domestic Water Piping Specialties" for drain valves and strainers.
- F. Install shutoff valve immediately upstream of each dielectric fitting.
- G. Install domestic water piping level and plumb.
- H. Install piping concealed from view and protected from physical contact by building occupants unless otherwise indicated and except in equipment rooms and service areas.
- I. 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.
- J. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal, and coordinate with other services occupying that space.
- K. Install piping adjacent to equipment and specialties to allow service and maintenance.
- L. Install piping to permit valve servicing.
- M. Install nipples, unions, special fittings, and valves with pressure ratings the same as or higher than system pressure rating used in applications below unless otherwise indicated.

- N. Install piping free of sags and bends.
- O. Install fittings for changes in direction and branch connections.
- P. Install unions in copper tubing at final connection to each piece of equipment, machine, and specialty.
- Q. Install pressure gages on suction and discharge piping from each plumbing pump and packaged booster pump. Comply with requirements in Division 22 Section "Meters and Gages for Plumbing Piping" for pressure gages.
- R. Install thermostats in hot-water circulation piping. Comply with requirements in Division 22 Section "Domestic Water Pumps" for thermostats.
- S. Install thermometers on inlet and outlet piping from each water heater. Comply with requirements in Division 22 Section "Meters and Gages for Plumbing Piping" for thermometers.

3.3 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 pipes, tubes, and fittings before assembly.
- C. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
 - 1. Apply appropriate tape or thread compound to external pipe threads.
 - 2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged.
- D. Brazed Joints: Join copper tube and fittings according to CDA's "Copper Tube Handbook," "Brazed Joints" Chapter.
- E. Soldered Joints: Apply ASTM B 813, water-flushable flux to end of tube. Join copper tube and fittings according to ASTM B 828 or CDA's "Copper Tube Handbook."
- F. Flanged Joints: Select appropriate asbestos-free, nonmetallic gasket material in size, type, and thickness suitable for domestic water service. Join flanges with gasket and bolts according to ASME B31.9.
- G. Dissimilar-Material Piping Joints: Make joints using adapters compatible with materials of both piping systems.

3.4 VALVE INSTALLATION

- A. General-Duty Valves: Comply with requirements in Division 22 Section "General-Duty Valves for Plumbing Piping" for valve installations.
- B. Install shutoff valve close to water main on each branch and riser serving plumbing fixtures or equipment, on each water supply to equipment, and on each water supply to plumbing fixtures that do not have supply stops. Use ball or gate valves for piping NPS 2 and smaller. Use gate valves for piping NPS 2-1/2 and larger.

- C. Install drain valves for equipment at base of each water riser, at low points in horizontal piping, and where required to drain water piping. Drain valves are specified in Division 22 Section "Domestic Water Piping Specialties."
 - 1. Hose-End Drain Valves: At low points in water mains, risers, and branches.
 - 2. Stop-and-Waste Drain Valves: Instead of hose-end drain valves where indicated.
- D. Install calibrated balancing valves in each hot-water circulation return branch and discharge side of each pump and circulator. Set calibrated balancing valves partly open to restrict but not stop flow. Comply with requirements in Division 22 Section "Domestic Water Piping Specialties" for calibrated balancing valves.

3.5 TRANSITION FITTING INSTALLATION

- A. Install transition couplings at joints of dissimilar piping.
- B. Transition Fittings in Underground Domestic Water Piping:
 - 1. NPS 1-1/2 and Smaller: Fitting-type coupling.
 - 2. NPS 2 and Larger: Sleeve-type coupling.

3.6 DIELECTRIC FITTING INSTALLATION

- A. Install dielectric fittings in piping at connections of dissimilar metal piping and tubing.
- B. Dielectric Fittings for NPS 2 and Smaller: Use dielectric couplings.
- C. Dielectric Fittings for NPS 2-1/2 to NPS 4: Use dielectric flange kits.
- D. Dielectric Fittings for NPS 5 and Larger: Use dielectric flange kits.

3.7 FLEXIBLE CONNECTOR INSTALLATION

- A. Install flexible connectors in suction and discharge piping connections to each domestic water pump and in suction and discharge manifold connections to each domestic water booster pump.
- B. Install bronze-hose flexible connectors in copper domestic water tubing.
- C. Install stainless-steel-hose flexible connectors in steel domestic water piping.

3.8 HANGER AND SUPPORT INSTALLATION

- A. Comply with requirements in Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment" for pipe hanger and support products and installation.
 - 1. Vertical Piping: MSS Type 8 or 42, clamps.
 - 2. Individual, Straight, Horizontal Piping Runs:
 - a. 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.

- b. Longer Than 100 Feet: MSS Type 43, adjustable roller hangers.
- 3. Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
- 4. Base of Vertical Piping: MSS Type 52, spring hangers.
- B. Support vertical piping and tubing at base and at each floor.
- C. Install hangers for copper tubing with the following maximum horizontal spacing and minimum rod diameters:
 - 1. NPS 3/4 and Smaller: 60 inches with 3/8-inch rod.
 - 2. NPS 1 and NPS 1-1/4: 72 inches with 3/8-inch rod.
 - 3. NPS 1-1/2 and NPS 2: 96 inches with 3/8-inch rod.
 - 4. NPS 2-1/2: 108 inches with 1/2-inch rod.
 - 5. NPS 3 to NPS 5: 10 feet with 1/2-inch rod.
- D. Install supports for vertical copper tubing every 10 feet.
- E. Support piping and tubing not listed in this article according to MSS SP-69 and manufacturer's written instructions.

3.9 CONNECTIONS

- A. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Install piping adjacent to equipment and machines to allow service and maintenance.

3.10 ESCUTCHEON INSTALLATION

- A. Install escutcheons for penetrations of walls, ceilings, and floors.
- B. Escutcheons for New Piping:
 - 1. Piping with Fitting or Sleeve Protruding from Wall: One piece, deep pattern.
 - 2. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One piece, cast brass with polished chrome-plated finish .
 - 3. Bare Piping at Ceiling Penetrations in Finished Spaces: One piece, cast brass with polished chrome-plated finish.
 - 4. Bare Piping in Unfinished Service Spaces: One piece, cast brass with polished chrome-plated finish .
 - 5. Bare Piping in Equipment Rooms: One piece, cast brass .
 - 6. Bare Piping at Floor Penetrations in Equipment Rooms: One-piece floor plate.
- C. Escutcheons for Existing Piping:
 - 1. Chrome-Plated Piping: Split casting, cast brass with chrome-plated finish.
 - 2. Insulated Piping: Split plate, stamped steel with concealed hinge and spring clips.
 - 3. Bare Piping at Wall and Floor Penetrations in Finished Spaces: Split casting, cast brass with chrome-plated finish.

- 4. Bare Piping at Ceiling Penetrations in Finished Spaces: Split casting, cast brass with chromeplated finish.
- 5. Bare Piping in Unfinished Service Spaces: Split casting, cast brass with polished chrome-plated finish.
- 6. Bare Piping in Equipment Rooms: Split casting, cast brass.
- 7. Bare Piping at Floor Penetrations in Equipment Rooms: Split-casting floor plate.

3.11 SLEEVE INSTALLATION

- A. General Requirements: Install sleeves for pipes and tubes passing through penetrations in floors, partitions, roofs, and walls.
- B. Sleeves are not required for core-drilled holes.
- C. Permanent sleeves are not required for holes formed by removable PE sleeves.
- D. Cut sleeves to length for mounting flush with both surfaces unless otherwise indicated.
- E. Install sleeves in new partitions, slabs, and walls as they are built.
- F. For interior wall penetrations, seal annular space between sleeve and pipe or pipe insulation using joint sealants appropriate for size, depth, and location of joint. Comply with requirements in Division 07 Section "Joint Sealants" for joint sealants.
- G. For exterior wall penetrations above grade, seal annular space between sleeve and pipe using joint sealants appropriate for size, depth, and location of joint. Comply with requirements in Division 07 Section "Joint Sealants" for joint sealants.
- H. For exterior wall penetrations below grade, seal annular space between sleeve and pipe using sleeve seals specified in this Section.
- I. Seal space outside of sleeves in concrete slabs and walls with grout.
- J. Install sleeves that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation unless otherwise indicated.
- K. Install sleeve materials according to the following applications:
 - 1. Sleeves for Piping Passing through Concrete Floor Slabs: Steel pipe.
 - 2. Sleeves for Piping Passing through Concrete Floor Slabs of Mechanical Equipment Areas or Other Wet Areas: Steel pipe Stack sleeve fittings.
 - a. Extend sleeves 2 inches above finished floor level.
 - b. For pipes penetrating floors with membrane waterproofing, extend cast-iron sleeve fittings below floor slab as required to secure clamping ring if ring is specified. Secure flashing between clamping flanges. Install section of cast-iron soil pipe to extend sleeve to 2 inches above finished floor level. Comply with requirements in Division 07 Section "Sheet Metal Flashing and Trim" for flashing.
 - 3. Sleeves for Piping Passing through Gypsum-Board Partitions:
 - a. Steel pipe sleeves for pipes smaller than NPS 6.

- b. Exception: Sleeves are not required for water supply tubes and waste pipes for individual plumbing fixtures if escutcheons will cover openings.
- 4. Sleeves for Piping Passing through Concrete Roof Slabs: Steel pipe.
- 5. Sleeves for Piping Passing through Exterior Concrete Walls:
 - a. Steel pipe sleeves for pipes smaller than NPS 6.
 - b. Install sleeves that are large enough to provide 1-inch annular clear space between sleeve and pipe or pipe insulation when sleeve seals are used.
 - c. Do not use sleeves when wall penetration systems are used.
- 6. Sleeves for Piping Passing through Interior Concrete Walls:
 - a. Steel pipe sleeves for pipes smaller than NPS 6.
- L. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Comply with requirements in Division 07 Section "Penetration Firestopping" for firestop materials and installations.

3.12 SLEEVE SEAL INSTALLATION

- A. Install sleeve seals in sleeves in exterior concrete walls at water-service piping entries into building.
- B. Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble sleeve seal components and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

3.13 WALL PENETRATION SYSTEM INSTALLATION

- A. Install wall penetration systems in new, exterior concrete walls.
- B. Assemble wall penetration system components with sleeve pipe. Install so that end of sleeve pipe and face of housing are flush with wall. Adjust locking devices to secure sleeve pipe in housing.

3.14 IDENTIFICATION

- A. Identify system components. Comply with requirements in Division 22 Section "Identification for Plumbing Piping and Equipment" for identification materials and installation.
- B. Label pressure piping with system operating pressure.

3.15 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
- B. Piping Inspections:
 - 1. Do not enclose, cover, or put piping into operation until it has been inspected and approved by authorities having jurisdiction.

- 2. During installation, notify authorities having jurisdiction at least one day before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction:
 - a. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.
 - b. Final Inspection: Arrange final inspection for authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.
- 3. Reinspection: If authorities having jurisdiction find that piping will not pass tests or inspections, make required corrections and arrange for reinspection.
- 4. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.
- C. Piping Tests:
 - 1. Fill domestic water piping. Check components to determine that they are not air bound and that piping is full of water.
 - 2. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit a separate report for each test, complete with diagram of portion of piping tested.
 - 3. Leave new, altered, extended, or replaced domestic water piping uncovered and unconcealed until it has been tested and approved. Expose work that was covered or concealed before it was tested.
 - 4. Cap and subject piping to static water pressure of 50 psig above operating pressure, without exceeding pressure rating of piping system materials. Isolate test source and allow to stand for four hours. Leaks and loss in test pressure constitute defects that must be repaired.
 - 5. Repair leaks and defects with new materials and retest piping or portion thereof until satisfactory results are obtained.
 - 6. Prepare reports for tests and for corrective action required.
- D. Domestic water piping will be considered defective if it does not pass tests and inspections.
- E. Prepare test and inspection reports.

3.16 ADJUSTING

- A. Perform the following adjustments before operation:
 - 1. Close drain valves, hydrants, and hose bibbs.
 - 2. Open shutoff valves to fully open position.
 - 3. Remove plugs used during testing of piping and for temporary sealing of piping during installation.
 - 4. Remove and clean strainer screens. Close drain valves and replace drain plugs.
 - 5. Remove filter cartridges from housings and verify that cartridges are as specified for application where used and are clean and ready for use.
 - 6. Check plumbing specialties and verify proper settings, adjustments, and operation.

3.17 CLEANING

- A. Clean and disinfect potable domestic water piping as follows:
 - 1. Purge new piping and parts of existing piping that have been altered, extended, or repaired before using.

- 2. Use purging and disinfecting procedures prescribed by authorities having jurisdiction; if methods are not prescribed, use procedures described in either AWWA C651 or AWWA C652 or follow procedures described below:
 - a. Flush piping system with clean, potable water until dirty water does not appear at outlets.
 - b. Fill and isolate system according to either of the following:
 - 1) Fill system or part thereof with water/chlorine solution with at least 50 ppm of chlorine. Isolate with valves and allow to stand for 24 hours.
 - 2) Fill system or part thereof with water/chlorine solution with at least 200 ppm of chlorine. Isolate and allow to stand for three hours.
 - c. Flush system with clean, potable water until no chlorine is in water coming from system after the standing time.
 - d. Submit water samples in sterile bottles to authorities having jurisdiction. Repeat procedures if biological examination shows contamination.
- B. Prepare and submit reports of purging and disinfecting activities.
- C. Clean interior of domestic water piping system. Remove dirt and debris as work progresses.

3.18 PIPING SCHEDULE

- A. Transition and special fittings with pressure ratings at least equal to piping rating may be used in applications below unless otherwise indicated.
- B. Flanges and unions may be used for aboveground piping joints unless otherwise indicated.
- C. Fitting Option: Extruded-tee connections and brazed joints may be used on aboveground copper tubing.
- D. Under-building-slab, domestic water piping, NPS 2 and smaller, shall be the following:
 - 1. Hard or soft copper tube, ASTM B 88, Type K; wrought-copper solder-joint fittings; and brazed joints.
- E. Aboveground domestic water piping, NPS 2 and smaller, shall be the following:
 - 1. Hard copper tube, ASTM B 88, Type L; cast-copper solder-joint fittings; and soldered joints.
- F. Aboveground domestic water piping, NPS 2-1/2 to NPS 4, shall be the following:
 - 1. Hard copper tube, ASTM B 88, Type L; cast- or wrought- copper solder-joint fittings; and brazed joints.

3.19 VALVE SCHEDULE

- A. Drawings indicate valve types to be used. Where specific valve types are not indicated, the following requirements apply:
 - 1. Shutoff Duty: Use ball or gate valves for piping NPS 3 and smaller. Use butterfly, ball, or gate valves with flanged ends for piping NPS 4 and larger.

- 2. Hot-Water Circulation Piping, Balancing Duty: Memory-stop balancing valves.
- 3. Drain Duty: Hose-end drain valves.
- B. Use check valves to maintain correct direction of domestic water flow to and from equipment.

END OF SECTION 221116

SECTION 221119 DOMESTIC WATER PIPING 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. This Section includes the following domestic water piping specialties:
 - 1. Temperature-actuated water mixing valves.
 - 2. Strainers.
 - 3. Hose bibbs.
 - 4. Wall hydrants.
 - 5. Drain valves.
 - 6. Water hammer arresters.
 - 7. Air vents.
 - 8. Trap-seal primer valves.
- B. Related Sections include the following:
 - 1. Division 22 Section "Meters and Gages for Plumbing Piping" for thermometers, pressure gages, and flow meters in domestic water piping.

1.3 PERFORMANCE REQUIREMENTS

A. Minimum Working Pressure for Domestic Water Piping Specialties: 125 psig, unless otherwise indicated.

1.4 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: Diagram power, signal, and control wiring.
- C. Field quality-control test reports.
- D. Operation and Maintenance Data: For domestic water piping specialties to include in emergency, operation, and maintenance manuals.

1.5 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- B. NSF Compliance:
 - 1. Comply with NSF 14, "Plastics Piping Components and Related Materials," for plastic domestic water piping components.
 - 2. Comply with NSF 61, "Drinking Water System Components Health Effects; Sections 1 through 9."

PART 2 - PRODUCTS

2.1 TEMPERATURE-ACTUATED WATER MIXING VALVES

- A. Individual-Fixture, Water Tempering Valves:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Lawler Manufacturing Company, Inc.
 - b. Watts Industries, Inc.; Water Products Div.
 - c. Zurn Plumbing Products Group; Wilkins Div.
 - 2. Standard: ASSE 1016, thermostatically controlled water tempering valve.
 - 3. Pressure Rating: 125 psig minimum, unless otherwise indicated.
 - 4. Body: Bronze body with corrosion-resistant interior components.
 - 5. Temperature Control: Adjustable.
 - 6. Inlets and Outlet: Threaded.
 - 7. Finish: Rough or chrome-plated bronze.
 - 8. Tempered-Water Setting: 90 deg F.
 - 9. Tempered-Water Design Flow Rate: 0.5 gpm.

2.2 STRAINERS FOR DOMESTIC WATER PIPING

- A. Y-Pattern Strainers:
 - 1. Pressure Rating: 125 psig minimum, unless otherwise indicated.
 - 2. Body: Bronze for NPS 2 and smaller; cast iron with interior lining complying with AWWA C550 or FDA-approved, epoxy coating and for NPS 2-1/2 and larger.
 - 3. End Connections: Threaded for NPS 2 and smaller; flanged for NPS 2-1/2 and larger.
 - 4. Screen: Stainless steel with round perforations, unless otherwise indicated.
 - 5. Perforation Size:
 - a. StrainersNPS 2 and Smaller: 0.033 inch.
 - b. Strainers NPS 2-1/2 to NPS 4: 0.062 inch.

6. Drain: Factory-installed, hose-end drain valve.

2.3 HOSE BIBBS

A. Hose Bibbs:

- 1. Standard: ASME A112.18.1 for sediment faucets.
- 2. Body Material: Bronze.
- 3. Seat: Bronze, replaceable.
- 4. Supply Connections: NPS 1/2 or NPS 3/4 threaded or solder-joint inlet.
- 5. Outlet Connection: Garden-hose thread complying with ASME B1.20.7.
- 6. Pressure Rating: 125 psig.
- 7. Vacuum Breaker: Integral or field-installation, nonremovable, drainable, hose-connection vacuum breaker complying with ASSE 1011.
- 8. Finish for Equipment Rooms: Rough bronze, or chrome or nickel plated.
- 9. Finish for Service Areas: Chrome or nickel plated.
- 10. Finish for Finished Rooms: Chrome or nickel plated.
- 11. Operation for Equipment Rooms: Wheel handle or operating key.
- 12. Operation for Service Areas: Wheel handle Operating key.
- 13. Operation for Finished Rooms: Operating key.
- 14. Include operating key with each operating-key hose bibb.
- 15. Include integral wall flange with each chrome- or nickel-plated hose bibb.

2.4 DRAIN VALVES

- A. Ball-Valve-Type, Hose-End Drain Valves:
 - 1. Standard: MSS SP-110 for standard-port, two-piece ball valves.
 - 2. Pressure Rating: 400-psig minimum CWP.
 - 3. Size: NPS 3/4.
 - 4. Body: Copper alloy.
 - 5. Ball: Chrome-plated brass.
 - 6. Seats and Seals: Replaceable.
 - 7. Handle: Vinyl-covered steel.
 - 8. Inlet: Threaded or solder joint.
 - 9. Outlet: Threaded, short nipple with garden-hose thread complying with ASME B1.20.7 and cap with brass chain.

2.5 WATER HAMMER ARRESTERS

- A. Water Hammer Arresters:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Josam Company.
 - b. MIFAB, Inc.
 - c. PPP Inc.
 - d. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
 - e. Watts Drainage Products Inc.

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- f. Zurn Plumbing Products Group; Specification Drainage Operation.
- 2. Standard: ASSE 1010 or PDI-WH 201.
- 3. Type: Copper tube with piston.
- 4. Size: ASSE 1010, Sizes AA and A through F or PDI-WH 201, Sizes A through F.

2.6 AIR VENTS

- A. Bolted-Construction Automatic Air Vents:
 - 1. Body: Bronze.
 - 2. Pressure Rating: 125-psig minimum pressure rating at 140 deg F.
 - 3. Float: Replaceable, corrosion-resistant metal.
 - 4. Mechanism and Seat: Stainless steel.
 - 5. Size: NPS 1/2 minimum inlet.
 - 6. Inlet and Vent Outlet End Connections: Threaded.
- B. Welded-Construction Automatic Air Vents:
 - 1. Body: Stainless steel.
 - 2. Pressure Rating: 150-psig minimum pressure rating.
 - 3. Float: Replaceable, corrosion-resistant metal.
 - 4. Mechanism and Seat: Stainless steel.
 - 5. Size: NPS 3/8 minimum inlet.
 - 6. Inlet and Vent Outlet End Connections: Threaded.

2.7 TRAP-SEAL PRIMER VALVES

- A. Supply-Type, Trap-Seal Primer Valves:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. MIFAB, Inc.
 - b. PPP Inc.
 - c. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
 - d. Watts Industries, Inc.; Water Products Div.
 - 2. Standard: ASSE 1018.
 - 3. Pressure Rating: 125 psig minimum.
 - 4. Body: Bronze.
 - 5. Inlet and Outlet Connections: NPS 1/2 threaded, union, or solder joint.
 - 6. Gravity Drain Outlet Connection: NPS 1/2 threaded or solder joint.
 - 7. Finish: Chrome plated, or rough bronze for units used with pipe or tube that is not chrome finished.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Refer to Division 22 Section "Common Work Results for Plumbing" for piping joining materials, joint construction, and basic installation requirements.
- B. Install water control valves with inlet and outlet shutoff valves and bypass with globe valve. Install pressure gages on inlet and outlet.
- C. Install temperature-actuated water mixing valves with check stops or shutoff valves on inlets and with shutoff valve on outlet.
 - 1. Install thermometers and water regulators if specified.
 - 2. Install cabinet-type units recessed in or surface mounted on wall as specified.
- D. Install Y-pattern strainers for water on supply side of each control valve, solenoid valve, and pump.
- E. Install water hammer arresters in water piping according to PDI-WH 201.
- F. Install air vents at high points of water piping. Install drain piping and discharge onto floor drain.
- G. Install supply-type, trap-seal primer valves with outlet piping pitched down toward drain trap a minimum of 1 percent, and connect to floor-drain body, trap, or inlet fitting. Adjust valve for proper flow.

3.2 CONNECTIONS

- A. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping and specialties.
- B. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."
- C. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

3.3 LABELING AND IDENTIFYING

- A. Equipment Nameplates and Signs: Install engraved plastic-laminate equipment nameplate or sign on or near each of the following:
 - 1. Supply-type, trap-seal primer valves.
- B. Distinguish among multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations, in addition to identifying unit. Nameplates and signs are specified in Division 22 Section "Identification for Plumbing Piping and Equipment."

3.4 ADJUSTING

A. Set field-adjustable temperature set points of temperature-actuated water mixing valves.

END OF SECTION 221119

SECTION 221316 SANITARY WASTE AND VENT PIPING

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 for soil, waste, and vent piping inside the building:
 - 1. Pipe, tube, and fittings.
 - 2. Special pipe fittings.
 - 3. Encasement for underground metal piping.

1.3 DEFINITIONS

- A. ABS: Acrylonitrile-butadiene-styrene plastic.
- B. EPDM: Ethylene-propylene-diene terpolymer rubber.
- C. LLDPE: Linear, low-density polyethylene plastic.
- D. NBR: Acrylonitrile-butadiene rubber.
- E. PE: Polyethylene plastic.
- F. PVC: Polyvinyl chloride plastic.
- G. TPE: Thermoplastic elastomer.

1.4 PERFORMANCE REQUIREMENTS

- A. Components and installation shall be capable of withstanding the following minimum working pressure, unless otherwise indicated:
 - 1. Soil, Waste, and Vent Piping: 10-foot head of water.

1.5 SUBMITTALS

- A. Product Data: For pipe, tube, fittings, and couplings.
- B. Field quality-control inspection and test reports.

1.6 QUALITY ASSURANCE

A. Piping materials shall bear label, stamp, or other markings of specified testing agency.

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. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 PIPING MATERIALS

A. Refer to Part 3 "Piping Applications" Article for applications of pipe, tube, fitting, and joining materials.

2.3 HUB-AND-SPIGOT, CAST-IRON SOIL PIPE AND FITTINGS

- A. Pipe and Fittings: ASTM A 74, Service and Extra-Heavy class(es).
- B. Gaskets: ASTM C 564, rubber.
- C. Calking Materials: ASTM B 29, pure lead and oakum or hemp fiber.

2.4 HUBLESS CAST-IRON SOIL PIPE AND FITTINGS

- A. Pipe and Fittings: ASTM A 888 or CISPI 301.
- B. Sovent Stack Fittings: ASME B16.45 or ASSE 1043, hubless, cast-iron aerator and deaerator drainage fittings.
- C. Shielded Couplings: ASTM C 1277 assembly of metal shield or housing, corrosion-resistant fasteners, and rubber sleeve with integral, center pipe stop.
 - 1. Heavy-Duty, Shielded, Stainless-Steel Couplings: With stainless-steel shield, stainless-steel bands and tightening devices, and ASTM C 564, rubber sleeve.
 - a. Manufacturers:
 - 1) ANACO.
 - 2) Clamp-All Corp.
 - 3) Tyler Pipe; Soil Pipe Div.

2.5 COPPER TUBE AND FITTINGS

- A. Copper DWV Tube: ASTM B 306, drainage tube, drawn temper.
 - 1. Copper Drainage Fittings: ASME B16.23, cast copper or ASME B16.29, wrought copper, solderjoint fittings.

2.6 SPECIAL PIPE FITTINGS

- A. Flexible, Nonpressure Pipe Couplings: Comply with ASTM C 1173, elastomeric, sleeve-type, reducing or transition pattern. Include shear ring, ends of same sizes as piping to be joined, and corrosion-resistant-metal tension band and tightening mechanism on each end.
 - a. Fernco, Inc.
 - b. Mission Rubber Co.
 - c. Plastic Oddities, Inc.
 - 2. Sleeve Materials:
 - a. For Cast-Iron Soil Pipes: ASTM C 564, rubber.
 - b. For Plastic Pipes: ASTM F 477, elastomeric seal or ASTM D 5926, PVC.
 - c. For Dissimilar Pipes: ASTM D 5926, PVC or other material compatible with pipe materials being joined.
- B. Flexible Ball Joints: Ductile-iron fitting with combination of flanged and mechanical-joint ends complying with AWWA C110 or AWWA C153. Include gasketed ball-joint section and ductile-iron gland, rubber gasket, and steel bolts.
 - 1. Manufacturers:
 - a. EBAA Iron Sales, Inc.
- C. Expansion Joints: Two or three-piece, ductile-iron assembly consisting of telescoping sleeve(s) with gaskets and restrained-type, ductile-iron, bell-and-spigot end sections complying with AWWA C110 or AWWA C153. Select and assemble components for expansion indicated. Include AWWA C111, ductile-iron glands, rubber gaskets, and steel bolts.
 - 1. Manufacturers:
 - a. EBAA Iron Sales, Inc.
 - b. Romac Industries, Inc.

2.7 ENCASEMENT FOR UNDERGROUND METAL PIPING

- A. Description: ASTM A 674 or AWWA C105, high-density, crosslaminated PE film of 0.004-inch minimum thickness.
- B. Form: tube.
- C. Color: Black.

PART 3 - EXECUTION

3.1 EXCAVATION

A. Refer to Division 31 Section "Earth Moving" for excavating, trenching, and backfilling.

3.2 PIPING APPLICATIONS

- A. Flanges and unions may be used on aboveground pressure piping, unless otherwise indicated.
- B. Aboveground, soil and waste piping NPS 4 and smaller shall be the following:
 - 1. Service class, cast-iron soil pipe and fittings; gaskets; and gasketed joints.
 - 2. Hubless cast-iron soil pipe and fittings; heavy-duty shielded, stainless-steel couplings; and hublesscoupling joints.
 - 3. Copper DWV tube, copper drainage fittings, and soldered joints.
 - 4. Dissimilar Pipe-Material Couplings: Flexible, nonpressure pipe couplings for joining dissimilar pipe materials with small difference in OD.
- C. Aboveground, vent piping NPS 4 and smaller shall be the following:
 - 1. Service class, cast-iron soil pipe and fittings; gaskets; and gasketed joints.
 - 2. Hubless cast-iron soil pipe and fittings; heavy-duty shielded, stainless-steel couplings; and hubless-coupling joints.
 - 3. Copper DWV tube, copper drainage fittings, and soldered joints.
 - 4. Dissimilar Pipe-Material Couplings: Flexible, nonpressure pipe couplings for joining dissimilar pipe materials with small difference in OD.
- D. Underground, soil, waste, and vent piping NPS 4 and smaller shall be the following:
 - 1. Extra-Heavy Service class, cast-iron soil piping; gaskets; and gasketed joints.
 - 2. Dissimilar Pipe-Material Couplings: Flexible, nonpressure pipe couplings for joining dissimilar pipe materials with small difference in OD.
- E. Underground, soil and waste piping NPS 5 and larger shall be the following:
 - 1. Extra-Heavy Service class, cast-iron soil piping; gaskets; and gasketed joints.
 - 2. Dissimilar Pipe-Material Couplings: Flexible, nonpressure pipe couplings for joining dissimilar pipe materials with small difference in OD.

3.3 PIPING INSTALLATION

- A. Sanitary sewer piping outside the building is specified in Division 22 Section "Facility Sanitary Sewers."
- B. Basic piping installation requirements are specified in Division 22 Section "Common Work Results for Plumbing."
- C. Install seismic restraints on piping. Seismic-restraint devices are specified in Division 22 Section "Vibration and Seismic Controls for Plumbing Piping and Equipment."

- D. Install cleanouts at grade and extend to where building sanitary drains connect to building sanitary sewers.
- E. Install cleanout fitting with closure plug inside the building in sanitary force-main piping.
- F. Install cast-iron sleeve with water stop and mechanical sleeve seal at each service pipe penetration through foundation wall. Select number of interlocking rubber links required to make installation watertight. Sleeves and mechanical sleeve seals are specified in Division 22 Section "Common Work Results for Plumbing."
- G. Install wall-penetration fitting at each service pipe penetration through foundation wall. Make installation watertight.
- H. Install cast-iron soil piping according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings."
 - 1. Install encasement on underground piping according to ASTM A 674 or AWWA C105.
- I. Make changes in direction for soil and waste drainage and vent piping using appropriate branches, bends, and long-sweep bends. Sanitary tees and short-sweep 1/4 bends may be used on vertical stacks if change in direction of flow is from horizontal to vertical. Use long-turn, double Y-branch and 1/8-bend fittings if 2 fixtures are installed back to back or side by side with common drain pipe. Straight tees, elbows, and crosses may be used on vent lines. Do not change direction of flow more than 90 degrees. Use proper size of standard increasers and reducers if pipes of different sizes are connected. Reducing size of drainage piping in direction of flow is prohibited.
- J. Lay buried building drainage piping beginning at low point of each system. Install true to grades and alignment indicated, with unbroken continuity of invert. Place hub ends of piping upstream. Install required gaskets according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements. Maintain swab in piping and pull past each joint as completed.
- K. Install soil and waste drainage and vent piping at the following minimum slopes, unless otherwise indicated:
 - 1. Building Sanitary Drain: 2 percent downward in direction of flow for piping NPS 3 and smaller; 1 percent downward in direction of flow for piping NPS 4 and larger.
 - 2. Horizontal Sanitary Drainage Piping: 2 percent downward in direction of flow.
 - 3. Vent Piping: 1 percent down toward vertical fixture vent or toward vent stack.
- L. Sleeves are not required for cast-iron soil piping passing through concrete slabs-on-grade if slab is without membrane waterproofing.
- M. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.

3.4 JOINT CONSTRUCTION

- A. Basic piping joint construction requirements are specified in Division 22 Section "Common Work Results for Plumbing."
- B. Join hub-and-spigot, cast-iron soil piping with gasket joints according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for compression joints.

- C. Join hubless cast-iron soil piping according to CISPI 310 and CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for hubless-coupling joints.
- D. Soldered Joints: Use ASTM B 813, water-flushable, lead-free flux; ASTM B 32, lead-free-alloy solder; and ASTM B 828 procedure, unless otherwise indicated.

3.5 HANGER AND SUPPORT INSTALLATION

- A. Seismic-restraint devices are specified in Division 22 Section "Vibration and Seismic Controls for Plumbing Piping and Equipment."
- B. Pipe hangers and supports are specified in Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment." Install the following:
 - 1. Vertical Piping: MSS Type 8 or Type 42, clamps.
 - 2. Install individual, straight, horizontal piping runs according to the following:
 - a. 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.
 - b. Longer Than 100 Feet: MSS Type 43, adjustable roller hangers.
 - c. Longer Than 100 Feet, if Indicated: MSS Type 49, spring cushion rolls.
 - 3. Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
 - 4. Base of Vertical Piping: MSS Type 52, spring hangers.
- C. Install supports according to Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment."
- D. Support vertical piping and tubing at base and at each floor.
- E. Rod diameter may be reduced 1 size for double-rod hangers, with 3/8-inch minimum rods.
- F. Install hangers for cast-iron soil piping with the following maximum horizontal spacing and minimum rod diameters:
 - 1. NPS 1-1/2 and NPS 2: 60 inches with 3/8-inch rod.
 - 2. NPS 3: 60 inches with 1/2-inch rod.
 - 3. NPS 4 and NPS 5: 60 inches with 5/8-inch rod.
- G. Install supports for vertical cast-iron soil piping every 15 feet.
- H. Install hangers for copper tubing with the following maximum horizontal spacing and minimum rod diameters:
 - 1. NPS 1-1/4: 72 inches with 3/8-inch rod.
 - 2. NPS 1-1/2 and NPS 2: 96 inches with 3/8-inch rod.
- I. Install supports for vertical copper tubing every 10 feet.
- J. Support piping and tubing not listed above according to MSS SP-69 and manufacturer's written instructions.

3.6 CONNECTIONS

- A. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Connect soil and waste piping to exterior sanitary sewerage piping. Use transition fitting to join dissimilar piping materials.
- C. Connect drainage and vent piping to the following:
 - 1. Plumbing Fixtures: Connect drainage piping in sizes indicated, but not smaller than required by plumbing code.
 - 2. Plumbing Fixtures and Equipment: Connect atmospheric vent piping in sizes indicated, but not smaller than required by authorities having jurisdiction.
 - 3. Plumbing Specialties: Connect drainage and vent piping in sizes indicated, but not smaller than required by plumbing code.
 - 4. Equipment: Connect drainage piping as indicated. Provide shutoff valve, if indicated, and union for each connection. Use flanges instead of unions for connections NPS 2-1/2 and larger.

3.7 FIELD QUALITY CONTROL

- A. During installation, notify authorities having jurisdiction at least 24 hours before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction.
 - 1. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.
 - 2. Final Inspection: Arrange for final inspection by authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.
- B. Reinspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for reinspection.
- C. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.
- D. Test sanitary drainage and vent piping according to procedures of authorities having jurisdiction or, in absence of published procedures, as follows:
 - 1. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.
 - 2. Leave uncovered and unconcealed new, altered, extended, or replaced drainage and vent piping until it has been tested and approved. Expose work that was covered or concealed before it was tested.
 - 3. Roughing-in Plumbing Test Procedure: Test drainage and vent piping, except outside leaders, on completion of roughing-in. Close openings in piping system and fill with water to point of overflow, but not less than 10-foot head of water. From 15 minutes before inspection starts to completion of inspection, water level must not drop. Inspect joints for leaks.
 - 4. Finished Plumbing Test Procedure: After plumbing fixtures have been set and traps filled with water, test connections and prove they are gastight and watertight. Plug vent-stack openings on roof and building drains where they leave building. Introduce air into piping system equal to pressure of 1-inch wg. Use U-tube or manometer inserted in trap of water closet to measure this pressure. Air pressure must remain constant without introducing additional air throughout period of inspection. Inspect plumbing fixture connections for gas and water leaks.

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- 5. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.
- 6. Prepare reports for tests and required corrective action.

3.8 CLEANING

- A. Clean interior of piping. Remove dirt and debris as work progresses.
- B. Protect drains during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.
- C. Place plugs in ends of uncompleted piping at end of day and when work stops.

END OF SECTION 221316

SECTION 221319 SANITARY WASTE PIPING 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. This Section includes the following sanitary drainage piping specialties:
 - 1. Cleanouts.
 - 2. Floor drains.
 - 3. Roof flashing assemblies.
 - 4. Miscellaneous sanitary drainage piping specialties.
 - 5. Flashing materials.

1.3 DEFINITIONS

- A. ABS: Acrylonitrile-butadiene-styrene plastic.
- B. FOG: Fats, oils, and greases.
- C. FRP: Fiberglass-reinforced plastic.
- D. HDPE: High-density polyethylene plastic.
- E. PE: Polyethylene plastic.
- F. PP: Polypropylene plastic.
- G. PVC: Polyvinyl chloride plastic.

1.4 SUBMITTALS

- A. Field quality-control test reports.
- B. Operation and Maintenance Data: For drainage piping specialties to include in emergency, operation, and maintenance manuals.

1.5 QUALITY ASSURANCE

A. Drainage piping specialties shall bear label, stamp, or other markings of specified testing agency.

1.6 COORDINATION

A. Coordinate size and location of roof penetrations.

PART 2 - PRODUCTS

2.1 CLEANOUTS

- A. Exposed Metal Cleanouts:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Josam Company; Josam Div.
 - b. MIFAB, Inc.
 - c. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
 - d. Tyler Pipe; Wade Div.
 - e. Watts Drainage Products Inc.
 - f. Zurn Plumbing Products Group; Specification Drainage Operation.
 - g. Josam Company; Blucher-Josam Div.
 - 2. Standard: ASME A112.36.2M for cast iron ASME A112.3.1 for stainless steel for cleanout test tee.
 - 3. Size: Same as connected drainage piping
 - 4. Body Material: Hub-and-spigot, cast-iron soil pipe T-branch as required to match connected piping.
 - 5. Closure: Countersunk, brass cast-iron plastic plug.
 - 6. Closure Plug Size: Same as or not more than one size smaller than cleanout size.
 - 7. Closure: Stainless-steel plug with seal.

B. Metal Floor Cleanouts:

- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Josam Company; Josam Div.
 - b. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
 - c. Tyler Pipe; Wade Div.
 - d. Zurn Plumbing Products Group; Light Commercial Operation.
 - e. Zurn Plumbing Products Group; Specification Drainage Operation.
 - f. Josam Company; Josam Div.
 - g. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
 - h. Josam Company; Blucher-Josam Div.
- 2. Standard: ASME A112.36.2M for adjustable housing heavy-duty, adjustable housing cleanout.
- 3. Size: Same as connected branch.

- 4. Type: Adjustable housing Heavy-duty, adjustable housing.
- 5. Body or Ferrule: Cast iron .
- 6. Clamping Device: As required.
- 7. Outlet Connection: Inside calk.
- 8. Closure: Brass plug with tapered threads.
- 9. Adjustable Housing Material: Cast iron with threads.
- 10. Frame and Cover Material and Finish: Nickel-bronze, copper alloy .
- 11. Frame and Cover Shape: Round Square.
- 12. Top Loading Classification: Extra Heavy Duty.
- 13. Riser: ASTM A 74, Service class, cast-iron drainage pipe fitting and riser to cleanout.
- 14. Standard: ASME A112.3.1.
- 15. Size: Same as connected branch.
- 16. Housing: Stainless steel.
- 17. Closure: Stainless steel with seal.
- 18. Riser: Stainless-steel drainage pipe fitting to cleanout.
- C. Cast-Iron Wall Cleanouts:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Josam Company; Josam Div.
 - b. MIFAB, Inc.
 - c. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
 - d. Tyler Pipe; Wade Div.
 - e. Watts Drainage Products Inc.
 - f. Zurn Plumbing Products Group; Specification Drainage Operation.
 - 2. Standard: ASME A112.36.2M. Include wall access.
 - 3. Size: Same as connected drainage piping.
 - 4. Body: Hubless, cast-iron soil pipe test tee as required to match connected piping.
 - 5. Closure: Countersunk, brass cast-iron plug.
 - 6. Closure Plug Size: Same as or not more than one size smaller than cleanout size.
 - 7. Wall Access: Round, flat, chrome-plated brass or stainless-steel cover plate with screw.
 - 8. Wall Access: Round, nickel-bronze, copper-alloy, or stainless-steel wall-installation frame and cover.

2.2 FLOOR DRAINS

- A. Cast-Iron Floor Drains:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Josam Company; Josam Div.
 - b. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
 - c. Zurn Plumbing Products Group; Light Commercial Operation.
 - d. Zurn Plumbing Products Group; Specification Drainage Operation.
 - 2. Drains shall be as scheduled on the plans.

2.3 MISCELLANEOUS SANITARY DRAINAGE PIPING SPECIALTIES

- A. Deep-Seal Traps:
 - 1. Description: Cast-iron or bronze casting, with inlet and outlet matching connected piping and cleanout trap-seal primer valve connection.
 - 2. Size: Same as connected waste piping.
 - a. NPS 2: 4-inch-minimum water seal.
 - b. NPS 2-1/2 and Larger: 5-inch- minimum water seal.
- B. Floor-Drain, Trap-Seal Primer Fittings:
 - 1. Description: Cast iron, with threaded inlet and threaded or spigot outlet, and trap-seal primer valve connection.
 - 2. Size: Same as floor drain outlet with NPS 1/2 side inlet.
- C. Air-Gap Fittings:
 - 1. Standard: ASME A112.1.2, for fitting designed to ensure fixed, positive air gap between installed inlet and outlet piping.
 - 2. Body: Bronze or cast iron.
 - 3. Inlet: Opening in top of body.
 - 4. Outlet: Larger than inlet.
 - 5. Size: Same as connected waste piping and with inlet large enough for associated indirect waste piping.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Refer to Division 22 Section "Common Work Results for Plumbing" for piping joining materials, joint construction, and basic installation requirements.
- B. Install cleanouts in aboveground piping and building drain piping according to the following, unless otherwise indicated:
 - 1. Size same as drainage piping up to NPS 4. Use NPS 4 for larger drainage piping unless larger cleanout is indicated.
 - 2. Locate at each change in direction of piping greater than 45 degrees.
 - 3. Locate at minimum intervals of 50 feet for piping NPS 4 and smaller and 100 feet for larger piping.
 - 4. Locate at base of each vertical soil and waste stack.
- C. For floor cleanouts for piping below floors, install cleanout deck plates with top flush with finished floor.
- D. For cleanouts located in concealed piping, install cleanout wall access covers, of types indicated, with frame and cover flush with finished wall.
- E. Install floor drains at low points of surface areas to be drained. Set grates of drains flush with finished floor, unless otherwise indicated.

- 1. Position floor drains for easy access and maintenance.
- 2. Set floor drains below elevation of surrounding finished floor to allow floor drainage. Set with grates depressed according to the following drainage area radii:
 - a. Radius, 30 Inches or Less: Equivalent to 1 percent slope, but not less than 1/4-inch total depression.
 - b. Radius, 30 to 60 Inches: Equivalent to 1 percent slope.
 - c. Radius, 60 Inches or Larger: Equivalent to 1 percent slope, but not greater than 1-inch total depression.
- 3. Install floor-drain flashing collar or flange so no leakage occurs between drain and adjoining flooring. Maintain integrity of waterproof membranes where penetrated.
- 4. Install individual traps for floor drains connected to sanitary building drain, unless otherwise indicated.
- F. Install deep-seal traps on floor drains and other waste outlets, if indicated.
- G. Install floor-drain, trap-seal primer fittings on inlet to floor drains that require trap-seal primer connection.
 - 1. Exception: Fitting may be omitted if trap has trap-seal primer connection.
 - 2. Size: Same as floor drain inlet.
- H. Install air-gap fittings on draining-type backflow preventers and on indirect-waste piping discharge into sanitary drainage system.
- I. Install sleeve flashing device with each riser and stack passing through floors with waterproof membrane.
- J. Install traps on plumbing specialty drain outlets. Omit traps on indirect wastes unless trap is indicated.
- K. Install escutcheons at wall, floor, and ceiling penetrations in exposed finished locations and within cabinets and millwork. Use deep-pattern escutcheons if required to conceal protruding pipe fittings.

3.2 CONNECTIONS

- A. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Install piping adjacent to equipment to allow service and maintenance.

3.3 FIELD QUALITY CONTROL

- A. Tests and Inspections:
 - 1. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
 - 2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

3.4 **PROTECTION**

- A. Protect drains during remainder of construction period to avoid clogging with dirt or debris and to prevent damage from traffic or construction work.
- B. Place plugs in ends of uncompleted piping at end of each day or when work stops.

END OF SECTION 221319

SECTION 224000 PLUMBING FIXTURES

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 conventional plumbing fixtures and related components:
 - 1. Faucets for lavatories.
 - 2. Shower panels.
 - 3. Flushometers.
 - 4. Toilet seats.
 - 5. Protective shielding guards.
 - 6. Fixture supports.
 - 7. Water closets.
 - 8. Urinals.
 - 9. Lavatories.
 - 10. Sinks
- B. Related Sections include the following:
 - 1. Division 10 Section "Toilet, Bath, and Laundry Accessories."
 - 2. Division 22 Section "Domestic Water Piping Specialties" for backflow preventers, floor drains, and specialty fixtures not included in this Section.

1.3 DEFINITIONS

- A. ABS: Acrylonitrile-butadiene-styrene plastic.
- B. Accessible Fixture: Plumbing fixture that can be approached, entered, and used by people with disabilities.
- C. Cast Polymer: Cast-filled-polymer-plastic material. This material includes cultured-marble and solidsurface materials.
- D. Cultured Marble: Cast-filled-polymer-plastic material with surface coating.
- E. Fitting: Device that controls the flow of water into or out of the plumbing fixture. Fittings specified in this Section include supplies and stops, faucets and spouts, shower heads and tub spouts, drains and tailpieces, and traps and waste pipes. Piping and general-duty valves are included where indicated.

- F. FRP: Fiberglass-reinforced plastic.
- G. PMMA: Polymethyl methacrylate (acrylic) plastic.
- H. PVC: Polyvinyl chloride plastic.
- I. Solid Surface: Nonporous, homogeneous, cast-polymer-plastic material with heat-, impact-, scratch-, and stain-resistance qualities.

1.4 SUBMITTALS

- A. Product Data: For each type of plumbing fixture indicated. Include selected fixture and trim, fittings, accessories, appliances, appurtenances, equipment, and supports. Indicate materials and finishes, dimensions, construction details, and flow-control rates.
- B. Shop Drawings: Diagram power, signal, and control wiring.
- C. Operation and Maintenance Data: For plumbing fixtures to include in emergency, operation, and maintenance manuals.
- D. Warranty: Special warranty specified in this Section.

1.5 QUALITY ASSURANCE

- A. Source Limitations: Obtain plumbing fixtures, faucets, and other components of each category through one source from a single manufacturer.
 - 1. Exception: If fixtures, faucets, or other components are not available from a single manufacturer, obtain similar products from other manufacturers specified for that category.
- B. 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.
- C. Regulatory Requirements: Comply with requirements in ICC A117.1, "Accessible and Usable Buildings and Facilities"; Public Law 90-480, "Architectural Barriers Act"; and Public Law 101-336, "Americans with Disabilities Act"; for plumbing fixtures for people with disabilities.
- D. Regulatory Requirements: Comply with requirements in Public Law 102-486, "Energy Policy Act," about water flow and consumption rates for plumbing fixtures.
- E. NSF Standard: Comply with NSF 61, "Drinking Water System Components--Health Effects," for fixture materials that will be in contact with potable water.
- F. Select combinations of fixtures and trim, faucets, fittings, and other components that are compatible.
- G. Comply with the following applicable standards and other requirements specified for plumbing fixtures:
 - 1. Enameled, Cast-Iron Fixtures: ASME A112.19.1M.
 - 2. Porcelain-Enameled, Formed-Steel Fixtures: ASME A112.19.4M.

- 3. Slip-Resistant Bathing Surfaces: ASTM F 462.
- 4. Solid-Surface-Material Lavatories and Sinks: ANSI/ICPA SS-1.
- 5. Vitreous-China Fixtures: ASME A112.19.2M.
- 6. Water-Closet, Flush Valve, Tank Trim: ASME A112.19.5.
- 7. Water-Closet, Flushometer Tank Trim: ASSE 1037.
- H. Comply with the following applicable standards and other requirements specified for lavatory faucets:
 - 1. Integral, Atmospheric Vacuum Breakers: ASSE 1001.
 - 2. NSF Potable-Water Materials: NSF 61.
 - 3. Pipe Threads: ASME B1.20.1.
 - 4. Supply Fittings: ASME A112.18.1.
 - 5. Brass Waste Fittings: ASME A112.18.2.
- I. Comply with the following applicable standards and other requirements specified for shower faucets:
 - 1. Backflow Protection Devices for Hand-Held Showers: ASME A112.18.3M.
 - 2. Combination, Pressure-Equalizing and Thermostatic-Control Antiscald Faucets: ASSE 1016.
 - 3. Deck-Mounted Bath/Shower Transfer Valves: ASME 18.7.
 - 4. Faucets: ASME A112.18.1.
 - 5. Hand-Held Showers: ASSE 1014.
 - 6. High-Temperature-Limit Controls for Thermal-Shock-Preventing Devices: ASTM F 445.
 - 7. Hose-Coupling Threads: ASME B1.20.7.
 - 8. Manual-Control Antiscald Faucets: ASTM F 444.
 - 9. Pipe Threads: ASME B1.20.1.
 - 10. Pressure-Equalizing-Control Antiscald Faucets: ASTM F 444 and ASSE 1016.
 - 11. Thermostatic-Control Antiscald Faucets: ASTM F 444 and ASSE 1016.
- J. Comply with the following applicable standards and other requirements specified for miscellaneous fittings:
 - 1. Atmospheric Vacuum Breakers: ASSE 1001.
 - 2. Brass and Copper Supplies: ASME A112.18.1.
 - 3. Manual-Operation Flushometers: ASSE 1037.
 - 4. Plastic Tubular Fittings: ASTM F 409.
 - 5. Brass Waste Fittings: ASME A112.18.2.
- K. Comply with the following applicable standards and other requirements specified for miscellaneous components:
 - 1. Flexible Water Connectors: ASME A112.18.6.
 - 2. Floor Drains: ASME A112.6.3.
 - 3. Grab Bars: ASTM F 446.
 - 4. Hose-Coupling Threads: ASME B1.20.7.
 - 5. Off-Floor Fixture Supports: ASME A112.6.1M.
 - 6. Pipe Threads: ASME B1.20.1.
 - 7. Plastic Toilet Seats: ANSI Z124.5.
 - 8. Supply and Drain Protective Shielding Guards: ICC A117.1.

1.6 WARRANTY

- A. Special Warranties: Manufacturer's standard form in which manufacturer agrees to repair or replace components of whirlpools that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Structural failures of unit shell.
 - b. Faulty operation of controls, blowers, pumps, heaters, and timers.
 - c. Deterioration of metals, metal finishes, and other materials beyond normal use.
 - 2. Warranty Period for Commercial Applications: One year(s) from date of Substantial Completion.

1.7 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. Faucet Washers and O-Rings: Equal to 10 percent of amount of each type and size installed.
 - 2. Faucet Cartridges and O-Rings: Equal to 5 percent of amount of each type and size installed.
 - 3. Flushometer Valve, Repair Kits: Equal to 10 percent of amount of each type installed, but no fewer than 12 of each type.
 - 4. Provide hinged-top wood or metal box, or individual metal boxes, with separate compartments for each type and size of extra materials listed above.
 - 5. Flushometer Tank, Repair Kits: Equal to 5 percent of amount of each type installed, but no fewer than 2 of each type.
 - 6. Toilet Seats: Equal to 5 percent of amount of each type installed.

PART 2 - PRODUCTS

2.1 LAVATORY FAUCETS

- A. Lavatory Faucets:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. American Standard Companies, Inc.
 - b. Chicago Faucets.
 - c. T & S Brass and Bronze Works, Inc.
 - d. Symmons Industries, Inc.
 - 2. Lavatory faucets shall meet all criteria as scheduled on drawings and have material construction and characteristics equal to the basis-of-design fixture scheduled on drawings.

2.1 SINK FAUCETS

- A. Sink Faucets:
 - 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. Chicago Faucets.
 - b. Delta Faucet Company.
 - c. T & S Brass and Bronze Works, Inc.
 - 2. Sinks faucets shall meet all criteria as scheduled on drawings and have material construction and characteristics equal to the basis-of-design fixture scheduled on drawings.

2.2 SHOWER PANELS

- A. Shower Panels:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Acorn Engineering Company
 - b. Bradley Corporation
 - c.
 - 2. Shower panels shall meet all criteria as scheduled on drawings and have material construction and characteristics equal to the basis-of-design fixture scheduled on drawings.

2.3 FLUSHOMETERS

- A. Flushometers:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Kohler Co.
 - b. Sloan Valve Company.
 - c. Zurn Plumbing Products Group; Commercial Brass Operation.
 - 2. Flushometers shall meet all criteria as scheduled on drawings and have material construction and characteristics equal to the basis-of-design fixture scheduled on drawings.

2.4 TOILET SEATS

- A. Toilet Seats:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Bemis Manufacturing Company.
 - b. Church Seats.
 - c. Kohler Co.
 - d. Olsonite Corp.
 - 2. Toilet seats shall meet all criteria as scheduled on drawings and have material construction and characteristics equal to the basis-of-design fixture scheduled on drawings.

2.5 PROTECTIVE SHIELDING GUARDS

- A. Protective Shielding Pipe Covers:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. McGuire Manufacturing Co., Inc.
 - b. TRUEBRO, Inc.
 - c. Zurn Plumbing Products Group; Tubular Brass Plumbing Products Operation.
 - 2. Description: Manufactured plastic wraps for covering plumbing fixture hot- and cold-water supplies and trap and drain piping. Comply with Americans with Disabilities Act (ADA) requirements.

2.6 FIXTURE SUPPORTS

- 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:
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. MIFAB Manufacturing Inc.
 - 2. Smith, Jay R. Mfg. Co.
 - 3. Watts Drainage Products Inc.; a div. of Watts Industries, Inc.
 - 4. Zurn Plumbing Products Group; Specification Drainage Operation.
- C. Water-Closet Supports:
 - 1. Description: Combination adjustable carrier designed for accessible and standard mounting height of wall-mounting, water-closet-type fixture. Include single or double, vertical or horizontal, huband-spigot or hubless waste fitting as required for piping arrangement; faceplates; couplings with gaskets; feet; and fixture bolts and hardware matching fixture. Include additional extension coupling, faceplate, and feet for installation in wide pipe space.

- D. Urinal Supports:
 - 1. Description: Type I, urinal carrier with fixture support plates and coupling with seal and fixture bolts and hardware matching fixture for wall-mounting, urinal-type fixture. Include steel uprights with feet.
 - 2. Accessible-Fixture Support: Include rectangular steel uprights.
- E. Lavatory Supports:
 - 1. Description: Type II, lavatory carrier with concealed arms and tie rod for wall-mounting, lavatory-type fixture. Include steel uprights with feet.
 - 2. Accessible-Fixture Support: Include rectangular steel uprights.

2.7 SHOWER RECEPTORS

- A. Shower Receptors:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Acorn Engineering Company.
 - b. Florestone Products Co., Inc.
 - c. Precast Terrazzo Enterprises, Inc.
 - 2. Description: Precast-terrazzo base for built-up-type shower fixture.
 - 3. Shower receptors shall meet all criteria as scheduled on drawings and have material construction and characteristics equal to the basis-of-design fixture scheduled on drawings.

2.8 WATER CLOSETS

- A. Water Closets:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. American Standard Companies, Inc.
 - b. Kohler Co.
 - c. Zurn Plumbing Products Group
 - 2. Description Accessible, wall-mounting, back-outlet, vitreous-china fixture designed for flushometer valve operation.
 - 3. Water closets shall meet all criteria as scheduled on drawings and have material construction and characteristics equal to the basis-of-design fixture scheduled on drawings.

2.9 URINALS

- A. Urinals:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. American Standard Companies, Inc.
 - b. Kohler Co.
 - c. Zurn Plumbing Products Group
 - 2. Description: Accessible, wall-mounting, back-outlet, vitreous-china fixture designed for flushometer valve operation.
 - 3. Urinals shall meet all criteria as scheduled on drawings and have material construction and characteristics equal to the basis-of-design fixture scheduled on drawings.

2.10 LAVATORIES

- A. Lavatories:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. American Standard Companies, Inc.
 - b. Kohler Co.
 - c. Zurn Plumbing Products Group
 - 2. Lavatories shall meet all criteria as scheduled on drawings and have material construction and characteristics equal to the basis-of-design fixture scheduled on drawings.

2.11 SINKS

- A. Sinks:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Advance Tabco.
 - b. Elkay Manufacturing Co.
 - c. Just Manufacturing Company.
 - 2. Description: Under-mounting, stainless-steel, commercial, handwash-sink fixture.
 - a. Type: Basin with radius corners, back for faucet, and support brackets.

- b. Faucet: Back-mounting, chrome-plated, solid-brass, gooseneck type with individual valves.
- c. Supplies: NPS 1/2 (DN 15) chrome-plated copper with stops.
- d. Drain: Grid.
- e. Drain Piping: NPS 1-1/2 (DN 40) chrome-plated, cast-brass P-trap; 0.045-inch-(1.1-mm-) thick tubular brass waste to wall; and wall escutcheon.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine roughing-in of water supply and sanitary drainage and vent piping systems to verify actual locations of piping connections before plumbing fixture installation.
- B. Examine cabinets, counters, floors, and walls for suitable conditions where fixtures will be installed.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Assemble plumbing fixtures, trim, fittings, and other components according to manufacturers' written instructions.
- B. Install off-floor supports, affixed to building substrate, for wall-mounting fixtures.
 - 1. Use carrier supports with waste fitting and seal for back-outlet fixtures.
 - 2. Use carrier supports without waste fitting for fixtures with tubular waste piping.
 - 3. Use chair-type carrier supports with rectangular steel uprights for accessible fixtures.
- C. Install back-outlet, wall-mounting fixtures onto waste fitting seals and attach to supports.
- D. Install wall-mounting fixtures with tubular waste piping attached to supports.
- E. Install counter-mounting fixtures in and attached to casework.
- F. Install fixtures level and plumb according to roughing-in drawings.
- G. Install water-supply piping with stop on each supply to each fixture to be connected to water distribution piping. Attach supplies to supports or substrate within pipe spaces behind fixtures. Install stops in locations where they can be easily reached for operation.
 - 1. Exception: Use ball, gate, or globe valves if supply stops are not specified with fixture. Valves are specified in Division 22 Section "General-Duty Valves for Plumbing Piping."
- H. Install trap and tubular waste piping on drain outlet of each fixture to be directly connected to sanitary drainage system.
- I. Install tubular waste piping on drain outlet of each fixture to be indirectly connected to drainage system.

- J. Install flushometer valves for accessible water closets and urinals with handle mounted on wide side of compartment. Install other actuators in locations that are easy for people with disabilities to reach.
- K. Install toilet seats on water closets.
- L. Install faucet-spout fittings with specified flow rates and patterns in faucet spouts if faucets are not available with required rates and patterns. Include adapters if required.
- M. Install water-supply flow-control fittings with specified flow rates in fixture supplies at stop valves.
- N. Install shower flow-control fittings with specified maximum flow rates in shower arms.
- O. Install traps on fixture outlets.
 - 1. Exception: Omit trap on fixtures with integral traps.
 - 2. Exception: Omit trap on indirect wastes, unless otherwise indicated.
- P. Install escutcheons at piping wall ceiling penetrations in exposed, finished locations and within cabinets and millwork. Use deep-pattern escutcheons if required to conceal protruding fittings. Escutcheons are specified in Division 22 Section "Common Work Results for Plumbing."
- Q. Set shower receptors and basins in leveling bed of cement grout. Grout is specified in Division 22 Section "Common Work Results for Plumbing."
- R. Seal joints between fixtures and walls, floors, and countertops using sanitary-type, one-part, mildewresistant silicone sealant. Match sealant color to fixture color. Sealants are specified in Division 07 Section "Joint Sealants."

3.3 CONNECTIONS

- A. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Connect fixtures with water supplies, stops, and risers, and with traps, soil, waste, and vent piping. Use size fittings required to match fixtures.
- C. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."

3.4 FIELD QUALITY CONTROL

- A. Verify that installed plumbing fixtures are categories and types specified for locations where installed.
- B. Check that plumbing fixtures are complete with trim, faucets, fittings, and other specified components.
- C. Inspect installed plumbing fixtures for damage. Replace damaged fixtures and components.
- D. Test installed fixtures after water systems are pressurized for proper operation. Replace malfunctioning fixtures and components, then retest. Repeat procedure until units operate properly.

3.5 ADJUSTING

- A. Operate and adjust faucets and controls. Replace damaged and malfunctioning fixtures, fittings, and controls.
- B. Adjust water pressure at faucets and flushometer valves to produce proper flow and stream.
- C. Replace washers and seals of leaking and dripping faucets and stops.
- D. Install fresh batteries in sensor-operated mechanisms.

3.6 CLEANING

- A. Clean fixtures, faucets, and other fittings with manufacturers' recommended cleaning methods and materials. Do the following:
 - 1. Remove faucet spouts and strainers, remove sediment and debris, and reinstall strainers and spouts.
 - 2. Remove sediment and debris from drains.
- B. After completing installation of exposed, factory-finished fixtures, faucets, and fittings, inspect exposed finishes and repair damaged finishes.

3.7 PROTECTION

- A. Provide protective covering for installed fixtures and fittings.
- B. Do not allow use of plumbing fixtures for temporary facilities unless approved in writing by Owner.

END OF SECTION 224000

SECTION 230000

GENERAL PROVISIONS FOR HEATING, VENTILATING AND AIR CONDITIONING WORK

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Work in this Section includes the providing of labor, materials, equipment and services necessary for a complete and safe installation in accordance with the contract documents and all applicable codes and authorities having jurisdiction for heating, ventilating and air conditioning work covered by all sections within the specifications (including but not limited to HVAC systems and equipment).
- B. Provide cutting and patching, except as noted in "AIA Document A210" and "Supplementary Conditions for Mechanical and Electrical Work."
- C. Provide piping from plumbing terminations, 10 ft from equipment, for water, gas, compressed air and as indicated.
- D. Provide drainage from noted equipment to floor drains, roof, sink, or funnel drains.
- E. Provide piping connections to equipment, as required, and as indicated.
- F. Related Work And Requirements
 - 1. Requirements of general conditions, supplementary conditions for mechanical and electrical work and Division No. 1.
 - 2. Requirements noted under other Divisions of Work

1.2 WORK NOT INCLUDED:

- 1. Providing temporary heat.
- 2. Providing access doors and filler.
- 3. Cutting and patching, except as noted in "AIA Document A201" and "Supplementary Conditions for Mechanical and Electrical Work."
- 4. Providing louvers in doors.
- 5. Providing undercut doors.
- 6. Providing wall louvers and screens.
- 7. Providing plenums other than sheet metal.
- 8. Providing flashing.

1.3 DESCRIPTION OF BID DOCUMENTS

- A. Specifications, in general, describe quality and character of materials and equipment.
- B. Drawings, in general are diagrammatic and indicate sizes, locations, connections to equipment and methods of installation. Provide additional offsets, fittings, hangers, supports, valves, drains as required for construction and coordination with work of other trades.
- C. Scaled and indicated dimensions are approximate and are for estimating purposes only. Before proceeding with work, check and verify all dimensions.

- D. Make adjustments that may be necessary or requested in order to resolve space problems, preserve headroom, and avoid architectural openings, structural members and work of other trades.
- E. Typical details, where shown on the drawings, apply to each and every item of the project where such items are applicable. Typical details are not repeated in full on the plans, and are diagrammatic only, but with the intention that such details shall be incorporated in full.
- F. If any part of Specifications or Drawings appears unclear or contradictory, consult Architect and/or Engineer for interpretation and decision as early as possible during bidding period. Do not proceed with work without the Architect's and/or Engineer's decision.

1.4 DEFINITIONS

- A. "Furnish" or "provide": to supply, install and make complete, safe, and operable, the particular work referred to unless specifically indicated otherwise.
- B. "Install": to erect, mount and make complete with all related accessories.
- C. "Supply": to purchase, procure, acquire, and deliver complete with related accessories.
- D. "Work": includes labor, materials, equipment, services, and all related accessories necessary for the proper and complete installation of complete systems.
- E. "Piping": includes pipe, tube, fittings, flanges, valves, controls, strainers, hangers, supports, unions, traps, drains, insulation, and all related accessories.
- F. "Wiring": includes raceway, fittings, wire, boxes, and all related accessories.
- G. "Concealed": not in view, installed in masonry or other construction, within furred spaces, double partitions, hung ceilings, trenches, crawl spaces, or enclosures.
- H. "Exposed": in view, not installed underground or "concealed" as defined above.
- I. "Indicated," "shown," or "noted": as indicated, shown or noted on drawings or specifications.
- J. "Similar" or "equal": of base bid manufacturer, equal in quality, materials, weight, size, performance, design and efficiency of specified product, conforming with "Base Bid Manufacturers."
- K. "Reviewed," "satisfactory," "accepted," or "directed": as reviewed, satisfactory, accepted, or directed by or to Architect and/or Engineer.
- L. "Motor Controllers": includes manual or magnetic starters with or without switches, individual pushbuttons or hand-off-automatic (HOA) switches controlling the operation of motors.
- M. "Control or Actuating Devices": includes automatic sensing and switching devices such as thermostats, pressure, float, flow, electro-pneumatic switches and electrodes controlling operation of equipment.

1.5 QUALITY ASSURANCE

A. All equipment and accessories shall be the product of manufacturers regularly engaged in their manufacture. All items of a given type shall be the products of the same manufacturer.

- B. Furnish all equipment and accessories new and free from defects.
- C. All electrical equipment shall be listed by Underwriters' Laboratories, Inc. (UL) or bear UL labels.
- D. Supply all equipment and accessories in complete compliance with and in accordance with the applicable standards listed in reference standards of this Section and with all applicable national, state and local codes.

1.6 JOB CONDITIONS

- A. Inspection of Site Conditions:
 - 1. Before starting work, visit the site and examine the conditions under which the work has to be performed. Report in writing any conditions which might adversely affect the work.
- B. Connections to existing work:
 - 1. Install new work and connect to existing work with minimum interference to existing facilities.
 - 2. Provide temporary shutdown of existing services at no additional charges and only with written consent of Owner. Schedule shutdowns not to interfere with normal operation of existing facilities.
 - 3. Maintain continuous operation of existing facilities as required with necessary temporary connections between new and existing work.
 - 4. Connect new work to existing work in neat and acceptable manner. Restore existing disturbed work to original condition.
- C. Removal and relocation of existing work.
 - 1. Disconnect, remove, or relocate HVAC material, equipment, and other work noted and required by alterations, modifications, or changes in existing construction.
 - 2. Provide new material and equipment required for relocated equipment.
 - 3. Plug or cap active piping or ductwork behind or below finish.
 - 4. Dispose of removed HVAC equipment as directed.
 - 5. Return removed HVAC equipment to Owner as directed.

1.7 REFERENCE STANDARDS

- A. Published specifications, standards tests, or recommended methods of trade, industry or governmental organizations apply to work in all Sections as noted below:
 - 1. ASHRAE American Society of heating, Refrigerating and Air Conditioning engineers.
 - 2. AABC Associated Air Balance Controls.
 - 3. AMCA Air Moving and Conditioning Association.
 - 4. ADC Air Diffuser Council.
 - 5. NEMA National Electrical Manufacturers' Association.
 - 6. ANSI American National Standards Institute.
 - 7. ASME American Society of Mechanical Engineers.
 - 8. ASTM American Society for Testing and Materials.
 - 9. NFPA National Fire Protection Association.
 - 10. ARI Air-Conditioning and Refrigeration Institute.
 - 11. UL Underwriters' Laboratories, Inc.
 - 12. OSHA Occupational Safety and Health Administration Regulations.

1.8 SUBMITTALS

- A. Submit shop drawings product data, samples and certificates of compliance required by contract documents.
- B. Operating instructions, maintenance manuals and parts lists.
 - 1. Provide manufacturer's equipment brochures and service manuals consisting of the following:
 - a. Descriptive literature for equipment and components.
 - b. Model number and performance data.
 - c. Installation and operating instructions.
 - d. Maintenance and repair instructions.
 - e. Recommended spare parts lists.
 - 2. Assemble manufacturers' equipment manuals in chronological order following the specifications' numbering system using heavy duty three ring binders.
 - 3. Submit valve tag chart.
 - 4. Submit field test reports including instrument set points and normal operating valves.

1.9 ELECTRONIC COPIES OF AKF DRAWINGS

- A. Upon award of contract, contractor shall submit list of drawings that they will require. AKF will provide drawings in (.PDF) format only.
- B. If the contractor requires (.dwg) format for shop drawing production, these will provided. After preparation the drawings will be forwarded only upon receipt of signed acceptance of terms form. Permission from the architect must first be obtained for AKF to include the architectural background as reference. The contractor is to obtain the architects latest drawings directly from the architect.
- C. These files are being issued for the convenience of the contractor and the contractor remains responsible for all contract requirements related to the normal shop drawing preparation process.

1.10 SUBMISSIONS:

- A. Provide all coordination drawings, ductwork and piping shop drawings in 'AutoCad' format, version compatible with owner. All catalog cuts and submittals to be provided in electronic "PDF" format the architect will forward all submissions to the engineer.
- B. If paper submissions are to be provided the following shall be adhered to.
 - 1. Submissions 11 in. X 17 in. or smaller: If the submission is a catalog cut, then the contractor shall submit one original and one copy. Otherwise, they shall submit two copies. The architect will forward the original and one copy (two copies when no original is received) to the engineer. All catalog cuts shall be complete.
 - 2. Submissions larger than 11 in. X 17 in.: submit two copies to the architect. The architect will forward to the engineer.

- C. Indicate on each submission: project name and location, architect and engineer, item identification and approval stamp of prime contractor, subcontractor names and phone numbers, reference to the applicable design drawing or specification article, date and scale.
- D. The work described in all shop drawing submission shall be carefully checked for all clearances (including those required for maintenance and servicing), field conditions, maintenance of architectural conditions and proper coordination with all trades on the job.
- E. Each submitted shop drawing is to include a certification that all related job conditions have been checked and verified and that there are no conflicts.
- F. All shop drawings are to be submitted to allow ample time for checking in advance of field requirements. All submittals to be complete and contain all required and detailed information. Shop drawings with multiple parts shall be submitted as a package.
- G. If submittals differ from the contract document requirements, make specific mention of such difference in a letter of transmittal, with request for substitution, together with reasons for same.

1.11 AS-BUILTS AND EQUIPMENT OPERATION INSTRUCTIONS

- A. Provide all coordination drawings, ductwork and piping shop drawings in AutoCad format, version compatible with owner. All catalog cuts and submittals to be provided in electronic "PDF" format the architect will forward all submissions to the engineer.
- B. On completion and acceptance of work, this contractor shall furnish written instructions, equipment manuals and demonstrate to the owner the proper operation and maintenance of all equipment and apparatus furnished under this contract.
- C. The contractor shall give one copy of the instructions to the owner and one copy to the engineer. .
- D. Final "as-built" drawings indicating as installed conditions shall be provided to the architect and engineer after completion of the installation.

1.12 CLEARANCE FROM ELECTRICAL EQUIPMENT

- A. Piping and ductwork is prohibited in electric and telephone rooms and closets, elevator machine rooms, and for installations over or within 5 ft of transformers, substations, switchboards, motor control centers, standby power plants, and motors.
- B. Branch piping to equipment is acceptable when installed over or within 5 ft of motors.
- 1.13 PRODUCT, DELIVERY, HANDLING AND STORAGE
 - A. Ship materials and equipment in crated sections of sizes to permit passing through available space, where required
 - B. Deliver equipment with protective crating and shrink-wrapped covering.
 - C. Receive and accept materials and equipment at the site, properly handle, house, and protect them from damage and the weather until installation. Replace equipment damaged in the course of handling without additional charge.

- D. Store to prevent damage and protect from weather, dirt, fumes, water, and construction debris in clean dry space
- E. Arrange for and provide storage space or area at the job site for all materials and equipment to be received and/or installed in this project
- F. All exposed openings of equipment, piping and ductwork are to be covered
- G. Handle according to manufacturer's written rigging and installation instructions for unloading, transporting, and setting in final location
- H. Protect units from physical damage. Leave factory shipping covers in place until installation

1.14 ACCESSIBILITY

- A. Install all work so that parts requiring periodic inspection, operation, maintenance, and repair are readily accessible. Minor deviations from the drawings may be made to accomplish this, but changes of substantial magnitude shall not be made without written approval.
- B. Group concealed valves, expansion joints, controls, dampers, and equipment requiring access, so as to be freely accessible through access doors.

1.15 SPECIAL TOOLS

- A. Provide one set of any special tools required to operate, adjust, dismantle or repair equipment furnished under this Division for the Owner's use at the completion of the work.
- B. Provide one pressure grease gun with adapters for each type of grease required.
- C. Provide one suitable tool case for special tools.

1.16 PROTECTION OF MATERIALS

A. Protect from damage, water, dust, etc., materials, equipment and apparatus provided under this trade, both in storage and installed

1.17 SUBSTITUTIONS

A. .No substitute material or manufacturer of equipment shall be permitted without a formal written submittal to the engineer which includes all dimensional, performance and material specifications and is approved in writing by the engineer. Any changes in layout or design brought about by the use of a substitution shall be submitted to the engineer fully designed for review in conjunction with the submittal of the alternate. Any substitution must be submitted with an explanation why a substitution is being utilized. If the substitute is being utilized for financial reasons, the associated credit must be simultaneously submitted. Final acceptance or rejection of any substitution is subject to the owner's review.

1.18 STANDARDS:

A. If any item in the specification, as furnished by the contractor, is manufactured in a location which does not certify ASME/ANSI standards, the contractor is to pay the Owner for ALL expenses incurred by the Owner for an outside testing company to confirm such compliance.

1.19 COORDINATION

- A. Arrange for pipe spaces, duct spaces, space for equipment, chases, slots, and openings in building structure during progress of construction, to allow for mechanical installations.
- B. Coordinate installation of required supporting devices and set sleeves in poured-in-place concrete and other structural components as they are constructed.
- C. Coordinate requirements for access panels and doors for mechanical items requiring access that are concealed behind finished surfaces.
- D. Provide coordination drawing for all areas of the work. The drawings shall have the following qualities:
 - 1. Minimum 3/8" scale
 - 2. Clearly show all the work for each trade including, but not limited to hangers, valves, dampers, actuators, access doors and service access requirements for all items.
 - 3. Indicate bottom elevations of all ductwork, electrical conduit, raceways, cable trays, control wiring and piping.
 - 4. Ductwork, piping, and conduit 3 inches and smaller may be shown in single line.
 - 5. Ductwork, piping, and conduit greater than 3 inches shall be shown in double line.
 - 6. Color scheme:
 - a. Architectural and structural background: Light grey.
 - b. Ductwork: Black.
 - c. Equipment and pads: Purple.
 - d. HVAC piping and equipment: Green.
 - e. Electrical conduits and equipment: Blue.
 - f. Plumbing: Orange.
 - g. Control wiring: Pink.

1.20 GUARANTEE

- A. In accordance with General Conditions (AIA Document 201) & Supplementary Conditions for Mechanical & Electrical Work.
- B. The Contractor shall furnish a written guarantee to replace or repair promptly and assume responsibility for all expenses incurred for any workmanship and equipment in which defects develop within one year form the date of final certificate for payment and/or from date or actual use of equipment or occupancy of spaces by Owner included under the various parts of work, whichever date is earlier. This work shall be done as directed by the Owner. This guarantee shall also provide that where defects occur, the Contractor will assume responsibility for all expenses incurred in repairing and replacing work of other trades affected by defects, repairs or replacements in equipment supplied by the Contractor.
- 1.21 PERMITS AND FEES

- A. In accordance with General Conditions (AIA Document 201) & Supplementary Conditions for Mechanical & Electrical Work.
- B. The Contractor shall give necessary notice, file drawings and specifications with the department having jurisdiction, obtain permits or licenses necessary to carry out this work and pay all fees therefore. The Contractor shall arrange for inspection and test of any or all parts of the work if so required by authorities and pay all charges for same. The Contractor shall pay all costs for, furnish to the Owner before final billing, all certificates necessary as evidence that the work installed conforms with all regulations where they apply to this work.
- C. This contractor shall prepare or hire the necessary consultants to prepare and file all plans, calculation, forms, etc.. required for filing with all agencies required for this work including but not limited to The DEP (Department of Environmental Protection), DEC (Department of Environmental Conservation, Bureau of Air Resources, EPA Environmental protection Agency, etc..

1.22 INSPECTIONS / TESTING

A. Independent testing and inspections shall be provided by the mechanical contractor who shall hire the inspector or testing agency

1.23 SERVICE AND WARRANTY (MAINTENANCE CONTRACT

Coordinate with owner if emergency service is required. This would be a 2 hour response time during normal hours and 4 hour response time afterhours.

A. This contract shall provide a full year service and warranty of all mechanical components and systems, with add alternate prices for years 2, 3 and 4 following this first year. At the time of acceptance of project, the tenant or owner's representative will decide to accept which alternate, if any.

1.24 RIGGING

- A. This contractor shall provide all required rigging, hoisting and bracing to install the equipment as indicated on the plans. This work shall be performed by an insured certified licensed rigging company that is experienced in rigging equipment of the type indicated for the areas shown on the construction documents. This contractor shall submit rigging plans for approval prior to proceeding with the work.
- B. All permits required from the authorities and agencies involved to perform the rigging are the responsibilities of this contractor.
- C. All structural supports, modifications or additions are to be submitted to the structural engineer for approval prior to proceeding with the work. All supplemental structural supports, elevator charges /modifications, bracing and protection required for the rig is the responsibility of this contractor
- D. The rigging contractor shall hire and pay for all charges and services of the building elevator contractor for the rigging of the equipment
- 1.25 REUSE OF EXISTING EQUIPMENT AND TESTING
 - A. Refer to "TESTING, ADJUSTING AND BALANCING FOR HVAC" for all requirements and testing.

PART 2 - PRODUCTS

2.1 BASE BID MANUFACTURERS

- A. Base bid on materials or equipment are specified by name of manufacturer, brand or trade name and catalog reference.
- B. The choice will be optional with bidder where two or more manufacturers are named.
- C. The following are base bid manufacturers for items under this Section:
 - 1. Access doors: Karp Associates, Inc., Higgins Mfg. Co., Milcor Steel Co., and Walsh-Spencer Co.
 - 2. Inserts: F and S Mfg Co., Fee and Mason and Grinnell.
 - 3. Hangers and supports: I.T.T. Grinnell, Carpenter and Patterson, Inc., and Fee & Mason.
 - 4. Paint: Sherwin-Williams, Pittsburgh Plate Glass Co., Pratt and Lambert, and Rust-Oleum.
 - 5. Gratings: Irving Grating IKG Industries and Ryerson Inland Steel Co.

2.2 INSERTS AND SUPPORTS

- A. Support all HVAC work from building construction by providing inserts, beam clamps, steel fishplates (in concrete fill only), and acceptable brackets. Submit all methods for review.
- B. Provide trapeze hangers of bolted angles or channels for grouped lines and services.
- C. Provide additional framing where building construction is inadequate. Submit for review.
- D. Inserts shall be steel, slotted type and factory-painted.
 - 1. Single rod shall be similar to Grinnell Fig. 281.
 - 2. Multi-rod shall be similar to Fee & Mason Series 9000 with end caps and closure strips.
 - 3. Clip form nails flush with inserts.
 - 4. Maximum loading including pipe, contents and covering shall not exceed 75 percent of rated insert capability.

2.3 SUPPLEMENTARY STEEL, CHANNELS AND SUPPORTS:

- A. Furnish supplementary steel, channels and supports required for proper installation, mounting and support of HVAC work.
- B. Connect supplementary steel and channels firmly to building construction in an acceptable manner.
- C. Determine type and size of supporting channels and supplementary steel. Supplementary steel and channels shall be of sufficient strength and size to allow only a minimum deflection in conformance with manufacturer's requirements of loading.
- D. Install supplementary steel and channels in a neat and workmanlike manner parallel to walls, floors, and ceiling construction.
- E. All supplementary steel, channels, supports shall be submitted to Structural Engineer for review.
- F. Do not cut or drill structural members without review by Architect and Structural Engineer.
- 2.4 EXPANSION ANCHORS

- A. Provide smooth wall, non-self-drilling internal plug expansion type anchors constructed of AISC 12L14 steel and zinc plated in accordance with Fed. Spec. QQ-A-325 Type 1, Class 3.
- B. Do not exceed 1/4 of average valves for a specific anchor size using 2000 psig (13,800 kpa) concrete only, for maximum working load.
- C. Provide spacing and install anchors in accordance with manufacturer's recommendations.
- D. Do not cut or drill structural members without review by Architect and Structural Engineer.

2.5 ACCESS DOORS

- A. This contractor shall submit to the architect for approval a plan indicating the size (minimum 18" x 18") and location of all access doors required for operation and maintenance of all concealed equipment, devices, valves, dampers and controls. Contractor shall arrange for furnishing and installation of all access doors in finished construction and include costs in the bid.
- B. Provide access doors for all concealed HVAC items in inaccessible walls and ceilings for complete access, using a minimum door size of 12 in. x 12 in. Locating and setting shall be performed after review.
- C. Flush type access doors shall be similar to Karp Type DSC-211 with No. 13 USSG steel doors and trim and No. 16 USSG steel frame, metal wings for keying into construction, concealed hinges and screwdriver operated stainless steel cam lock. Provide lift off type access doors, similar to Karp Type DSC-212, where door cannot swing open.
- D. In acoustic tile ceilings, factory finished white access doors shall be similar to Karp Type DSC-210, with No. 13 USSG steel frame, No. 16 USSG steel pan door suitable for receiving tile thickness and hinges that are not visible when door is closed. Access door shall have screwdriver operated stainless steel cam locks finishing flush with tile with a minimum of 2 per door.
- E. In plaster ceilings recessed access doors shall be similar to Karp DSC-210-PL, with recess to receive plaster.
- F. In fire rated construction provide fire rated access doors, similar to Karp KRP-150-FR, in accordance with applicable code requirements.
- G. Access doors shall have one coat of shop-painted zinc chromate primer.
- 2.6 ACCESS TILE IDENTIFICATION:
 - A. In removable ceiling tiles, provide buttons, tabs, and markers to identify location of concealed work. Submit for review.
- 2.7 TAGS:
 - A. Provide 2 in. round valve tags on all valves and controls of No. 18 BS gauge aluminum with stamped numbers and letters filled in with black paint.
 - B. Indicate identifying number and system letter on tags, and fasten by heavy aluminum or brass hooks or chains.

C. Tags shall be similar to Seton Name Plate Corporation.

2.8 NOTE: FOR EXISTING BUILDINGS

A. Supplement numbering and lettering of valve tags of existing building.

2.9 CHARTS

- A. Provide valve tag chart indicating valve number, system, type, size, location and function for all valves.
- B. Mount in aluminum frame and glass.
- C. Letter and number valves and controls to correspond with designations on metal tags.
- D. Fasten charts permanently in locations, as directed, with four brass screws.
- E. Supplement numbering and lettering of charts of existing building.

2.10 NAMEPLATES

- A. Provide nameplates with inscriptions, subject to review, indicating equipment and voltage. Fasten with epoxy cement or chrome plated screws. Nameplate shall be black Lamicoid sheet with white lettering.
- B. Provide nameplates for gauges, meters, instruments, control devices, pilot lamps, transmitters, motor controllers and panel mounted equipment.

PART 3 - - EXECUTION

3.1 PAINTING

- A. General:
 - 1. Provide labor, materials, and equipment necessary for field prime painting. Protect flooring and equipment with drop cloths and store paint and materials in a location where directed. Wire brush and remove all oil, dirt, rust and grease before applying paint.
 - 2. Paint all exposed, uninsulated, non-galvanized sheet metal, other than stainless steel and aluminum, with two coats of aluminum paint or alkyd paint of a color as directed.
 - 3. Paint all exposed, uninsulated, galvanized, aluminum and stainless steel sheet metal in finished spaces, including mechanical equipment rooms, with one coat of galvanized iron primers and two coats of alkyd oil paint.
 - 4. Paint insulated piping and equipment covering with one coat of primer sealer and two coats of alkyd oil paint of a color as directed.
 - 5. Factory or field apply one coat of heat resisting paint for steel pipe and finned tube radiation.
 - 6. Paint exposed steel and metal work not furnished with factory-painted finish, structural steel piping support and uninsulated piping with two coats of alkyd oil paint of a color as directed.
 - 7. Paint the following spaces under this contract:
 - a. Mechanical Equipment rooms.
 - 8. Apply zinc chromate primer for black steel piping, cast iron piping (except underground), steel and iron work and steel tanks before insulation.
 - 9. Dip in zinc chromate primer, uncoated hangers, supports, rods and inserts.

- B. Coordinate color of painting to be provided under General Construction Work.
- C. Supply and deliver, in original sealed containers, paint of the best grade for its purpose of colors, as selected, and apply in accordance with manufacturer's instructions.
- D. Finish painting:
 - 1. Provide finish painting for piping continuously painted in all exposed areas consisting of two finished coats of high gloss medium or long alkyd paint over prime coat of a color shade as accepted after submittal.
 - 2. Utilize color schedule as follows based on Sherwin Williams, name, figure numbers and finish.
 - a. Chilled water piping and equipment --- PALE BLUE, full glass.
 - b. Condenser water piping --- PALE GREEN, full glass.
 - c. High pressure steam --- ORANGE, full glass.
 - d. Medium pressure steam --- FERRITE YELLOW, full glass.
 - e. Low pressure steam --- LIGHT YELLOW, full glass.
 - f. Low pressure condensate --- IVORY, full glass.
 - g. Hot water, pumped condensate and equipment --- MAGENTA full glass
 - h. Chemical feed piping and equipment --- DARK BLUE, full glass.
 - i. Refrigeration machines and refrigerant piping --- BRIGHT BLUE, full glass.
 - j. Supply ductwork and fans --- SILVER GRAY, full glass.
 - k. Control panels --- SLATE GRAY, full glass.
 - 1. Exhaust and return ductwork and fans --- STEEL GRAY, full glass.
 - m. Fire detection and alarm conduit, fire stand pipe, sprinkler piping --- VERMILLION, full glass.
 - n. Compressed air piping and equipment --- LIGHT GRAY, full glass.
 - o. Vent and relief piping --- RICH BROWN, full glass.
 - p. Boilers and breeching --- SLATE GRAY, full glass.
 - q. Fuel and diesel oil --- BLACK, full glass.
 - r. High temperature water --- ORANGE, full glass.
 - s. Softened water, dealkalizers, softeners, brine tanks --- MEDIUM GREEN, full glass.
 - t. Expansion tanks same color as piping system.

- u. City water --- LIGHT GREEN, full glass.
- 3. Place unlisted piping, ductwork or equipment in one of the following classifications and color coded shades as accepted. This corresponds to colors of ANSI A13.1, (Scheme for identification of piping systems).
 - a. Red for fire-protection materials.
 - b. Yellow or Orange for dangerous materials.
 - c. Green or blue for safe materials.
 - d. Dark Blue or Purple for extra valuable materials.
 - e. Gray for general equipment.
- 4. Shades shall be consistent throughout the project.
- 5. Coat valve, strainer or other appurtenances operating at over 220 o F where bare metal is exposed with Silicone Alkyd Aluminum, 71S30.
- E. Paint interior of ductwork as far back as visible from outside, flat black.
- F. Apply factory prime coat for pumps, fans, motors, equipment, registers, diffusers, and grilles.
- G. Apply on machinery, one shop coat of metal primer and two finish coats of gray engine enamel.
- H. Apply on control valve handles, one coat of paint of color as selected.
- I. Paint fire dampers with prime coat and second coat of corrosion inhibitive paint.
- J. Spot prime coat marred surface of prime coated equipment and piping to match adjacent coat.

3.2 MECHANICAL IDENTIFICATION

A. Refer to identification Section.

3.3 WATERPROOFING

- A. Waterproofing will be provided under General Construction Work.
- B. Flashing:
 - 1. Provide No. 22 USSG aluminum.
 - 2. Provide galvanized cast iron bottom roof type fittings, similar to Josam No. 26440 or No. 26450 for piping through roof.
- 3.4 FIELD QUALITY CONTROL
 - A. Perform tests as noted, and in the presence of Architect and/or Engineer and authorities having jurisdiction.

- B. Provide required labor, material, equipment, and connections necessary for tests and submit results for review.
- C. Repair or replace defective work and pay for restoring or replacing damaged work due to tests, as directed.
- D. Tests and instruction: Refer to specification Section ----.

3.5 CLEANING

- A. Brush and clean work prior to concealing, painting and acceptance. Perform in stages if directed.
- B. Clean and repair painted exposed work, soiled or damaged, to match adjoining work before final acceptance.
- C. Remove debris from inside and outside of material and equipment.

END OF SECTION 230000

SECTION 23 05 23 GENERAL-DUTY VALVES FOR HVAC PIPING

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. Bronze gate valves.
 - 2. Bronze globe valves.
 - 3. Bronze swing check valves.
 - 4. Bronze angle valves.
 - 5. Iron gate valves.
 - 6. Bronze ball valves.
 - 7. Electric valve actuators.
- B. Related Sections:
 - 1. Division 23 Section "Identification for HVAC Piping and Equipment" for valve tags and schedules.

1.3 DEFINITIONS

- A. CWP: Cold working pressure.
- B. EPDM: Ethylene propylene copolymer rubber.
- C. NBR: Acrylonitrile-butadiene, Buna-N, or nitrile rubber.
- D. NRS: Nonrising stem.
- E. OS&Y: Outside screw and yoke.
- F. RS: Rising stem.
- G. SWP: Steam working pressure.
- H. PTFE: Polytetrafluoroethylene plastic.
- I. WOG: Water, oil, or gas.

- J. TFE: Tetrafluoroethylene plastic
- K. .OS&Y: Outside screw and yoke.

1.4 SUBMITTALS

- A. Product Data:
 - 1. For each type of valve indicated. Include body, seating, and trim materials; valve design; pressure and temperature classifications; end connections; arrangement; dimensions; and required clearances. Include list indicating valve and its application. Include rated capacities; shipping, installed, and operating weights; furnished specialties; and accessories.
 - 2. For each type of special duty valve indicated include flow and pressure drop curves based on manufacturer's testing for diverting fittings, calibrated balancing valves and automatic flow control valves.
- B. Maintenance Data.
 - 1. Furnish maintenance manuals as specified in Division 1.
 - 2. Furnish complete operation and maintenance manuals for the purchased equipment.
 - 3. Include the following items as a minimum for the purchased equipment.
 - a. Parts list.
 - b. Maintenance guide.
 - c. Preventive maintenance schedule.
 - d. Flow / pressure drop curves.
 - e. Performance data.
 - f. Lubrication schedule.

1.5 QUALITY ASSURANCE

- A. Source Limitations for Valves: Obtain each type of valve from single source from single manufacturer.
- B. ASME Compliance:
 - 1. ASME B16.10 and ASME B16.34 for ferrous valve dimensions and design criteria.
 - 2. ASME B31.1 for power piping valves.
 - 3. ASME B31.9 for building services piping valves.
- C. Standards: If any item in this specification, as furnished by the contractor is manufactured in a location which does not certify ASME / ANSI standards, the contractor is to pay the owner for <u>all</u> expenses incurred by the owner for an outside testing company to confirm such compliances.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Prepare valves for shipping as follows:
 - 1. Protect internal parts against rust and corrosion.
 - 2. Protect threads, flange faces, grooves, and weld ends. with wooden flange covers or with screwed plugs / caps as required.
 - 3. Set angle, gate, and globe valves closed to prevent rattling.

- 4. Set ball and plug valves open to minimize exposure of functional surfaces.
- 5. Block check valves in either closed or open position.
- 6. Protect instrumentation from damage.
- 7. Clean flanges and exposed metal surfaces and treat with anti-corrosive compound before assembly and testing.
- B. Use the following precautions during storage:
 - 1. Maintain valve end protection.
 - 2. Store valves indoors and maintain at higher than ambient dew point temperature. If outdoor storage is necessary, store valves off the ground in watertight enclosures.
- C. Use sling to handle large valves; rig sling to avoid damage to exposed parts. Do not use handwheels or stems as lifting or rigging points

1.7 WARRANTY

- A. General warranty: Special warranty specified in this article shall not deprive the owner of the other rights Owner may have under other provisions of the Contract Documents and shall be in addition to and run concurrent with other warranties made by Contractor under requirements of the Contract Documents.
- B. Manufacturer's warranty: written warranty signed by manufacturer agreeing to repair or replace all defective items including material, parts and labor at no additional cost to the owner.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR VALVES

- A. Refer to HVAC valve schedule articles for applications of valves (Part 3 "Valve Applications Schedule".
- B. Valve Pressure and Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.
- C. Valve Sizes: Same as upstream piping unless otherwise indicated.
- D. Valve Actuator Types:
 - 1. Gear Actuator: For quarter-turn valves NPS 8 and larger.
 - 2. Handwheel: For valves other than quarter-turn types.
 - 3. Handlever: For quarter-turn valves NPS 6 and smaller except plug valves.
 - 4. Wrench: For plug valves with square heads. Furnish Owner with 1 wrench for every 10 plug valves, for each size square plug-valve head.
 - 5. Chainwheel: Device for attachment to valve handwheel, stem, or other actuator; of size and with chain for mounting height, as indicated in the "Valve Installation" Article.
 - 6. Pneumatic motor: For quarter turn valves as indicated on the drawings.
 - 7. Electric motor: As indicated on the drawings.
- E. Valves in Insulated Piping: With 2-inch stem extensions and the following features:
 - 1. Gate Valves: With rising stem.

- 2. Ball Valves: With extended operating handle of non-thermal-conductive material, and protective sleeve that allows operation of valve without breaking the vapor seal or disturbing insulation.
- F. Valve-End Connections:
 - 1. Flanged: With flanges according to ASME B16.1 for iron valves
 - 2. Flanged: With flanges according to ASME B16.5 for steel valves,
 - 3. Flanged: With flanges according to ASME B16.24 for bronze valves.
 - 4. Solder Joint: With sockets according to ASME B16.18.
 - 5. Threaded: With threads according to ASME B1.20.1.
- G. Valve Bypass and Drain Connections: MSS SP-45.

2.2 VALVE DESCRIPTIONS

- A. Bronze Gate Valves, 2 inches and smaller, MSS SP-80 Type 1
 - 1. Manufacturers -Bronze gate valves
 - a. Crane Co.; Crane Valve Group; Jenkins Valves
 - b. Crane Co; Crane Valve Group; Crane Valves
 - c. Crane Co; Crane Valve Group; Stockham Division.
 - d. Grinnell Corporation
 - e. Walworth Company
 - f. NIBCO Inc.
- B. Bronze Globe Valves, 2 inches and smaller, MSS SP-80 Type 3
 - 1. Manufactures-Bronze globe valves
 - a. Crane Co; Crane Valve Group; Jenkins Valves
 - b. Crane Co; Crane Valve Group; Crane Valves
 - c. Crane Co; Crane Valve Group; Stockham Division.
 - d. Grinnell Corporation
 - e. Walworth Company
 - f. NIBCO Inc.
- C. Bronze Swing Check Valves, 2 inches and smaller, MSS SP-80
 - 1. Manufacturers Bronze check valves, Horizontal and Vertical
 - a. Horizontal
 - 1) Crane Co.; Crane Valve Group; Jenkins Valves
 - 2) Crane Co.; Crane Valve Group; Crane Valves
 - 3) Crane Co.; Crane Valve Group; Stockham Division
 - 4) Grinnell Corporation
 - 5) Walworth Company
 - 6) NIBCO Inc.
 - b. Vertical
 - 1) Crane Co.; Crane Valve Group; Jenkins Valves

- 2) Crane Co.; Crane Valve Group; Crane Valves
- 3) Cincinnati Valve Co
- D. Iron Gate Valves
 - 1. Manufacturers Iron gate valves
 - a. Crane Co.; Crane Valve Group; Jenkins Valves
 - b. Crane Co.; Crane Valve Group; Crane Valves
 - c. Crane Co.; Crane Valve Group; Stockham Division
 - d. Grinnell Corporation
 - e. Cincinnati Valve Co.
 - f. NIBCO Inc.
 - 2. 2 inch and smaller, MSS SP 25, MSS SP-70 type 1
 - a. Class 125 psi steam, 200 psi cold working pressure (CWP)
 - 1) ASTM A 126 class B cast-iron body and bonnet
 - 2) Bolted bonnet
 - 3) Outside screw & yoke
 - 4) Rising stem
 - 5) Solid bronze disc
 - 6) Bronze stem
 - 7) Renewable bronze seat rings
 - 8) Threaded end connection
 - 9) Non-asbestos packing and gaskets
 - 10) Aluminum or malleable-iron handwheel
 - 11) Schedule Valve No. 0601
 - 3. 2 1/2 inch to 12 inch, MSS SP 25, MSS SP-70 Type 1
 - a. Class 125 psi steam, 200 psi cold working pressure (CWP)
 - 1) ASTM A 126 class B cast-iron body and bonnet
 - 2) Bolted bonnet
 - 3) Outside screw & yoke
 - 4) Rising stem
 - 5) Solid bronze disc
 - 6) Steel stem
 - 7) Renewable bronze seat rings
 - 8) ANSI 125 flat face flanged ends
 - 9) Non-asbestos packing and gaskets
 - 10) Aluminum or malleable-iron handwheel
 - 11) Schedule Valve No. 0611
- E. Bronze Ball Valves, 3 inches and smaller
 - 1. Manufacturers Bronze ball valves
 - a. Conbraco Industries Inc.; Apollo Division
 - b. Crane Co.; Crane Valve Group; Jenkins Valves

- c. Crane Co.; Crane Valve Group; Stockham Division
- d. Jamesbury Inc.
- e. Milwaukee Valve Company
- 2. 3 piece, class 150 psi steam, 600 psi cold working pressure (CWP), full port
 - a. ASTM B584 cast bronze body
 - b. Stainless steel ball and stem
 - c. Blow out proof stem design
 - d. PTFE seats
 - e. PTFE stem packing
 - f. Zinc plated steel lever with vinyl covered grip
 - g. Threaded ends
 - h. Schedule Valve No. 1821
- F. Cast Iron Plug Valves
 - 1. Manufacturers Cast iron plug valves
 - a. Nordstrom Valve Inc.
 - b. Walworth Company
 - c. R&M Energy systems (Tomball Tx)
 - d. Olson Technologies; Homestead Div.
 - 2. 2 inch and smaller, MSS SP 25, MSS SP-78
 - a. 200 psi cold working pressure (CWP)
 - 1) ASTM A 126 gray iron body
 - 2) Regular pattern
 - 3) Screwed gland
 - 4) Buna-N gland and stem seals
 - 5) Gray iron lubricated tapered plug
 - 6) Carbon steel sealant fitting
 - 7) 1 year supply lubricant per valve
 - 8) 1 lubricating gun with 15,000 psi gauge and 12 inch connection hose per 10 valves
 - 9) 1 wrench operator per 10 valves
 - 10) Threaded end connection
 - 11) Schedule Valve No. 2001

2.3 ELECTRIC MOTOR ACTUATORS

- A. Manufacturers Electric valve actuators
 - 1. Limitorque Corporation
 - 2. Rotork Controls, Inc.
 - 3. Belimo Air Controls, Inc.
 - 4. EIM Company, Inc.
- B. Motor valve operators.
- C. Provide as follows:

- 1. Mount operators on side or top of valve at factory or at site under manufacturer's supervision. Provide gear operated single or double reduction. For 90 deg (1/4 turn) application, adjustable mechanical stops shall prevent travel of more than 90 deg
- 2. Grease or oil lubricated.
- 3. 120 Volt, 1 phase, 60 hertz
- 4. Control circuit: 24 volt, transformer as required.
- 5. Control circuit: 120 volt, transformer as required.
- 6. Assembly:
 - a. Motor shall be high speed, high torque, totally enclosed non-ventilated, Class B or F insulation and operational at up to 10 percent above or below nominal voltage. Motor shall be prelubricated, anti-friction bearing type with thermal overload protection.
 - b. Limit switches shall be integral to the unit. Gearing shall be bronze or stainless steel. Steel switches shall be fully adjustable and shall trip anywhere between full open and full close, as required. Switches shall be heavy duty, open contact type with rotary wiping action. Provide minimum spare contacts 2 normally open, 2 normally closed.
 - c. Torque switch shall have torque protection either direction, fully adjustable and shall shut off actuator motor when a predetermined amount of torque is reached.
 - d. Stem nut shall be high tensile bronze or material compatible to the valve stem and shall be constructed for easy removal without disassembling gear case.
 - e. Handwheel for manual operation: Handwheel shall declutch automatically when motor is energized. Rimpull shall not exceed a maximum of 80 lb. Handwheel shall be similar to Limitorque SMB and SMC.
- 7. For open/closed operation: All valves shall have integral control package including control transformer with fused secondary, motor reversing contactor (mechanically interlocked), limit switch compartment heater and terminal strip.
 - a. Indicating lights shall be:
 - 1) Red light glows when valve closed.
 - 2) Green light glows when valve open.
 - 3) Intermediate position indication.
 - b. Pushbutton station: Provide selector switch if required and momentary or maintained contacts as required.
- 8. For modulating service shall be controlled by analog signal 4-20 ma DC with momentary pushbuttons.
 - a. Controls shall be mounted inside the actuator.
 - b. Provide three phase power supply:
 - 1) Solid state reversing controller.
 - 2) Comparator circuit module.
 - 3) Transformer.
 - 4) 2 position selector switch (auto/manual).
 - 5) Limit switch compartment heater.
 - 6) Mechanical dial position indicator with 1,000 ohm potentiometer.
 - 7) Class F insulation motor.
 - 8) Mounted and wired.
 - 9) Similar to Limitorque Modutronic 30.

- c. Provide single phase power supply:
 - 1) Comparator circuit module.
 - 2) Mechanical dial position indicator with 1,000 ohm potentiometer feedback.
 - 3) 2 position (auto/manual) selector switch.
 - 4) Limit switch compartment heater.
 - 5) Motor: 2100 rpm D.C. in lieu of A.C.; class F insulation; 20 percent run valve duty.
 - 6) Mounted and wired, similar to Limitorque Modutronic 10A and 10B.
- 9. Closing time:
 - a. Gate shall be 12 inches per minute, minimum 1 minute.
 - b. Globe shall be 4 inches per minute, minimum 1 minute.
- 10. Provide remote open-close buttons and open-close indicating lights for installation on control board in Division 15 Section "Automatic Controls System".
- 11. Final field adjustment of valve operation shall be made by manufacturer's representative.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine piping system for compliance with requirements for installation tolerances and other conditions affecting performance.
 - 1. Proceed with installation only after unsatisfactory conditions have been corrected.
- B. Examine valve interior for cleanliness, freedom from foreign matter, and corrosion. Remove special packing materials, such as blocks, used to prevent disc movement during shipping and handling.
- C. Operate valves in positions from fully open to fully closed. Examine guides and seats made accessible by such operations.
- D. Examine threads on valve and mating pipe for form and cleanliness.
- E. Examine mating flange faces for conditions that might cause leakage. Check bolting for proper size, length, and material. Verify that gasket is of proper size, that its material composition is suitable for service, and that it is free from defects and damage.
- F. Do not attempt to repair defective valves; replace with new valves.

3.2 VALVE INSTALLATION

- A. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.
- B. Locate valves for easy access and provide separate support where necessary.
- C. Install valves in horizontal piping with stem at or above center of pipe.
- D. Install valves in position to allow full stem movement.

- E. Install check valves for proper direction of flow and as follows:
 - 1. Swing Check Valves: In horizontal position with hinge pin level.

3.3 ADJUSTING

A. Adjust or replace valve packing after piping systems have been tested and put into service but before final adjusting and balancing. Replace valves if persistent leaking occurs.

3.4 GENERAL REQUIREMENTS FOR VALVE APPLICATIONS

- A. General-Duty Valve Applications: Unless otherwise indicated, use the following valve types:
 - 1. Shutoff service, water: ball or gate valves.
 - 2. Throttling Service, water: Globe or angle valves.
- B. If valves with specified SWP classes or CWP ratings are not available, the same types of valves with higher SWP classes or CWP ratings may be substituted.
- C. Install shutoff duty valves at each branch connection to supply mains, at supply connection to each piece of equipment, unless only one piece of equipment is connected in the branch line. Install throttling duty valves at each branch connection to return mains, at return connections to each piece of equipment, and elsewhere as indicated.

END OF SECTION

SECTION 230529

HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following hangers and supports for HVAC system piping and equipment:
 - 1. Steel pipe hangers and supports.
 - 2. Trapeze pipe hangers.
 - 3. Fiberglass pipe hangers.
 - 4. Metal framing systems.
 - 5. Thermal-hanger shield inserts.
 - 6. Fastener systems.
 - 7. Pipe stands.
 - 8. Equipment supports.
- B. Related Sections include the following:
 - 1. Division 23 Section "Vibration and Seismic Controls for HVAC Piping and Equipment" for vibration isolation devices.
 - 2. Division 23 Section(s) "Metal Ducts" for duct hangers and supports.

1.3 DEFINITIONS

- A. MSS: Manufacturers Standardization Society for The Valve and Fittings Industry Inc.
- B. Terminology: As defined in MSS SP-90, "Guidelines on Terminology for Pipe Hangers and Supports."

1.4 PERFORMANCE REQUIREMENTS

- A. Design supports for multiple pipes, including pipe stands, capable of supporting combined weight of supported systems, system contents, and test water.
- B. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.
- C. Design seismic-restraint hangers and supports for piping and equipment.

1.5 SUPPLEMENTARY STEEL

- A. Furnish supplementary steel as required for proper installation, mounting and support of HVAC work.
- B. Connect supplementary steel firmly to building construction in an acceptable manner.

- C. Determine type and size of supplementary steel. Supplementary steel shall be of sufficient strength and size to allow a minimum deflection of 1/360 of the span and in conformance with manufacturer's requirements of loading.
- D. Install supplementary steel in a neat and workmanlike manner parallel to walls, floors and ceiling construction.
- E. All supplementary steel and channel supports shall be submitted to the structural engineer for review.

1.6 EXPANSION ANCHORS

- A. Provide smooth wall, non-self-drilling internal plug expansion type anchors constructed of AISC 12L14 steel and zinc plated in accordance with Fed. Spec. QQ-A-325 Type 1, Class 3.
- B. Do no exceed 1/4 of average values for a specific anchor size using 2,000 psig (13,800 kpa) concrete only for maximum working load.
- C. Provide spacing and install anchors in accordance with manufacturer's recommendations.

1.7 SUBMITTALS

- A. Product Data: For the following:
 - 1. Steel pipe hangers and supports.
 - 2. Fiberglass pipe hangers.
 - 3. Thermal-hanger shield inserts.
 - 4. Powder-actuated fastener systems.
- B. Shop Drawings: Show fabrication and installation details and include calculations for the following:
 - 1. Trapeze pipe hangers. Include Product Data for components.
 - 2. Metal framing systems. Include Product Data for components.
 - 3. Fiberglass strut systems. Include Product Data for components.
 - 4. Pipe stands. Include Product Data for components.
 - 5. Equipment supports.
- C. Submit to the structural engineer:
 - 1. Details of all proposed methods of attachment to the building structure for all hangers and supports.
 - 2. All forces and weights that will be imposed on the building structure by the hangers and supports.
- D. Welding certificates.

1.8 QUALITY ASSURANCE

- A. Welding: Qualify procedures and personnel according to AWS D1.1, "Structural Welding Code--Steel."
- B. Welding: Qualify procedures and personnel according to the following:
 - 1. AWS D1.1, "Structural Welding Code--Steel."
 - 2. AWS D1.2, "Structural Welding Code--Aluminum."
 - 3. AWS D1.3, "Structural Welding Code--Sheet Steel."
 - 4. AWS D1.4, "Structural Welding Code--Reinforcing Steel."
 - 5. ASME Boiler and Pressure Vessel Code: Section IX.
- C. Engineering Responsibility: Design and preparation of Shop Drawings and calculations for each multiple pipe support, trapeze, and seismic restraint by a qualified professional engineer.

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.

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. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.
 - 2. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 STEEL PIPE HANGERS AND SUPPORTS

- A. Description: MSS SP-58, Types 1 through 58, factory-fabricated components. Refer to Part 3 "Hanger and Support Applications" Article for where to use specific hanger and support types.
- B. Manufacturers:
 - 1. AAA Technology & Specialties Co., Inc.
 - 2. B-Line Systems, Inc.; a division of Cooper Industries.
 - 3. Carpenter & Paterson, Inc.
 - 4. Empire Industries, Inc.
 - 5. Globe Pipe Hanger Products, Inc.
 - 6. Grinnell Corp.
 - 7. GS Metals Corp.
 - 8. National Pipe Hanger Corporation.
 - 9. PHD Manufacturing, Inc.
 - 10. Piping Technology & Products, Inc.
 - 11. Tolco Inc.
- C. Galvanized, Metallic Coatings: Pregalvanized or hot dipped.
- D. Nonmetallic Coatings: Plastic coating, jacket, or liner.
- E. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion for support of bearing surface of piping.

2.3 TRAPEZE PIPE HANGERS

A. Description: MSS SP-69, Type 59, shop- or field-fabricated pipe-support assembly made from structuralsteel shapes with MSS SP-58 hanger rods, nuts, saddles, and U-bolts.

2.4 METAL FRAMING SYSTEMS

A. Description: MFMA-3, shop- or field-fabricated pipe-support assembly made of steel channels and other components.

GREENWICH PUBLIC SCHOOLS GREENWICH HIGH SCHOOL LOCKER ROOM RENOVATIONS PHASE II HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT

- B. Manufacturers:
 - 1. B-Line Systems, Inc.; a division of Cooper Industries.
 - 2. ERICO/Michigan Hanger Co.; ERISTRUT Div.
 - 3. GS Metals Corp.
 - 4. Power-Strut Div.; Tyco International, Ltd.
 - 5. Thomas & Betts Corporation.
 - 6. Tolco Inc.
 - 7. Unistrut Corp.; Tyco International, Ltd.
- C. Coatings: Manufacturer's standard finish, unless bare metal surfaces are indicated.
- D. Nonmetallic Coatings: Plastic coating, jacket, or liner.

2.5 THERMAL-HANGER SHIELD INSERTS

- A. Description: 100-psig- minimum, compressive-strength insulation insert encased in sheet metal shield.
- B. Manufacturers:
 - 1. Carpenter & Paterson, Inc.
 - 2. ERICO/Michigan Hanger Co.
 - 3. PHS Industries, Inc.
 - 4. Pipe Shields, Inc.
 - 5. Rilco Manufacturing Company, Inc.
 - 6. Value Engineered Products, Inc.
- C. Insulation-Insert Material for Hot Piping: Water-repellent treated, ASTM C 533, Type I calcium silicate.
- D. For Trapeze or Clamped Systems: Insert and shield shall cover entire circumference of pipe.
- E. For Clevis or Band Hangers: Insert and shield shall cover lower 180 degrees of pipe.
- F. Insert Length: Extend 2 inches beyond sheet metal shield for piping operating below ambient air temperature.

2.6 FASTENER SYSTEMS

- A. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete with pullout, tension, and shear capacities appropriate for supported loads and building materials where used.
 - 1. Manufacturers:
 - a. Hilti, Inc.
 - b. ITW Ramset/Red Head.
 - c. Masterset Fastening Systems, Inc.
 - d. MKT Fastening, LLC.
 - e. Powers Fasteners.
- B. Mechanical-Expansion Anchors: Insert-wedge-type zinc-coated steel, for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.
 - 1. Manufacturers:
 - a. B-Line Systems, Inc.; a division of Cooper Industries.
 - b. Empire Industries, Inc.

- c. Hilti, Inc.
- d. ITW Ramset/Red Head.
- e. MKT Fastening, LLC.
- f. Powers Fasteners.

2.7 EQUIPMENT SUPPORTS

A. Description: Welded, shop- or field-fabricated equipment support made from structural-steel shapes.

2.8 MISCELLANEOUS MATERIALS

- A. Structural Steel: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.
- B. Grout: ASTM C 1107, factory-mixed and -packaged, dry, hydraulic-cement, nonshrink and nonmetallic grout; suitable for interior and exterior applications.
 - 1. Properties: Nonstaining, noncorrosive, and nongaseous.
 - 2. Design Mix: 5000-psi 28-day compressive strength.

PART 3 - EXECUTION

3.1 HANGER AND SUPPORT APPLICATIONS

- A. Specific hanger and support requirements are specified in Sections specifying piping systems and equipment.
- B. Comply with MSS SP-69 for pipe hanger selections and applications that are not specified in piping system Sections.
- C. Use hangers and supports with galvanized, metallic coatings for piping and equipment that will not have field-applied finish.
- D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.
- E. Use padded hangers for piping that is subject to scratching.
- F. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
 - 1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated stationary pipes, NPS 1/2 to NPS 30.
 - 2. Yoke-Type Pipe Clamps (MSS Type 2): For suspension of 120 to 450 deg F pipes, NPS 4 to NPS 16, requiring up to 4 inches of insulation.
 - 3. Carbon- or Alloy-Steel, Double-Bolt Pipe Clamps (MSS Type 3): For suspension of pipes, NPS 3/4 to NPS 24, requiring clamp flexibility and up to 4 inches of insulation.
 - 4. Steel Pipe Clamps (MSS Type 4): For suspension of cold and hot pipes, NPS 1/2 to NPS 24, if little or no insulation is required.
 - 5. Pipe Hangers (MSS Type 5): For suspension of pipes, NPS 1/2 to NPS 4, to allow off-center closure for hanger installation before pipe erection.
 - 6. Adjustable, Swivel Split- or Solid-Ring Hangers (MSS Type 6): For suspension of noninsulated stationary pipes, NPS 3/4 to NPS 8.
 - 7. Adjustable, Steel Band Hangers (MSS Type 7): For suspension of noninsulated stationary pipes, NPS 1/2 to NPS 8.
 - 8. Adjustable Band Hangers (MSS Type 9): For suspension of noninsulated stationary pipes, NPS 1/2 to NPS 8.

- 9. Adjustable, Swivel-Ring Band Hangers (MSS Type 10): For suspension of noninsulated stationary pipes, NPS 1/2 to NPS 2.
- 10. Split Pipe-Ring with or without Turnbuckle-Adjustment Hangers (MSS Type 11): For suspension of noninsulated stationary pipes, NPS 3/8 to NPS 8.
- 11. Extension Hinged or 2-Bolt Split Pipe Clamps (MSS Type 12): For suspension of noninsulated stationary pipes, NPS 3/8 to NPS 3.
- 12. U-Bolts (MSS Type 24): For support of heavy pipes, NPS 1/2 to NPS 30.
- 13. Clips (MSS Type 26): For support of insulated pipes not subject to expansion or contraction.
- 14. Pipe Saddle Supports (MSS Type 36): For support of pipes, NPS 4 to NPS 36, with steel pipe base stanchion support and cast-iron floor flange.
- 15. Pipe Stanchion Saddles (MSS Type 37): For support of pipes, NPS 4 to NPS 36, with steel pipe base stanchion support and cast-iron floor flange and with U-bolt to retain pipe.
- Adjustable, Pipe Saddle Supports (MSS Type 38): For stanchion-type support for pipes, NPS 2-1/2 to NPS 36, if vertical adjustment is required, with steel pipe base stanchion support and castiron floor flange.
- 17. Single Pipe Rolls (MSS Type 41): For suspension of pipes, NPS 1 to NPS 30, from 2 rods if longitudinal movement caused by expansion and contraction might occur.
- 18. Adjustable Roller Hangers (MSS Type 43): For suspension of pipes, NPS 2-1/2 to NPS 20, from single rod if horizontal movement caused by expansion and contraction might occur.
- 19. Complete Pipe Rolls (MSS Type 44): For support of pipes, NPS 2 to NPS 42, if longitudinal movement caused by expansion and contraction might occur but vertical adjustment is not necessary.
- 20. Pipe Roll and Plate Units (MSS Type 45): For support of pipes, NPS 2 to NPS 24, if small horizontal movement caused by expansion and contraction might occur and vertical adjustment is not necessary.
- 21. Adjustable Pipe Roll and Base Units (MSS Type 46): For support of pipes, NPS 2 to NPS 30, if vertical and lateral adjustment during installation might be required in addition to expansion and contraction.
- G. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
 - 1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers, NPS 3/4 to NPS 20.
 - 2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers, NPS 3/4 to NPS 20, if longer ends are required for riser clamps.
- H. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
 - 1. Steel Turnbuckles (MSS Type 13): For adjustment up to 6 inches for heavy loads.
 - 2. Steel Clevises (MSS Type 14): For 120 to 450 deg F piping installations.
 - 3. Swivel Turnbuckles (MSS Type 15): For use with MSS Type 11, split pipe rings.
 - 4. Malleable-Iron Sockets (MSS Type 16): For attaching hanger rods to various types of building attachments.
 - 5. Steel Weldless Eye Nuts (MSS Type 17): For 120 to 450 deg F piping installations.
- I. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
 - 1. Steel or Malleable Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.

- 2. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joist construction to attach to top flange of structural shape.
- 3. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.
- 4. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.
- 5. Welded Beam Attachments (MSS Type 22): For attaching to bottom of beams if loads are considerable and rod sizes are large.
- 6. C-Clamps (MSS Type 23): For structural shapes.
- 7. Top-Beam Clamps (MSS Type 25): For top of beams if hanger rod is required tangent to flange edge.
- 8. Side-Beam Clamps (MSS Type 27): For bottom of steel I-beams.
- 9. Steel-Beam Clamps with Eye Nuts (MSS Type 28): For attaching to bottom of steel I-beams for heavy loads.
- 10. Linked-Steel Clamps with Eye Nuts (MSS Type 29): For attaching to bottom of steel I-beams for heavy loads, with link extensions.
- 11. Malleable Beam Clamps with Extension Pieces (MSS Type 30): For attaching to structural steel.
- 12. Welded-Steel Brackets: For support of pipes from below, or for suspending from above by using clip and rod. Use one of the following for indicated loads:
 - a. Light (MSS Type 31): 750 lb.
 - b. Medium (MSS Type 32): 1500 lb.
 - c. Heavy (MSS Type 33): 3000 lb.
- 13. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.
- 14. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.
- 15. Horizontal Travelers (MSS Type 58): For supporting piping systems subject to linear horizontal movement where headroom is limited.
- J. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
 - 1. Steel Pipe-Covering Protection Saddles (MSS Type 39): To fill interior voids with insulation that matches adjoining insulation.
 - 2. Protection Shields (MSS Type 40): Of length recommended in writing by manufacturer to prevent crushing insulation.
 - 3. Thermal-Hanger Shield Inserts: For supporting insulated pipe.
- K. Spring Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
 - 1. Restraint-Control Devices (MSS Type 47): Where indicated to control piping movement.
 - 2. Spring Cushions (MSS Type 48): For light loads if vertical movement does not exceed 1-1/4 inches.
 - 3. Spring-Cushion Roll Hangers (MSS Type 49): For equipping Type 41 roll hanger with springs.
 - 4. Spring Sway Braces (MSS Type 50): To retard sway, shock, vibration, or thermal expansion in piping systems.
 - 5. Variable-Spring Hangers (MSS Type 51): Preset to indicated load and limit variability factor to 25 percent to absorb expansion and contraction of piping system from hanger.
 - 6. Variable-Spring Base Supports (MSS Type 52): Preset to indicated load and limit variability factor to 25 percent to absorb expansion and contraction of piping system from base support.

- 7. Variable-Spring Trapeze Hangers (MSS Type 53): Preset to indicated load and limit variability factor to 25 percent to absorb expansion and contraction of piping system from trapeze support.
- 8. Constant Supports: For critical piping stress and if necessary to avoid transfer of stress from one support to another support, critical terminal, or connected equipment. Include auxiliary stops for erection, hydrostatic test, and load-adjustment capability. These supports include the following types:
 - a. Horizontal (MSS Type 54): Mounted horizontally.
 - b. Vertical (MSS Type 55): Mounted vertically.
 - c. Trapeze (MSS Type 56): Two vertical-type supports and one trapeze member.
- L. Comply with MSS SP-69 for trapeze pipe hanger selections and applications that are not specified in piping system Sections.
- M. Comply with MFMA-102 for metal framing system selections and applications that are not specified in piping system Sections.
- N. Use mechanical-expansion anchors instead of building attachments where required in concrete construction.

3.2 HANGER AND SUPPORT INSTALLATION

- A. Steel Pipe Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from building structure.
- B. Trapeze Pipe Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Arrange for grouping of parallel runs of horizontal piping and support together on field-fabricated trapeze pipe hangers.
 - 1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified above for individual pipe hangers.
 - 2. Field fabricate from ASTM A 36/A 36M, steel shapes selected for loads being supported. Weld steel according to AWS D1.1.
- C. Metal Framing System Installation: Arrange for grouping of parallel runs of piping and support together on field-assembled metal framing systems.
- D. Thermal-Hanger Shield Installation: Install in pipe hanger or shield for insulated piping.
- E. Fastener System Installation:
 - 1. Install powder-actuated fasteners for use in lightweight concrete or concrete slabs less than 4 inches thick in concrete after concrete is placed and completely cured. Use operators that are licensed by powder-actuated tool manufacturer. Install fasteners according to powder-actuated tool manufacturer's operating manual.
 - 2. Install mechanical-expansion anchors in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.
- F. Pipe Stand Installation:
 - 1. Pipe Stand Types except Curb-Mounting Type: Assemble components and mount on smooth roof surface. Do not penetrate roof membrane.
 - 2. Curb-Mounting-Type Pipe Stands: Assemble components or fabricate pipe stand and mount on permanent, stationary roof curb. Refer to Division 07 Section "Roof Accessories" for curbs.
- G. Install hangers and supports complete with necessary inserts, bolts, rods, nuts, washers, and other accessories.
- H. Equipment Support Installation: Fabricate from welded-structural-steel shapes.
- I. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.
- J. Install lateral bracing with pipe hangers and supports to prevent swaying.

- K. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, NPS 2-1/2 and larger and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.
- L. Load Distribution: Install hangers and supports so piping live and dead loads and stresses from movement will not be transmitted to connected equipment.
- M. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and so maximum pipe deflections allowed by ASME B31.1 (for power piping) and ASME B31.9 (for building services piping) are not exceeded.
- N. Insulated Piping: Comply with the following:
 - 1. Attach clamps and spacers to piping.
 - a. Piping Operating above Ambient Air Temperature: Clamp may project through insulation.
 - b. Piping Operating below Ambient Air Temperature: Use thermal-hanger shield insert with clamp sized to match OD of insert.
 - c. Do not exceed pipe stress limits according to ASME B31.1 for power piping and ASME B31.9 for building services piping.
 - 2. Install MSS SP-58, Type 39, protection saddles if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.
 - a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.
 - 3. Install MSS SP-58, Type 40, protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees.
 - a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.
 - 4. Shield Dimensions for Pipe: Not less than the following:
 - a. NPS 1/4 to NPS 3-1/2: 12 inches long and 0.048 inch thick.
 - b. NPS 4: 12 inches long and 0.06 inch thick.
 - c. NPS 5 and NPS 6: 18 inches long and 0.06 inch thick.
 - d. NPS 8 to NPS 14: 24 inches long and 0.075 inch thick.
 - e. NPS 16 to NPS 24: 24 inches long and 0.105 inch thick.
 - 5. Pipes NPS 8 and Larger: Include wood inserts.
 - 6. Insert Material: Length at least as long as protective shield.
 - 7. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.

3.3 EQUIPMENT SUPPORTS

- A. Fabricate structural-steel stands to suspend equipment from structure overhead or to support equipment above floor.
- B. Grouting: Place grout under supports for equipment and make smooth bearing surface.
- C. Provide lateral bracing, to prevent swaying, for equipment supports.
- 3.4 METAL FABRICATIONS
 - A. Cut, drill, and fit miscellaneous metal fabrications for trapeze pipe hangers and equipment supports.
 - B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.

- C. Field Welding: Comply with AWS D1.1 procedures for shielded metal arc welding, appearance and quality of welds, and methods used in correcting welding work, and with the following:
 - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 - 2. Obtain fusion without undercut or overlap.
 - 3. Remove welding flux immediately.
 - 4. Finish welds at exposed connections so no roughness shows after finishing and contours of welded surfaces match adjacent contours.

3.5 ADJUSTING

- A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.
- B. Trim excess length of continuous-thread hanger and support rods to 1-1/2 inches.

3.6 PAINTING

- A. Touch Up: 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. Touch Up: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal are specified in Division 09 painting Sections.
- C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

END OF SECTION

SECTION 230548 MECHANICAL VIBRATION ISOLATION AND SEISMIC RESTRAINT SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. It is the objective of this Specification to provide the necessary design requirements for the control of excessive noise and vibration in the buildings due to the operation of machinery or equipment, and/or due to interconnected piping, ductwork or conduit. It is also the objective of this specification to provide the design criteria for seismic restraints for all isolated and non-isolated equipment.
- B. Work in this section includes the providing of labor, materials, equipment and services necessary for a complete and safe installation in of vibration isolation systems and seismic restraints for every mechanical system including piping and ductwork within and on the roof of the building, complete, as shown and specified per the contract documents and all applicable codes and authorities having jurisdiction.
- C. The work of this section includes, but is not limited to the following:
 - 1. Vibration isolation elements for piping and equipment.
 - 2. Equipment isolation bases.
 - 3. Seismic restraints for isolated and non-isolated ductwork, VAV boxes, and equipment.
- D. Related Sections:
 - 1. All Division 23000 Sections as issued for this project under "Mechanical/HVAC".
- E. Seismic restraints:
 - 1. All equipment, piping and ductwork shall be adequately restrained to resist seismic forces. This specification is in addition to the specified vibration isolation for this project. Restraint devices shall be designed and selected to meet seismic requirements as defined in the latest issue of the state and local codes and other authorities having jurisdiction.
 - 2. Anchor bolt calculations, signed and stamped by a registered Professional Engineer, shall be submitted showing adequacy of the bolt sizing and type. Calculations shall include anchor embedment, minimum edge distance and minimum center distance. The design lateral forces shall be distributed in proportion to the mass distribution of the equipment. Calculations shall be furnished for anchors on restraint devices, cables, isolators and on rigid mounted equipment. The seismic designer must perform final jobsite inspection to verify anchor installation.
 - 3. Contractor shall supply all supplemental steel required for all equipment, ductwork and roof mounted equipment.
 - 4. All isolators and equipment shall meet OSHPD requirements and contain approval from OSHPD.
- F. This specification shall be supplemented by all local codes and ordinance which shall take precedence in the event of the existence of any conflict between same and this specification. Where methods or materials specified are equivalent to the code requirements specified, comply with the specified requirements.
- 1.3 SUBMITTALS

GREENWICH PUBLIC SCHOOLS GREENWICH HIGH SCHOOL LOCKER ROOM RENOVATIONS PHASE II MECHANICAL VIBRATION ISOLATION AND SEISMIC RESTRAINT SYSTEMS

- A. In addition to the requirements of the section on Mechanical General Provisions, the submittal material shall include thirteen (13) copies of descriptive data for all products and materials including, but not limited to, the following:
 - 1. Descriptive Data:
 - a. Catalog cuts and data sheets on specific vibration isolators and seismic restraints to be utilized showing compliance with the specifications.
 - b. An itemized list showing the items of equipment or piping to be isolated, the isolator type and model number selected, isolator loading and deflection, and reference to specific drawings showing seismic restraints, base and construction where applicable.
 - c. An itemized list of non-isolated equipment, and ductwork to be seismically restrained.
 - d. Seismic restraint calculations.
 - e. Structural or civil engineer's stamp verifying design and calculations for seismic restraining systems used.
 - 2. Shop Drawings:
 - a. Drawings showing equipment base constructions for each machine, including dimensions, structural member sizes and support point locations.
 - b. Number and location of seismic restraints and anchors for each piece of equipment and of ductwork.
 - c. Specific details of restraints, including anchor bolts for mounting and maximum loading at each location for each piece of equipment.

1.4 CODE AND REFERENCE STANDARD REQUIREMENTS

- A. All equipment supplied under this specification shall conform in all respects to the rules and regulations of:
 - SMACNA "Guidelines for Seismic Restraints of Mechanical Systems and Plumbing Piping Systems." 1982
 - 2. 2003 ASHRAE GUIDE, Chapter 47, and Chapter 54
 - 3. 2005 State of Connecticut Building Code and supplements. and all authorities having jurisdiction. Seismic Design Category I requirements shall apply for mechanical systems.
 - 4. American Society for Testing and Materials:
 - a. ASTM A 36/a 36M-96: Specification for Carbon Structural Steel.
 - b. ASTM E 488-96: Test Methods for Strength of Anchors in Concrete and Masonry Elements.
 - 5. American Welding Society:
 - a. ASW D1.1-98: Structural Welding Code Steel.

1.5 QUALITY ASSURANCE

- A. All vibration isolation and seismic restraint devices shall be the product of a single manufacturer. Products of other manufacturer's are acceptable provided that their systems comply with the design intent for system performance, static deflection and structural design of the base manufacturer.
- B. Vibration isolation firms having a minimum ten years experience designing and supervising the installation of vibration isolation and seismic restraint systems shall be qualified to provide the materials and installation required by this section. Project listings shall be provided including geographical location and a reference contact.

- C. The installation of all vibration isolation units, and associated seismic restraints, hangers and bases, shall be under the direct supervision of the vibration isolation manufacturer's representative. The isolation manufacturer is to send a letter stating that they have inspected all of the vibration isolation units installed and they are installed properly and operating.
- D. 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.
- E. Purchased and/or fabricated equipment must be designed to safely accept external forces of 1.0 g load in any direction for all rigidly and resiliently supported equipment, piping and ductwork without failure and permanent displacement of the equipment. Life safety equipment such as fire pumps, smoke exhaust fans, emergency generators and other life safety designated equipment must be capable of accepting external forces of up to 1.5 g in any direction without permanent displacement or failure of the equipment.
- F. Standards: If any item in this specification as furnished by the contractor is manufactured in a location which does not certify the referenced standards as defined in paragraph 1.4 of this specification, the contractor is to pay the owner for <u>all</u> expenses incurred by the owner for an outside testing company top confirm such compliances.
- G. Welding: Qualify procedures and personnel according to AWS D1.1, "Structural Welding Code--Steel."

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver each item as a factory-assembled unit with protective crating and covering.
- B. Store in a dry location.
- C. Provide disassembly and re-assembly as required to accommodate rigging and shipping.
- D. Comply with the manufacturer's written rigging and installation instructions for unloading, transporting and setting in final location.
- E. All equipment with shaft bearings (pump, fans, etc..) must have the shaft rotated every 2 weeks and the equipment must be stared inside.

1.7 SUBSTITUTIONS

- A. Any proposed substitution must be submitted at the time the bid is submitted. No substitute material or manufacturer of equipment shall be permitted without a formal written submittal to the engineer which includes all dimensional, performance and material specifications and is approved in writing by the engineer. Any changes in layout or design brought about by the use of a substitution shall be submitted to the engineer fully designed for review in conjunction with the submittal of the alternate. Any substitutions must be submitted with an explanation why a substitution is being proposed. If the substitute is being proposed for financial reasons the associated credit must be simultaneously submitted.
- B. Final acceptance or rejection of any substitution is subject to the Owner's review.

1.8 COORDINATION

A. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into base. Coordinate with the architect and structural engineer for concrete, reinforcement, and formwork requirements.

B. Coordinate installation of roof curbs, equipment supports, and roof penetrations. These items are specified in Division 7 Section "Roof Accessories."

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. The following are approved manufacturers, provided their systems strictly comply with the design intent for performance, deflection and structural capacity of this specification.
 - 1. Mason Industries, Inc., Hauppauge, NY
 - 2. Vibration Mountings & Controls, Inc., Bloomingdale, NJ
 - 3. Vibration Eliminator Co., Inc., Capiague, NY
 - 4. Amber Booth, Houston, TX

2.2 DESCRIPTION

- A. All vibration isolators shall have either known undeflected heights or calibration markings so that, after adjustment, when carrying their load, the deflection under load can be verified, thus determining that the load is within the proper range of the device and that the correct degree of vibration isolation is being provided according to the design.
- B. All isolators shall operate in the linear portion of their load versus deflection curve. Load versus deflection curves shall be furnished by the manufacturer, and must be linear over a deflection range of not less than 50% above the design deflection.
- C. Where spring isolation systems are described in the following specifications, the mounting assemblies shall utilize bare springs with the spring diameter not less than 0.8 of the loaded operating height of the spring. Each spring isolator shall be designed and installed so that the ends of the springs remain parallel. The minimum deflection from loaded operating height to spring solid height shall be 50% of the rated static deflection of the spring.
- D. The isolator ratio of lateral to vertical stiffness shall not be less than 0.9 nor more than 1.5.
- E. The theoretical vertical natural frequency for each support point, based upon load per isolator and isolator stiffness, shall not differ from the design objectives for the equipment as a whole by more than $\pm 10\%$.
- F. All mounting systems, including seismic restraints, exposed to weather and other corrosive environments shall be protected with factory corrosion resistance. All metal parts of mountings (except springs and hardware) to be hot dip galvanized. Springs shall be powder coated and neoprene coated. Nuts and bolts shall be cadmium plated.
- G. All roof-mounted isolators shall be bolted or welded to building steel and anchored to the deck to resist 110 mph wind loads.

2.3 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 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.

2.4 VIBRATION ISOLATORS

- A. Type A: Bare spring isolators shall incorporate the following:
 - 1. Minimum 1/4" (6 mm) thick neoprene acoustical base pad on underside, unless designated otherwise.
 - 2. Non-resonant with equipment forcing frequencies or support structure natural frequencies.
 - 3. Requires seismic restraint type II
 - 4. Spring isolators to be Mason Type SLF, or as approved.
- B. Type B: Spring isolators shall be same as Type A, except:
 - 1. Provide built-in vertical limit stops with minimum 1/4" (6 mm) clearance under normal operation.
 - 2. Tapped holes in top plate for bolting to equipment.
 - 3. Capable of supporting equipment at a fixed elevation during equipment erection. Installed and operating heights shall be identical.
 - 4. Shall incorporate snubbing restraint in all directions. Cast or aluminum housings are unacceptable. System to be field bolted or welded to deck with ability to resist forces of 1.5 g acceleration.
 - 5. Mason Type SLR, or as approved.

2.5 EQUIPMENT BASES

- A. Curb Mounted Base, Type B-3
 - 1. Curb mounted rooftop equipment shall be mounted on spring isolation curbs that directly sit on roof construction and are flashed and incorporated into roof's membrane waterproofing system.
 - 2. All spring locations shall have removable waterproof covers to allow for spring adjustment and/or removal.
 - 3. All spring mounts shall be as Isolator Type B.
 - 4. Curb and spring mounting shall be capable of withstanding 110mph wind and 1.5 g seismic loads.
 - 5. Curbs shall be Mason Type CMAB or RSC (depending on deflection required), or approved equal.

2.6 SEISMIC RESTRAINTS

- A. All seismic restraints for mechanical equipment shall be capable of safely accepting 1.0 g (1.5 g for designated life safety equipment) external forces without failure, and shall maintain equipment, piping, duct and pressure reducing boxes in a captive position. Seismic restraints shall not short circuit isolation systems or transmit objectionable vibration or noise, and shall be provided on all equipment as scheduled on drawings.
- B. Submit calculations by a licensed Structural or Civil Engineer substantiating that all equipment mountings and foundations and their seismic restraints can safely accept external forces of 1.0 g load for all rigidly and resiliently supported equipment, piping, and ductwork (1.5 g load for all life safety equipment) without failure and permanent displacement. Restrain all resiliently mounted piping and ductwork with cable sway bracing by Mason Industries, or approved equal.
- C. Seismic Restraint Types
 - 1. Seismic Restraint, Type I
 - a. Shall comply with general characteristics of spring isolators.

- b. Shall have vertical restraints and are capable of supporting equipment at fixed elevation during equipment erection.
- c. Shall incorporate seismic snubbing restraint in all directions at specified acceleration loadings.
- d. System to be field bolted to structure with minimum capability to withstand external forces of 1.5 g.
- e. Mason Type SSLR, or as approved
- 2. Seismic Restraint, Type II
 - a. Each corner or side seismic restraint shall incorporate minimum 5/8" (16 mm) thick pad limit stops. Restraints shall be made of plate, structural members or square metal tubing in a welded assembly, incorporating resilient pads. Angle bumpers are not acceptable. System to be field bolted to deck with 1.5 g acceleration capacity.
 - b. Seismic spring mountings as described above are an acceptable alternative providing all seismic loading requirements are met.
 - c. Mason Industries Type Z-1011, Type Z-1225, or as approved.

PART 3 - EXECUTION

3.1 GENERAL VIBRATION ISOLATION REQUIREMENTS

- A. Install in accordance with manufacturer's written instructions. Vibration isolators must not cause any change of position of equipment or piping resulting in piping stresses or misalignment.
- B. Mechanical equipment shall be isolated from the building structure by means of noise and vibration isolators as scheduled on the drawings or within these specifications.
- C. No rigid connections between equipment and building structure shall be made that degrades the noise and vibration isolation systems herein specified.
- D. Electrical circuit connections to isolated equipment shall be looped to allow free motion of isolated equipment.
- E. The contractor shall not install any equipment, piping or conduit which makes rigid contact with the "building" unless permitted in this Specification. Building includes, but is not limited to, slabs, beams, columns, studs and walls.
- F. Isolation mounting deflection shall be (minimum) as specified or scheduled on drawings.
- G. Coordinate work with other trades to avoid rigid contact with the building. Inform other trades following work, such as plastering or electrical, to avoid any contact which would reduce the vibration isolation.
- H. Bring to the Architect's attention, prior to installation, any conflicts with other trades which will result in unavoidable rigid contact with equipment or piping as described herein, due to inadequate space or other unforeseen conditions. Corrective work necessitated by conflicts after installation shall be at the responsible contractor's expense.
- I. Bring to the Architect's attention any discrepancies between the specifications and field conditions or changes required due to specific equipment selection, prior to installation. Corrective work necessitated by discrepancies after installation shall be at the contractor's expense.
- J. Obtain inspection and approval of any installation to be covered or enclosed, prior to such closure.

K. Correct, at no additional cost, all installations which are deemed defective in workmanship or materials.

3.2 GENERAL SEISMIC RESTRAINT REQUIREMENT

- A. All equipment whether isolated or not shall be bolted to structure to allow for minimum 1.0 g of acceleration (1.5 g for life safety equipment). Bolt points and diameter of inserts shall be submitted and verified as part of the contractor's submission for each piece of equipment and stamped and sealed by a civil or structural engineer.
- B. Position all corner or side seismic restraints with equipment at operating weight for proper operation clearance and weld or bolt seismic restraint to seismic anchor plates in housekeeping pad. Install equipment with flexibility in wiring connection. Verify all installed isolators and mounting systems permit equipment motion in all directions. Adjust or provide additional resilient restraints to flexibly limit startup equipment lateral motion to 1/4 inch. Prior to startup, clean out all foreign matter between bases and equipment. Verify that there are no isolation short circuits in the base, isolators or seismic restraints.
- C. Seismic restraints are not required for the following:
 - 1. All rectangular ducts less than 6 sq. ft. (0.56 m^2) in cross sectional area.
 - 2. All round ducts less than 28" (710 m) in diameter.
 - 3. All ducts suspended by hangers 12" (305 mm) or less in length from the point of the attachment to the duct to the bottom of the support for the hanger.
- D. For overhead supported equipment, overstress of the building structure must not occur. Bracing may occur from:
 - 1. Upper flanges of structural beams;
 - 2. Upper truss chords in bar joist construction at the panel points;
 - 3. Cast-in-place inserts or drilled and shielded inserts in concrete structures suitably located away from edges.
- E. Each seismic restraint and snubbing device shall be installed after equipment is installed and fully operational. Each isolation mounting incorporating seismic restraint shall be adjusted to provide the minimum operating clearance in all directions to permit the operation of the equipment without objectionable noise or vibration to any part of the building structure. The operating clearance for equipment seismic restraints shall not be greater than 1/4" (6 mm). Seismic restraints must not result in short-circuiting of isolated equipment.

3.3 INSPECTION

A. On completion of installation of all vibration isolation and seismic restraint devices herein specified, the local 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 representatives 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.

3.4 CLEANING

- A. After completing equipment installation, inspect vibration isolation and seismic-control devices. Remove paint splatters and other spots, dirt, and debris.
- 3.5 DEMONSTRATION

GREENWICH PUBLIC SCHOOLS GREENWICH HIGH SCHOOL LOCKER ROOM RENOVATIONS PHASE II MECHANICAL VIBRATION ISOLATION AND SEISMIC RESTRAINT SYSTEMS

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain air-mounting systems. Refer to Division 23 Section HVAC General Provisions or to Division 1 Section "[Closeout Procedures] [Demonstration and Training]."

3.6 VIBRATION ISOLATION AND SEISMIC RESTRAINT SCHEDULE

| Equipment Type | Horsepower and Other | RPM | Base Type | Isolator Type | Min. Defl., in. |
|-------------------------------|-------------------------|-----|--------------|------------------|--------------------|
| Packaged Rooftop Equipment | All | All | B-3 | В | 2.0 |
| Ducted Rotating | | | | | |
| Equipment | Up to 600 | | | | |
| Small fans, fan-powered boxes | Up to 600 cfm | All | - | А | 0.50 |
| | 601 cfm & up | All | - | А | |
| | | | | | |
| | | | | | |
| | | | | | |

END OF SECTION 230548

GREENWICH PUBLIC SCHOOLS GREENWICH HIGH SCHOOL LOCKER ROOM RENOVATIONS PHASE II NOISE CONTROL AND ACOUSTICAL PERFORMANCE

SECTION 230549 NOISE CONTROL AND ACOUSTICAL PERFORMANCE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and General Provisions for Heating, Ventilating and Air Conditioning Work, including General and Supplementary Conditions and Division 1 Specification Sections apply to this Section.

1.2 SUMMARY

- A. It is the objective of this Specification to provide the necessary design requirements for the noise control measures and acoustical performance criteria for mechanical systems.
- B. Work in this section includes the providing of labor, materials, equipment and services necessary for a complete installation of sound control for every mechanical system including piping and ductwork within and on the roof of the building, complete, as shown and specified per the contract documents and all applicable codes and authorities having jurisdiction for the following:
 - 1. Sound linings
- C. Related section include the following:
 - 1. Vibration Isolation and Seismic Restraints, Section 15071.

1.3 SUBMITTAL DATA REQUIREMENTS

- A. Submit data for each product indicated.
- B. Sound Linings:
 - 1. Certification that sound lining meets erosion test method described in UL Publication No. 181.
 - 2. Certification that sound lining meets ASTM standards C1071, G21 and G22.
- C. Include product description, list of materials for each service, and locations.
- D. Submit manufacturer's installation instructions.

1.4 CODE AND REFERENCE STANDARDS

- A. Published Specifications' standards, tests or recommended methods of trade, industry or governmental organizations that apply to work in this Section.
- B. Comply with all applicable national, state and local codes. Refer to General Provisions Section for additional reference standards.
- C. ANSI/ASTM C553 Mineral Fiber Blanket And Felt Insulation.
- D. ANSI/ASTM C612 Mineral Fiber Block And Board Thermal Insulation.
- E. ASTM E84 Surface Burning Characteristics Of Building Materials.
- F. NFPA 255 Surface Burning Characteristics Of Building Materials.

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- G. UL 723 Surface Burning Characteristics Of Building Materials.
- H. UL 181 Factory-Made Air Ducts And Air Connectors
- I. ASTM C1071-00 Standard Specification For Fibrous Glass Duct Lining Insulation
- J. ASTM C423-02 Standard Test Method For Sound Absorption And Sound Absorption Coefficients By The Reverberation Room Method
- K. ASTM E795-00 Standard Practices For Mounting Test Specimens During Sound Absorption Tests
- L. ASTM C919-02 Standard Practice For Use Of Sealants In Acoustical Applications
- M. NFPA 90A Standard For The Installation Of Air-Conditioning And Ventilating Systems
- N. NFPA 90B Standard For The Installation Of Warm Air Heating And Air-Conditioning Systems
- O. ARI 885-98 Procedure For Estimating Occupied Space Sound Levels In The Application Of Air Terminals And Air Outlets
- P. ASTM E1414-91 Standard Test Method For Airborne Sound Attenuation Between Rooms Sharing A Common Ceiling Plenum.
- 1.5 QUALITY ASSURANCE
 - A. Applicator: Company specializing in sound trap construction with five years minimum experience.
 - B. Acoustical Criteria:
 - 1. Noise levels due to equipment and ductwork shall permit attaining sound pressure levels in all 8 octave bands in occupied spaces conforming to noise Criteria (NC) curves as follows:

| | NC- |
|--|-----|
| | 40 |
| All spaces | |
| All spaces | |
| | |
| Except below: | |
| 1 | |
| | NC- |
| | 35 |
| | 35 |
| Conference Rooms | |
| | |
| Lobbies, Toilets, Corridors, Computer Terminal | |
| Rooms, Laboratories (without fume hoods), Retail | NC- |
| Tenant Spaces, Spaces within 10 feet of duct | 45 |
| | 45 |
| penetration through floor and walls of fan rooms | |
| | NC- |
| | 50 |
| Storago Looker Dooms | 20 |
| Storage, Locker Rooms | |
| | NC- |
| | 35 |
| Classrooms | |
| | |

C.

D. MECHANICAL EQUIPMENT ACOUSTICAL DESIGN PERFORMANCE

Air Distribution System:

1. Pressure Reducing Device Noise: Maximum permissible sound-power levels in octave bands of airborne transmission through the combination of grille, registers, diffusers, and terminal units or related pressure reducing devices, when operated at the maximum inlet pressure and cfm in installed condition per plans and specifications shall be as follows:

AIR DISTRIBUTION SYSTEM EQUIPMENT/TERMINAL DEVICE NOISE

MAX PWL (dB re 10-12 Watt)

| Octave Band | NC-30 | NC-35 | NC-40 | NC-45 | NC-50+ |
|----------------|-------|-------|-------|-------|--------|
| 1 | 58 | 62 | 66 | 68 | 70 |
| 2 | 50 | 56 | 60 | 63 | 66 |
| 3 | 45 | 49 | 54 | 58 | 62 |
| 4 | 41 | 46 | 51 | 56 | 61 |
| 5 | 38 | 43 | 48 | 53 | 58 |
| 6 | 37 | 42 | 47 | 52 | 57 |
| 7 | 36 | 41 | 46 | 51 | 56 |
| 8 | 37 | 42 | 47 | 52 | 57 |

2. Pressure reducing valve radiated noise, including VAV Boxes.

a. Maximum permissible radiated sound-power levels in octave bands of pressure reducing valves when operated at the maximum inlet pressure and air quantity in an installed condition over occupied spaces shall be as follows:

RADIATED SOUND POWER (dB re 10⁻¹² WATT)

| Octave Band | NC-35 | NC-40 | NC-45 | NC-50+ |
|----------------|-------|-------|-------|--------|
| 1 | 72 | 76 | 79 | 82 |
| 2 | 70 | 74 | 77 | 80 |
| 3 | 61 | 65 | 68 | 71 |
| 4 | 60 | 64 | 68 | 72 |
| 5 | 57 | 62 | 68 | 72 |
| 6 | 56 | 60 | 65 | 70 |
| 7 | 66 | 70 | 75 | 80 |
| 8 | 65 | 70 | 75 | 80 |

- 3. Acoustical Performance Within Equipment Spaces: Equipment room noise levels and noise transmission to adjacent buildings shall comply with all Federal, State and City Noise Ordinances.
- 4. Motor Acoustical Performance:
 - a. Motor drives for pumps and refrigeration machine, when installed per plans and specifications, shall operate with noise levels not exceeding 90 dB(A).
 - b. Noise levels shall be determined in accordance with IEEE Standard #85 Test "Procedure for Airborne Noise Measurements on Rotating Electric Equipment."
- 5. Return Air Light Fixture Crosstalk: The minimum permissible noise transmission through air-light return fixtures shall be a Ceiling Attenuation Class rating of 42 tested according to ASTM E1414-91, "Standard Test Method for Airborne Sound Attenuation Between Rooms Sharing a Common Ceiling Plenum."

PRODUCTS

1.6 SOUND LINING

- A. Fibrous glass.
- B. Facing for low pressure duct liners.

Airstream Finish: neoprene or acrylic coated 100% coverage with acrylic coating with a United States Environmental Protection Agency registered anti-microbial agent proven resistant to microbial growth per ASTM Standards G21 and G22. Stenciled NFPA 90A and 90B.

- C. Facing for circular medium and high pressure duct liner: Finish: Perforated 28 percent minimum open area 24 USSG sheet metal.
- D. Where lining could be exposed to weather or other sources of moisture and in medium pressure system, protective plastic film shall be provided between air stream and fill to prevent contact of the liner material with moisture. Protective plastic film shall be Tedlar, or approved, and comply with relevant flame and smoke ratings.
- E. Protective plastic film shall be protected by a perforated inner sheet metal liner.
- F. Minimum thickness:
 - 1. In ductwork less than 10 sq. ft cross section: 1 inch.
 - 2. In ductwork greater than 10 sq. ft cross section: 2 inch.
 - 3. In plenums: 2 inch.
- G. Minimum density:
 - 1. In ductwork: 1-1/2 lb per cu ft.
 - 2. In plenums: 3 lb per cu ft.
- H. Flamespread: maximum 25.
- I. Fuel contributed and smoke developed: maximum 50.
- J. Suitable for duct velocity of 5000 fpm.
- K. Dynamic loss coefficient: maximum 1.2.
- L. K Factor: maximum 0.25 BTU in/hr/deg F/sq ft.
- M. Noise reduction coefficient: for 1 inch thick lining: minimum NRC = 0.70 when tested in accordance with ASTM C423 in Type A mounting.
- N. Similar to Johns Manville Permacote Linacoustic meeting ASTM C1071.
- O. Adhesive and Sealer:
 - 1. In conformance with NFPA 90A.
 - 2. Maximum fire hazard ratings; as specified in insulation.
 - 3. Adhesive: similar to Benjamin Foster 81-99.
 - 4. Sealer: similar to Johns Manville Superseal or Benjamin Foster 82-07.
 - 5. In conformance with ASTM C919.

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1.7 NON-HARDENING CAULKING:

- A. Guaranteed to be permanently elastic.
- B. Similar to Tremco Polybutene.
- 1.8 EXTERIOR DUCT SOUND BARRIER CONSTRUCTION:
 - A. Rigid fibrous glass; 2" thick; 6 lb/cu ft, similar to Johns Manville Type 817 Board.
 - B. Minimum 20 ga. 2-1//2@ wide metal studs.
 - C. Drywall sheet, 5/8@ thick, 42 lb/cu ft

EXECUTION

- 1.9 SOUND LININGS
 - A. Adhere duct liner to duct wall with full coverage of adhesive conforming to ASTM C919.
 - B. Secure Insulation with mechanical fasteners per SMACNA, NAIMA or duct liner manufacturer's recommendations. Pin length shall be such as to limit compression of liner.
 - C. All exposed edges of duct liner shall be factory or field coated. For systems with air flow in excess of 2,500 fpm (12.7 m/sec) a metal nosing must be installed in all liner leading edges, trailing edges, and at all seams.
 - D. Repair all unprotected penetrations, tears and rips in the surface of the liner with liner adhesive meeting ASTM C919 or Johns Manville Superseal.
 - E. Dimensions of lined ductwork are clear inside dimensions after lining has been installed.
 - F. Provide 28% open perforated metal liner and plastic film, meeting the same fire and smoke characteristics as the duct liner, between air stream and duct liner to prevent any intermingling of the air stream with the liner material.
 - G. Extent of ductwork sound linings:
 - 1. All supply and return ducts in mechanical equipment room or a minimum of 30'-0" from discharge of HVAC units, whichever is greater.
 - 2. Upstream and downstream of all fans for minimum distance of 25'-0", (8 m). Exceptions: ducts for fume hoods, bio-hazard, wet exhaust, dust collector.
 - 3. Downstream of Terminal Boxes (VAV) for a minimum distance of 15'-0".
 - 4. All plenums at intake side of return and exhaust fans (except kitchen exhaust, fume hoods, biohazard, wet exhausts and dust collectors) and discharge side of supply fans. Plenum lining shall be 2 inch thick, 3 lb density. Provide lining for plenum walls, ceilings and sheet metal floors.
 - 5. Air transfer and jumper ducts.
 - 6. All ductwork serving Conference Rooms, Meeting Rooms, Classrooms, Ballrooms and Studios.
 - 7. Where indicated on drawings.
 - 8. Exposed supply ductwork in a space that is to be painted shall be acoustically lined in lieu of external insulation.

END OF SECTION 230549

SECTION 230553 IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT

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. Equipment labels.
 - 2. Warning signs and labels.
 - 3. Stencils.
 - 4. Warning tags.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Samples: For color, letter style, and graphic representation required for each identification material and device.
- C. Equipment Label Schedule: Include a listing of all equipment to be labeled with the proposed content for each label.

1.4 COORDINATION

- A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.
- B. Coordinate installation of identifying devices with locations of access panels and doors.
- C. Install identifying devices before installing acoustical ceilings and similar concealment.

PART 2 - PRODUCTS

2.1 EQUIPMENT LABELS

- A. Metal Labels for Equipment:
 - 1. Material and Thickness: Stainless steel, 0.025-inch minimum thickness, and having predrilled or stamped holes for attachment hardware.
 - 2. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.

- 3. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
- 4. Fasteners: Stainless-steel self-tapping screws.
- 5. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.
- B. Plastic Labels for Equipment:
 - 1. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/16 inch thick, and having predrilled holes for attachment hardware.
 - 2. Letter Color: Black Background Color: White Maximum Temperature: Able to withstand temperatures up to 160 deg F.
 - 3. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
 - 4. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
 - 5. Fasteners: Stainless- self-tapping screws. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.
- C. Label Content: Include equipment's Drawing designation or unique equipment number,
- D. Equipment Label Schedule: For each item of equipment to be labeled, on 8-1/2-by-11-inch bond paper. Tabulate equipment identification number and identify Drawing numbers where equipment is indicated (plans, details, and schedules), plus the Specification Section number and title where equipment is specified. Equipment schedule shall be included in operation and maintenance data.

2.2 WARNING SIGNS AND LABELS

- A. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/16 inch thick, and having predrilled holes for attachment hardware.
- B. Letter Color: Black
- C. Background Color: Yellow
- D. Maximum Temperature: Able to withstand temperatures up to 160 deg F.
- E. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
- F. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
- G. Fasteners: Stainless-steel self-tapping screws.
- H. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.
- I. Label Content: Include caution and warning information, plus emergency notification instructions.

2.3 WARNING TAGS

- A. Warning Tags: Preprinted or partially preprinted, accident-prevention tags, of plasticized card stock with matte finish suitable for writing.
 - 1. Size [Approximately 4 by 7 inches]
 - 2. Fasteners: [Brass grommet and wire]
 - 3. Nomenclature: Large-size primary caption such as "DANGER," "CAUTION," or "DO NOT OPERATE."
 - 4. Color: Yellow background with black lettering.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Clean piping and equipment surfaces of substances that could impair bond of identification devices, including dirt, oil, grease, release agents, and incompatible primers, paints, and encapsulants.
- 3.2 EQUIPMENT LABEL INSTALLATION
 - A. Install or permanently fasten labels on each major item of mechanical equipment.
 - B. Locate equipment labels where accessible and visible.

3.3 WARNING-TAG INSTALLATION

A. Write required message on, and attach warning tags to, equipment and other items where required.

END OF SECTION 230553

SECTION 230593 TESTING, ADJUSTING, AND BALANCING FOR HVAC

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 TAB to produce design objectives for the following:
 - 1. Air Systems:
 - a. Constant-volume air systems.
 - b. Variable-air-volume systems.
 - 2. Exhaust hood airflow balancing.
 - 3. Verifying that automatic control devices are functioning properly.
 - 4. 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 indicated 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. 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.
- J. Suction Head: The height of fluid surface above the centerline of the pump on the suction side.
- K. System Effect: A phenomenon that can create undesired or unpredicted conditions that cause reduced capacities in all or part of a system.
- L. 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.
- M. TAB: Testing, adjusting, and balancing.
- N. Terminal: A point where the controlled medium, such as fluid or energy, enters or leaves the distribution system.
- O. Test: A procedure to determine quantitative performance of systems or equipment.
- P. Testing, Adjusting, and Balancing (TAB) Firm: The entity responsible for performing and reporting TAB procedures.

1.4 SUBMITTALS

- A. Qualification Data: Within [15] days from Contractor's Notice to Proceed, submit copies of evidence that TAB firm and this Project's TAB team members meet the qualifications specified in "Quality Assurance" Article.
- B. Contract Documents Examination Report: Within 15days from Contractor's Notice to Proceed, submit copies of the Contract Documents review report as specified in Part 3.
- C. Strategies and Procedures Plan: Within 30 days from Contractor's Notice to Proceed, submit 2 copies of 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 two copies of reports prepared, as specified in this Section, on approved forms certified by TAB firm.
- E. Sample Report Forms: Submit two sets of sample TAB report forms.
- F. Warranties specified in this Section.

1.5 QUALITY ASSURANCE

- A. TAB Firm Qualifications: Engage a TAB firm certified by AABC, NEBB, or TABB.
- 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." Edit first paragraph below if Project scope justifies requirements, which can be imposed even if firm certification is not required.
- E. Instrumentation Type, Quantity, and Accuracy: As described in AABC's "National Standards for Testing and Balancing Heating, Ventilating, and Air Conditioning Systems.
- F. Instrumentation Calibration: Calibrate instruments at least every six months or more frequently if required by instrument manufacturer.
 - 1. Keep an updated record of instrument calibration that indicates date of calibration and the name of party performing instrument calibration.

1.6 PROJECT CONDITIONS

A. 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.

1.7 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.

1.8 WARRANTY

A. National Project Performance Guarantee: Provide a guarantee on AABC's "National Standards for Testing and Balancing Heating, Ventilating, and Air Conditioning Systems" forms stating that AABC FULLER AND D'ANGELO, PC ARCHITECTS AND PLANNERS will assist in completing requirements of the Contract Documents if TAB firm fails to comply with the Contract Documents. 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.

PART 2 - PRODUCTS (Not Applicable)

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 01 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 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 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 terminal units, such as variable-air-volume boxes, to verify that they are accessible and their controls are connected and functioning.
- L. Examine plenum ceilings used for supply air to verify that they are airtight. Verify that pipe penetrations and other holes are sealed.
- M. Examine strainers for clean screens and proper perforations.
- N. Examine heat-transfer coils for correct piping connections and for clean and straight fins.
- 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 variable-air-volume terminals.
 - 4. Thermostats 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 indicated 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 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 and this Section.
- B. Cut insulation, ducts, 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 insulation Specifications for this Project.
- C. Mark equipment and balancing device settings with paint or other suitable, permanent identification material, including damper-control positions, 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. 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.
- B. Prepare schematic diagrams of systems' "as-built" duct layouts.
- C. For variable-air-volume systems, develop a plan to simulate diversity.
- D. Determine the best locations in main and branch ducts for accurate duct airflow measurements.
- E. Check 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. For supply air systems with independent relief fans, balance supply and corresponding relief fans at the same time. Relief fan shall run in normal occupied mode, constant or variable volume, according to the sequence of operations during the supply air system balancing.

3.5 PROCEDURES FOR CONSTANT-VOLUME AIR SYSTEMS

- A. Adjust fans to deliver total indicated airflows within the maximum allowable fan speed listed by 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. 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.
 - 3. 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.
 - 4. 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 submain 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 submain and branch ducts to indicated 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 VARIABLE-AIR-VOLUME SYSTEMS

- A. Compensating for Diversity: When the total airflow of all terminal units is more than the indicated airflow of the fan, place a selected number of terminal units at a maximum set-point airflow condition until the total airflow of the terminal units equals the indicated airflow of the fan. Select the reduced airflow terminal units so they are distributed evenly among the branch ducts.
- B. Pressure-Independent, Variable-Air-Volume Systems: After the fan systems have been adjusted, adjust the variable-air-volume systems as follows:
 - 1. Set outside-air dampers at minimum, and return- and exhaust-air dampers at a position that simulates full-cooling load. Minimum position for outside air damper is the minimum airflow scheduled as measured by the airflow monitoring station.
 - 2. Select the terminal unit that is most critical to the supply-fan airflow and static pressure. Measure static pressure. Adjust system static pressure so the entering static pressure for the critical terminal unit is not less than the sum of terminal-unit manufacturer's recommended minimum inlet static pressure plus the static pressure needed to overcome terminal-unit discharge system losses.
 - 3. Measure total system airflow. Adjust to within indicated airflow.
 - 4. Set terminal units at maximum airflow and adjust controller or regulator to deliver the designed maximum airflow. Use terminal-unit manufacturer's written instructions to make this adjustment. When total airflow is correct, balance the air outlets downstream from terminal units as described for constant-volume air systems.
 - 5. Set terminal units at minimum airflow and adjust controller or regulator to deliver the designed minimum airflow. Check air outlets for a proportional reduction in airflow as described for constant-volume air systems. Verify minimum outside air is maintained as measured by the airflow monitoring station. Make adjustments as necessary.
 - a. If air outlets are out of balance at minimum airflow, report the condition but leave outlets balanced for maximum airflow.
 - 6. Remeasure the return airflow to the fan while operating at maximum return airflow and minimum outside airflow. Adjust the fan and balance the return-air ducts and inlets as described for constant-volume air systems.
 - 7. Measure static pressure at the most critical terminal unit and adjust the static-pressure controller at the main supply-air sensing station to ensure that adequate static pressure is maintained at the most critical unit.
 - 8. Record the final fan performance data.

3.7 REUSE OF EXISTING EQUIPMENT:

- A. Existing system survey
 - 1. Prior to start of construction, contractor to perform existing conditions survey of systems to be reused and prepare complete report indicating physical condition of units and accessories and note any repairs required beyond items included in design documents to restore equipment to a fully operational condition. Report to be submitted to engineer for review and any corrective action. Coordinate this work with any new or refurbishment work listed in the specifications or plans.

- 2. Provide a unit price list to be submitted with your bid for the repair of all internal components of all equipment to be reused as well as all accessories.
- 3. Upon completion of the project, the contractor shall warranty all reused equipment for one (1) year.

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.
- C. Shut off makeup water for the duration of the test, and verify that makeup and blowdown systems are fully operational after tests and before leaving the equipment. Perform the following tests and record the results:
 - 1. Measure condenser-water flow to each cell of the cooling tower.
 - 2. Measure entering- and leaving-water temperatures.
 - 3. Measure wet- and dry-bulb temperatures of entering air.
 - 4. Measure wet- and dry-bulb temperatures of leaving air.
 - 5. Measure condenser-water flow rate recirculating through the cooling tower.
 - 6. Measure cooling tower pump discharge pressure.
 - 7. Adjust water level and feed rate of makeup-water system.

3.9 PROCEDURES FOR HEAT-TRANSFER COILS

- A. Water Coils: Measure the following data for each coil:
 - 1. Entering- and leaving-water temperature.
 - 2. Water flow rate.
 - 3. Water pressure drop.
 - 4. Dry-bulb temperature of entering and leaving air.
 - 5. Wet-bulb temperature of entering and leaving air for cooling coils.
 - 6. Airflow.
 - 7. Air pressure drop.
- B. Electric-Heating Coils: Measure the following data for each coil:
 - 1. Nameplate data.
 - 2. Airflow.
 - 3. Entering- and leaving-air temperature at full load.

- 4. Voltage and amperage input of each phase at full load and at each incremental stage.
- 5. Calculated kilowatt at full load.
- 6. Fuse or circuit-breaker rating for overload protection.
- C. 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.

3.10 PROCEDURES FOR TEMPERATURE MEASUREMENTS

- A. During TAB, report the need for adjustment in temperature regulation within the automatic temperaturecontrol system.
- B. Measure indoor wet- and dry-bulb temperatures every other hour for a period of two successive eighthour 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.

3.11 PROCEDURES FOR EXHAUST HOODS

- A. Measure, adjust, and record the airflow of each exhaust hood. Measure airflow by duct Pitot-tube traverse. If a duct Pitot-tube traverse is not possible, explain why, in the report, and explain the test method used.
- B. After balancing is complete, do the following:
 - 1. Measure and record the static pressure at the hood exhaust-duct connection.
 - 2. Check the hood for capture and containment of smoke using a smoke emitting device. Observe the smoke pattern. Make adjustments to achieve optimum results.

3.12 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.

3.13 TOLERANCES

- A. Set HVAC system airflow and water flow rates within the following tolerances:
 - 1. Supply, Return, and Exhaust Fans and Equipment with Fans: Plus 5 to plus 10 percent.
 - 2. Air Outlets and Inlets: 0 to minus 10 percent.
 - 3. Heating-Water Flow Rate: 0 to minus 10 percent.
 - 4. Cooling-Water Flow Rate: 0 to minus 5 percent.

3.14 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.

3.15 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 instruments used for procedures, along with proof of calibration.
- C. Final Report Contents: In addition to certified field report data, include the following:

- 1. Fan curves.
- 2. Manufacturers' test data.
- 3. Field test reports prepared by system and equipment installers.
- 4. Other information relative to equipment performance, but do not include Shop Drawings and Product Data.
- D. General Report Data: In addition to 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 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. Fan drive settings including settings and percentage of maximum pitch diameter.
 - e. Settings for supply-air, static-pressure controller.
 - f. Other system operating conditions that affect performance.
- E. Rooftop Unit Test Reports:
 - 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. Outside airflow in cfm.
 - i. Return airflow in cfm.
 - j. Outside-air damper position.
 - k. Return-air damper position.
- F. 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 o.c.
 - 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. Refrigerant expansion valve and refrigerant types.
 - i. Refrigerant suction pressure in psig.
 - j. Refrigerant suction temperature in deg F.

- G. Fan Test Reports: For 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.
- H. 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.
- I. Instrument Calibration Reports:
 - 1. Report Data:
 - a. Instrument type and make.
 - b. Serial number.
 - c. Application.
 - d. Dates of use.
 - e. Dates of calibration.

3.16 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, inspecting, and adjusting during near-peak summer and winter conditions.

END OF SECTION 230593

SECTION 230700 HVAC 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. Insulation Materials:
 - a. Mineral fiber.
- 2. Factory-applied jackets.
- 3. Field-applied fabric-reinforcing mesh.
- 4. Field-applied cloths.
- 5. Field-applied jackets.
- 6. Tapes.
- 7. Securements.
- 8. Corner angles.
- B. Related Sections:
 - 1. Division 23 Section "General Provisions for HVAC Work."
 - 2. Division 23 Section "Metal Ducts."

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated. Include thermal conductivity, thickness, and jackets (both factory and field applied, if any).
- B. Shop Drawings:
 - 1. Detail application at linkages of control devices.
 - 2. Detail field application for each equipment type.

1.4 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. Fire-Test-Response Characteristics: Insulation and related materials shall have fire-test-response characteristics indicated, as determined by testing identical products per 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 and inspecting 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.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Packaging: Insulation material containers shall be marked by manufacturer with appropriate ASTM standard designation, type and grade, and maximum use temperature.

1.6 COORDINATION

A. Coordinate clearance requirements duct Installer for duct insulation application, and equipment Installer for equipment insulation application.

1.7 SCHEDULING

A. Schedule insulation application after pressure testing systems. Insulation application may begin on segments that have satisfactory test results.

1.8 DEFINITIONS

- A. Indoor Exposed: Indoor ducts, or equipment located in mechanical equipment rooms and in areas which will be visible without removing ceilings or opening access panels.
 - B. Indoor Concealed: Indoor ducts or equipment which are not exposed to the weather.
 - C. Outdoor: All Ducts, piping or equipment which is exposed to the weather.

PART 2 - PRODUCTS

2.1 INSULATION MATERIALS

- A. Comply with requirements in Part 3 schedule articles for where insulating materials shall be applied. Refer to paragraph 3.14 for insulation schedules.
- B. Products shall not contain asbestos, lead, mercury, or mercury compounds.
- C. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871.
- D. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.
- E. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.

- F. Mineral-Fiber Blanket Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 553, Type II and ASTM C 1290, Type III with factory-applied FSK jacket. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. CertainTeed Corp.; Duct Wrap.
 - b. Johns Manville; Microlite.
 - c. Knauf Insulation; Duct Wrap.
 - d. Owens Corning; All-Service Duct Wrap.
- G. Mineral-Fiber Board Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 612, Type IA or Type IB. For duct and plenum applications, provide insulation with factory-applied FSK jacket. For equipment applications, provide insulation with factory-applied ASJ. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.
 - 1. Products: Subject to compliance with requirements, provide the following:
 - a. CertainTeed Corp.; Commercial Board.
 - b. Johns Manville; 800 Series Spin-Glas.d
 - c. Knauf Insulation; Insulation Board.
 - d. Owens Corning; Fiberglas 700 Series.

2.2 ADHESIVES

- A. 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.
- B. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.
 - 1. Products: Subject to compliance with requirements, provide the following:
 - a. Childers Products, Division of ITW; CP-82.
 - b. Foster Products Corporation, H. B. Fuller Company; 85-20.
 - c. ITW TACC, Division of Illinois Tool Works; S-90/80.
 - d. Marathon Industries, Inc.; 225.
 - e. Mon-Eco Industries, Inc.; 22-25.
- C. ASJ Adhesive, and FSK and PVDC Jacket Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.
 - 1. Products: Subject to compliance with requirements, provide the following:
 - a. Childers Products, Division of ITW; CP-82.
 - b. Foster Products Corporation, H. B. Fuller Company; 85-20.
 - c. ITW TACC, Division of Illinois Tool Works; S-90/80.
 - d. Marathon Industries, Inc.; 225.
 - e. Mon-Eco Industries, Inc.; 22-25.

2.3 MASTICS

- A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-C-19565C, Type II.
- B. Vapor-Barrier Mastic: Water based; suitable for indoor and outdoor use on below ambient services.
 - 1. Products: Subject to compliance with requirements, provide the following:
 - a. Childers Products, Division of ITW; CP-35.
 - b. Foster Products Corporation, H. B. Fuller Company; 30-90.
 - c. ITW TACC, Division of Illinois Tool Works; CB-50.

GREENWICH PUBLIC SCHOOLS GREENWICH HIGH SCHOOL LOCKER ROOM RENOVATIONS PHASE II HVAC INSULATION

- d. Marathon Industries, Inc.; 590.
- e. Mon-Eco Industries, Inc.; 55-40.
- f. Vimasco Corporation; 749.
- 2. Water-Vapor Permeance: ASTM E 96, Procedure B, 0.013 perm at 43-mil dry film thickness.
- 3. Service Temperature Range: Minus 20 to plus 180 deg F.
- 4. Solids Content: ASTM D 1644, 59 percent by volume and 71 percent by weight.
- 5. Color: White.

2.4 SEALANTS

- A. Joint Sealants:
- B. FSK and Metal Jacket Flashing Sealants:
 - 1. Products: Subject to compliance with requirements, provide the following :
 - a. Childers Products, Division of ITW; CP-76-8.
 - b. Foster Products Corporation, H. B. Fuller Company; 95-44.
 - c. Marathon Industries, Inc.; 405.
 - d. Mon-Eco Industries, Inc.; 44-05.
 - e. Vimasco Corporation; 750.
 - 2. Materials shall be compatible with insulation materials, jackets, and substrates.
 - 3. Fire- and water-resistant, flexible, elastomeric sealant.
 - 4. Service Temperature Range: Minus 40 to plus 250 deg F.
 - 5. Color: Aluminum.
- C. ASJ Flashing Sealants, and Vinyl, PVDC, and PVC Jacket Flashing Sealants:
 - 1. Products: Subject to compliance with requirements, provide the following :
 - a. Childers Products, Division of ITW; CP-76.
 - 2. Materials shall be compatible with insulation materials, jackets, and substrates.
 - 3. Fire- and water-resistant, flexible, elastomeric sealant.
 - 4. Service Temperature Range: Minus 40 to plus 250 deg F.
 - 5. Color: White.

2.5 FACTORY-APPLIED JACKETS

- A. Insulation system schedules indicate factory-applied jackets on various applications. When factoryapplied jackets are indicated, comply with the following:
 - 1. ASJ: White, kraft-paper, fiberglass-reinforced scrim with aluminum-foil backing; complying with ASTM C 1136, Type I.
 - 2. ASJ-SSL: ASJ with self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip; complying with ASTM C 1136, Type I.
 - 3. FSK Jacket: Aluminum-foil, fiberglass-reinforced scrim with kraft-paper backing; complying with ASTM C 1136, Type II.
 - 4. FSP Jacket: Aluminum-foil, fiberglass-reinforced scrim with polyethylene backing; complying with ASTM C 1136, Type II.
 - 5. Vinyl Jacket: White vinyl with a permeance of 1.3 perms when tested according to ASTM E 96, Procedure A, and complying with NFPA 90A and NFPA 90B.

2.6 TAPES

- A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C 1136.
 - 1. Products: Subject to compliance with requirements, provide the following :
 - a. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0835.
 - b. Compac Corp.; 104 and 105.
 - c. Ideal Tape Co., Inc., an American Biltrite Company; 428 AWF ASJ.
 - d. Venture Tape; 1540 CW Plus, 1542 CW Plus, and 1542 CW Plus/SQ.
 - 2. Width: 3 inches.
 - 3. Thickness: 11.5 mils.
 - 4. Adhesion: 90 ounces force/inch in width.
 - 5. Elongation: 2 percent.
 - 6. Tensile Strength: 40 lbf/inch in width.
 - 7. ASJ Tape Disks and Squares: Precut disks or squares of ASJ tape.
- B. FSK Tape: Foil-face, vapor-retarder tape matching factory-applied jacket with acrylic adhesive; complying with ASTM C 1136.
 - 1. Products: Subject to compliance with requirements, provide the following :
 - a. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0827.
 - b. Compac Corp.; 110 and 111.
 - c. Ideal Tape Co., Inc., an American Biltrite Company; 491 AWF FSK.
 - d. Venture Tape; 1525 CW, 1528 CW, and 1528 CW/SQ.
 - 2. Width: 3 inches.
 - 3. Thickness: 6.5 mils.
 - 4. Adhesion: 90 ounces force/inch in width.
 - 5. Elongation: 2 percent.
 - 6. Tensile Strength: 40 lbf/inch in width.
 - 7. FSK Tape Disks and Squares: Precut disks or squares of FSK tape.
- C. Aluminum-Foil Tape: Vapor-retarder tape with acrylic adhesive.
 - Products: Subject to compliance with requirements, provide the following :
 - a. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0800.
 - b. Compac Corp.; 120.
 - c. Ideal Tape Co., Inc., an American Biltrite Company; 488 AWF.
 - d. Venture Tape; 3520 CW.
 - 2. Width: 2 inches.
 - 3. Thickness: 3.7 mils.
 - 4. Adhesion: 100 ounces force/inch in width.
 - 5. Elongation: 5 percent.
 - 6. Tensile Strength: 34 lbf/inch in width.

2.7 SECUREMENTS

A. Bands:

1.

- 1. Products: Subject to compliance with requirements, provide the following :
 - a. Childers Products; Bands.
 - b. PABCO Metals Corporation; Bands.
 - c. RPR Products, Inc.; Bands.
- 2. Stainless Steel: ASTM A 167 or ASTM A 240/A 240M, Type 304 or Type 316; 0.015 inch thick, 1/2 inch wide with wing or closed seal.
- 3. Aluminum: ASTM B 209, Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch thick, 1/2 inch wide with wing or closed seal.

- 4. Springs: Twin spring set constructed of stainless steel with ends flat and slotted to accept metal bands. Spring size determined by manufacturer for application.
- B. Insulation Pins and Hangers:

a.

- 1. Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitordischarge welding, 0.106-inch- diameter shank, length to suit depth of insulation indicated.
 - a. Products: Subject to compliance with requirements, provide the following :
 - 1) AGM Industries, Inc.; CWP-1.
 - 2) GEMCO; CD.
 - 3) Midwest Fasteners, Inc.; CD.
 - 4) Nelson Stud Welding; TPA, TPC, and TPS.
- 2. Cupped-Head, Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, 0.135-inch- diameter shank, length to suit depth of insulation indicated with integral 1-1/2-inch galvanized carbon-steel washer.
 - Products: Subject to compliance with requirements, provide the following :
 - 1) AGM Industries, Inc.; CWP-1.
 - 2) GEMCO; Cupped Head Weld Pin.
 - 3) Midwest Fasteners, Inc.; Cupped Head.
 - 4) Nelson Stud Welding; CHP.
- 3. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch- thick, aluminum sheet, with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches in diameter.
 - a. Products: Subject to compliance with requirements, provide the following :
 - 1) AGM Industries, Inc.; RC-150.
 - 2) GEMCO; R-150.
 - 3) Midwest Fasteners, Inc.; WA-150.
 - 4) Nelson Stud Welding; Speed Clips.
 - b. Protect ends with capped self-locking washers incorporating a spring steel insert to ensure permanent retention of cap in exposed locations.
- 4. Nonmetal Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch- thick nylon sheet, with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches in diameter.
 - a. Products: Subject to compliance with requirements, provide the following :
 - 1) GEMCO.
 - 2) Midwest Fasteners, Inc.
- C. Wire: 0.062-inch soft-annealed, stainless steel.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. C & F Wire.
 - b. Childers Products.
 - c. PABCO Metals Corporation.
 - d. RPR Products, Inc.

2.8 CORNER ANGLES

- A. PVC Corner Angles: 30 mils thick, minimum 1 by 1 inch, PVC according to ASTM D 1784, Class 16354-C. White or color-coded to match adjacent surface.
- B. Aluminum Corner Angles: 0.040 inch thick, minimum 1 by 1 inch, aluminum according to ASTM B 209, Alloy 3003, 3005, 3105 or 5005; Temper H-14.

C. Stainless-Steel Corner Angles: 0.024 inch thick, minimum 1 by 1 inch, stainless steel according to ASTM A 167 or ASTM A 240/A 240M, Type 304.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions for compliance with requirements for installation and other conditions affecting performance of insulation application.
 - 1. Verify that systems and equipment to be insulated have been tested and are free of defects.
 - 2. Verify that surfaces to be insulated are clean and dry.
 - 3. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.
- B. Mix insulating cements with clean potable water; if insulating cements are to be in contact with stainlesssteel surfaces, use demineralized water.

3.3 GENERAL INSTALLATION REQUIREMENTS

- A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of equipment, ducts and fittings.
- B. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of equipment, duct system, as specified in insulation system schedules.
- C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.
- D. Install insulation with longitudinal seams at top and bottom of horizontal runs.
- E. Install multiple layers of insulation with longitudinal and end seams staggered.
- F. Keep insulation materials dry during application and finishing.
- G. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.
- H. Install insulation with least number of joints practical.
- I. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.
 - 1. Install insulation continuously through hangers and around anchor attachments.
 - 2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.

- 3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
- J. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.
- K. Install insulation with factory-applied jackets as follows:
 - 1. Draw jacket tight and smooth.
 - 2. Cover circumferential joints with 3-inch- wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches o.c.
 - 3. Overlap jacket longitudinal seams at least 1-1/2 inches. Install insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 2 inches o.c.
 - a. For below ambient services, apply vapor-barrier mastic over staples.
 - 4. Cover joints and seams with tape as recommended by insulation material manufacturer to maintain vapor seal.
 - 5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to duct and pipe flanges and fittings.
- L. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.
- M. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.
- N. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.
- O. For above ambient services, do not install insulation to the following:
 - 1. Vibration-control devices.
 - 2. Testing agency labels and stamps.
 - 3. Nameplates and data plates.
 - 4. Manholes.
 - 5. Handholes.
 - 6. Cleanouts.

3.4 PENETRATIONS

- A. Insulation Installation at Roof Penetrations: Install insulation continuously through roof penetrations.
 - 1. Seal penetrations with flashing sealant.
 - 2. For applications requiring only indoor insulation, terminate insulation above roof surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
 - 3. Extend jacket of outdoor insulation outside roof flashing at least 2 inches below top of roof flashing.
 - 4. Seal jacket to roof flashing with flashing sealant.
- B. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.
 - 1. Seal penetrations with flashing sealant.
 - 2. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.

- 3. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches.
- 4. Seal jacket to wall flashing with flashing sealant.
- C. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.
- D. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Install insulation continuously through penetrations of fire-rated walls and partitions. Terminate insulation at fire damper sleeves for fire-rated wall and partition penetrations. Externally insulate damper sleeves to match adjacent insulation and overlap duct insulation at least 2 inches.
 - 1. Comply with requirements in Division 07 Section "Penetration Firestopping" irestopping and fireresistive joint sealers.

3.5 MINERAL-FIBER INSULATION INSTALLATION

- A. Blanket Insulation Installation on Ducts and Plenums: Secure with adhesive and insulation pins.
 - 1. Apply adhesives according to manufacturer's recommended coverage rates per unit area, for 100 percent coverage of duct and plenum surfaces.
 - 2. Apply adhesive to entire circumference of ducts and to all surfaces of fittings and transitions.
 - 3. Install either capacitor-discharge-weld pins and speed washers or cupped-head, capacitordischarge-weld pins on sides and bottom of horizontal ducts and sides of vertical ducts as follows:
 - a. On duct sides with dimensions 18 inches and smaller, place pins along longitudinal centerline of duct. Space 3 inches maximum from insulation end joints, and 16 inches o.c.
 - b. On duct sides with dimensions larger than 18 inches, place pins 16 inches o.c. each way, and 3 inches maximum from insulation joints. Install additional pins to hold insulation tightly against surface at cross bracing.
 - c. Pins may be omitted from top surface of horizontal, rectangular ducts and plenums.
 - d. Do not overcompress insulation during installation.
 - e. Impale insulation over pins and attach speed washers.
 - f. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.
 - 4. For ducts and plenums with surface temperatures below ambient, install a continuous unbroken vapor barrier. Create a facing lap for longitudinal seams and end joints with insulation by removing 2 inches from 1 edge and 1 end of insulation segment. Secure laps to adjacent insulation section with 1/2-inch outward-clinching staples, 1 inch o.c. Install vapor barrier consisting of factory- or field-applied jacket, adhesive, vapor-barrier mastic, and sealant at joints, seams, and protrusions.
 - a. Repair punctures, tears, and penetrations with tape or mastic to maintain vapor-barrier seal.
 - b. Install vapor stops for ductwork and plenums operating below 50 deg F at 18-foot intervals. Vapor stops shall consist of vapor-barrier mastic applied in a Z-shaped pattern over insulation face, along butt end of insulation, and over the surface. Cover insulation face and surface to be insulated a width equal to 2 times the insulation thickness but not less than 3 inches.
 - 5. Overlap unfaced blankets a minimum of 2 inches on longitudinal seams and end joints. At end joints, secure with steel bands spaced a maximum of 18 inches o.c.
 - 6. Install insulation on rectangular duct elbows and transitions with a full insulation section for each surface. Install insulation on round and flat-oval duct elbows with individually mitered gores cut to fit the elbow.
 - 7. Insulate duct stiffeners, hangers, and flanges that protrude beyond insulation surface with 6-inchwide strips of same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with pins spaced 6 inches o.c.

- B. Board Insulation Installation on Ducts and Plenums: Secure with adhesive and insulation pins.
 - 1. Apply adhesives according to manufacturer's recommended coverage rates per unit area, for 100 percent coverage of duct and plenum surfaces.
 - 2. Apply adhesive to entire circumference of ducts and to all surfaces of fittings and transitions.
 - 3. Install either capacitor-discharge-weld pins and speed washers or cupped-head, capacitordischarge-weld pins on sides and bottom of horizontal ducts and sides of vertical ducts as follows:
 - a. On duct sides with dimensions 18 inches and smaller, place pins along longitudinal centerline of duct. Space 3 inches maximum from insulation end joints, and 16 inches o.c.
 - b. On duct sides with dimensions larger than 18 inches, space pins 16 inches o.c. each way, and 3 inches maximum from insulation joints. Install additional pins to hold insulation tightly against surface at cross bracing.
 - c. Pins may be omitted from top surface of horizontal, rectangular ducts and plenums.
 - d. Do not overcompress insulation during installation.
 - e. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.
 - 4. For ducts and plenums with surface temperatures below ambient, install a continuous unbroken vapor barrier. Create a facing lap for longitudinal seams and end joints with insulation by removing 2 inches from 1 edge and 1 end of insulation segment. Secure laps to adjacent insulation section with 1/2-inch outward-clinching staples, 1 inch o.c. Install vapor barrier consisting of factory- or field-applied jacket, adhesive, vapor-barrier mastic, and sealant at joints, seams, and protrusions.
 - a. Repair punctures, tears, and penetrations with tape or mastic to maintain vapor-barrier seal.
 - b. Install vapor stops for ductwork and plenums operating below 50 deg F at 18-foot intervals. Vapor stops shall consist of vapor-barrier mastic applied in a Z-shaped pattern over insulation face, along butt end of insulation, and over the surface. Cover insulation face and surface to be insulated a width equal to 2 times the insulation thickness but not less than 3 inches.
 - 5. Install insulation on rectangular duct elbows and transitions with a full insulation section for each surface. Groove and score insulation to fit as closely as possible to outside and inside radius of elbows. Install insulation on round and flat-oval duct elbows with individually mitered gores cut to fit the elbow.
 - 6. Insulate duct stiffeners, hangers, and flanges that protrude beyond insulation surface with 6-inchwide strips of same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with pins spaced 6 inches o.c.

3.6 DUCT INSULATION SCHEDULE, GENERAL

- A. Plenums and Ducts Requiring Insulation:
 - 1. Indoor, concealed supply and outdoor air.
 - 2. Indoor, exposed supply and outdoor air.
 - 3. Indoor, concealed return.
 - 4. Indoor, exposed return.
 - 5. Indoor, concealed exhaust between isolation damper and penetration of building exterior.
 - 6. Indoor, exposed exhaust between isolation damper and penetration of building exterior.
- B. Items Not Insulated:
 - 1. Metal ducts with duct liner of sufficient thickness to comply with energy code and ASHRAE/IESNA 90.1.
 - 2. Factory-insulated flexible ducts.
 - 3. Factory-insulated plenums and casings.
 - 4. Flexible connectors.
 - 5. Vibration-control devices.
 - 6. Factory-insulated access panels and doors.

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3.7 INDOOR DUCT AND PLENUM INSULATION SCHEDULE

- A. Concealed, rectangular, supply-air duct insulation shall be the following:
 1. Mineral-Fiber Blanket: 2 inches thick and 0.75-lb/cu. ft. nominal density.
- B. Concealed, rectangular, return-air duct insulation shall be the following:
 1. Mineral-Fiber Blanket: 2 inches thick and 0.75-lb/cu. ft. nominal density.
- C. Concealed, rectangular, exhaust-air duct insulation between isolation damper and penetration of building exterior shall be the following:
 - 1. Mineral-Fiber Board: 2 inches thick and 6-lb/cu. ft. nominal density
- D. Concealed, supply-air plenum insulation shall be the following:
 1. Mineral-Fiber Board: 1-1/2 inches thick and 6-lb/cu. ft. nominal density.
- E. Concealed, return-air plenum insulation shall be the following:
 1. Mineral-Fiber Board: 1-1/2 inches thick and 6-lb/cu. ft. nominal density.
- F. Concealed, outdoor-air plenum insulation shall be the following:
 1. Mineral-Fiber Board: 2 inches thick and 6-lb/cu. ft. nominal density.
- G. Concealed, exhaust-air plenum insulation shall be the following:
 1. Mineral-Fiber Board: 2 inches thick and 6-lb/cu. ft. nominal density.
- H. Exposed, rectangular, supply-air duct insulation shall be the following:
 1. Mineral-Fiber Board: 1-1/2 inches thick and 3-lb/cu. ft. nominal density.
- I. Exposed, rectangular, return-air duct insulation shall be the following:
 1. Mineral-Fiber Board: 1-1/2 inches thick and 3-lb/cu. ft. nominal density.
- J. Exposed, rectangular, outdoor-air duct insulation shall be the following:
 1. Mineral-Fiber Board: 1-1/2 inches thick and 3-lb/cu. ft. nominal density.
- K. Exposed, rectangular, outdoor-air duct insulation (in unconditioned space) shall be the following:
 1. Mineral-Fiber Board: 1-1/2 inches thick and 6-lb/cu. ft. nominal density.
- L. Exposed, rectangular, exhaust-air duct insulation shall be the following:
 1. Mineral-Fiber Board: 1-1/2 inches thick and 3-lb/cu. ft. nominal density.
- M. Exposed, rectangular, exhaust-air duct insulation (in unconditioned space) shall be the following:
 1. Mineral-Fiber Board: 1-1/2 inches thick and 6-lb/cu. ft. nominal density.
- N. Exposed, supply-air plenum insulation (in unconditioned space) shall be the following:
 1. Mineral-Fiber Board: 1-1/2 inches thick and 6-lb/cu. ft. nominal density.
- O. Exposed, return-air plenum insulation (in unconditioned space) shall be the following:
 1. Mineral-Fiber Board: 1-1/2 inches thick and 6-lb/cu. ft. nominal density.
- P. Exposed, outdoor-air plenum insulation (in unconditioned space) shall be the following:
 1. Mineral-Fiber Board: 2 inches thick and 6-lb/cu. ft. nominal density.
- Q. Exposed, exhaust-air plenum insulation (in unconditioned space) shall be the following:
 1. Mineral-Fiber Board: 2 inches thick and 6-lb/cu. ft. nominal density.

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END OF SECTION 230700

SECTION 23 09 00 - HVAC INSTRUMENTATION AND CONTROLS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this section.

1.2 SUMMARY

A. This Section includes control equipment for HVAC systems and components, including control components for terminal heating and cooling units not supplied with factory-wired controls.

1.3 DEFINITIONS

- A.
- B. ATC: Automatic Temperature Control.
- C. BMS: Building Management System.
- D. CFM: Cubic Feet per Minute.
- E. DDC: Direct-digital controls.
- F. HVAC: Heating, Ventilating and Air Conditioning.
- G. LAN: Local area network.
- H. LCD: Liquid Crystal Display
- I. MER: Mechanical Equipment Room.
- J. PID: Proportional Integral Derivative.
- K. POT: Portable Operators Terminal.
- L. VFD: Variable Frequency Drive.

1.4 SYSTEM DESCRIPTION

- A. Control system shall consist of sensors, indicators, actuators, final control elements, interface equipment, other apparatus, accessories and software connected to distributed controllers operating in multiuser, multitasking environment on a network and programmed to control mechanical systems. An operator workstation permits interface with the network via dynamic color graphics with each mechanical system, building floor plan and control device depicted by point-and-click graphics.
- B. The new control system shall be compatible with the existing Automated Logic (ALC) WebCtrl BMS. Provide a seamless tie-in to the existing ALC BMS. Tie-in shall be made via an extension of the existing BMS local area network.

C. Furnish a totally BACnet-based system, based on a distributed control system in accordance with this specification. The operator's workstation, all controllers and all input/output devices shall communicate using the protocols and network standards as defined by the latest version of ANSI/ASHRAE Standard 135 - BACnet. In other words, all workstations and controllers shall be BACnet devices. No gateways shall be used for communication to controllers installed under this section. Gateways may be used for communication to existing systems or to systems installed under other sections. Use of proprietary protocol on any part of the network is prohibited.

1.5 SYSTEM PERFORMANCE

- A. Comply with the following performance requirements:
- B. Graphic Display: Display graphic with minimum 20 dynamic points with current data within 10 seconds.
 - 1. Graphic Refresh: Update graphic with minimum 20 dynamic points with current data within 8 seconds.
 - 2. Object Command: Reaction time of less than 2 seconds between operator command of a binary object and device reaction.
 - 3. Object Scan: Transmit change of state and change of analog values to control units or workstation within 6 seconds.
 - 4. Alarm Response Time: Annunciate alarm at workstation within 45 seconds. Multiple workstations must receive alarms within 5 seconds of each other.

1.6 WORK INCLUDED

- A. Furnish a complete distributed direct digital control system in accordance with this specification section. This includes all supervisory controllers, network controllers, logic controllers and all input/output devices. Items of work included are as follows:
 - 1. Provide a submittal that meets the requirements below for approval.
 - 2. Coordinate installation schedule with the mechanical contractor and general contractor.
 - 3. Provide installation of all panels and devices unless otherwise stated.
 - 4. Provide power for panels and control devices from a source designated by the electrical contractor. All 120 volt power circuits to the DDC panel(s) shall be provided by this Contractor (unless specifically shown on the electrical drawings).
 - 5. Provide all low voltage control wiring for the DDC system. All wiring of sensors and control devices including any power wiring of devices and necessary conduit shall be provided under this section of the specifications.
 - 6. Provide miscellaneous control wiring for HVAC and related systems regardless of voltage.
 - 7. Provide engineering and technician labor to program and commission software for each system and operator interface. Submit commissioning reports for approval.

- 8. Provide testing, demonstration and training as specified below.
- 9. Provide all necessary BACnet-compliant hardware and software to meet the system's functional specifications. Provide Protocol Implementation Conformance Statement (PICS) for Windows-based control software and every controller in system.
- 10. The BMS contractor shall provide an alternate price (ALT-1) to replace the existing BMS server with new. The BMS server licensing options shall allow a minimum of five (5) local workstation connections/access concurrently. The web server licensing options shall allow concurrent access by a minimum of five (5) remove browser connections. These licenses shall be in addition to the five (5) licenses assigned for local connections.
- B. The successful bidder shall provide a seamless tie-in to the existing ALC BMS. This shall include all modification as needed for the existing BMS and control points and sequence of operations defined in this specification.

1.7 SUBMITTALS

- A. One (1) submittal package shall be provided for the project that includes information for controls for all systems being provided as part of the project. Partial submittals are not acceptable and shall not be reviewed by the Engineer. For example, it is not acceptable to submit a control valve schedule as part of one package and control diagrams as part of a later package. For large projects or where partial submittals may be required to maintain the project schedule, the contractor shall coordinate a schedule for delivery of each partial submittal and the items to be contained within each submittal. It shall not be up to the contractor's discretion as to what shall be included in each partial submittal.
- B. Product Data: Include manufacturer's technical literature for each control device. Indicate dimensions, capacities, performance characteristics, electrical characteristics, finishes for materials and installation and startup instructions for each type of product indicated.
 - 1. Each control device labeled with setting or adjustable range of control.
 - 2. DDC System Hardware: Include technical data for operator workstation equipment, interface equipment, control units, transducers/transmitters, sensors, actuators, valves, relays/switches, control panels and operator interface equipment.
 - 3. Control System Software: Include technical data for operating system software, operator interface, color graphics and other third-party applications.
 - 4. Controlled Systems: Instrumentation list with element name, type of device, manufacturer, model number and product data. Include written description of sequence of operation including schematic diagram.
- C. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components and location and size of each field connection. Submittal shall include the following as a minimum:
 - 1. Schematic flow diagrams showing fans, coils, dampers, valves, instrumentation and control devices.
 - 2. Wiring Diagrams: Power, signal and control wiring.

- 3. Architecture drawing including all communication wiring, network devices, etc. Indicate type of cabling and number of conductors.
- 4. Symbol and abbreviation list for control diagrams.
- 5. Points list including hardwired and software points.
- 6. Manufacturer's technical cut sheets which include a table of contents and an associated sheet numbering system for all pages. Model number shall be circled or pointed with an arrow.
- 7. A complete bill of materials specific to each system detailing the equipment to be used, quantity, manufacturer, specific model number and tag number.
- 8. List of color graphics indicating monitored systems, data (connected and calculated) point addresses, output schedule and operator notations.
- 9. Details of control panel faces, including controls, instruments and labeling.
- 10. Schedule of dampers including size, leakage and flow characteristics.
- 11. Schedule of valves including leakage, flow characteristics, GPM, design pressure drop, actual pressure drop, design CV, calculated CV, valve body pressure rating, and close-off pressure rating at a minimum.
- 12. All shop drawings used by field personnel for the installation of equipment shall bear an Engineer's approval stamp.
- 13. Architectural floor plans indicating proposed locations of all wall-mounted devices (i.e., DDC units, control panels, sensors, thermostats, etc.) and mechanical drawings indicating proposed locations of all temperature, flow and pressure transmitters.
- 14. Qualification Data: For firms and persons specified in "Quality Assurance" Article.
- D. Data Communications Protocol Certificates: Certify that each proposed DDC system component complies with the latest version of ASHRAE 135 related to BACnet.
- E. Samples for Initial Selection: For each color required, of each type of thermostat and/or sensor cover with factory-applied color finishes.
- F. Operation and Maintenance Data: For HVAC instrumentation and control system to include in emergency, operation and maintenance manuals. In addition to items specified in Division 1 Section "Operation and Maintenance Data," include the following:
 - 1. Maintenance instructions and lists of spare parts for each type of control device.
 - 2. Keyboard illustrations and step-by-step procedures indexed for each operator function.
 - 3. Inspection period, cleaning methods, cleaning materials recommended and calibration tolerances.
 - 4. Calibration records and list of set points.

- G. The BMS Contractor shall correct any errors or omissions noted by the Owner and Engineer during review.
- H. Device substitutions shall be considered as long as they are submitted to the engineer one week in advance of the bid via a formal RFI. Contractor shall provide a technical comparison in spreadsheet format that includes, at a minimum, comparison of physical size, accuracy, drift, cost, turndown, options provided, device warranty, as applicable.

1.8 SEQUENCING AND SCHEDULING

A. Sequence and coordinate the work of this Section with the scheduling requirements and the Engineer. Review the approved schedule with the Engineer, sub-contractors, manufacturers, vendors, suppliers and all other contractors. Schedule and sequence all Work with the adjoining Work, and Work of others such that the all Work can be accomplished concurrently during the same time period.

1.9 QUALITY ASSURANCE

- A. Installer Qualifications: A qualified installer who is an authorized representative of the automatic control system manufacturer for both installation and maintenance of units required for this Project.
- B. 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.
- C. Comply with NFPA 90A, "Installation of Air Conditioning and Ventilation Systems."
- D. Materials and equipment shall be the catalogued products of manufacturers regularly engaged in production and installation of automatic temperature control systems and shall be manufacturer's latest standard design that complies with the specification requirements.
- E. All portions of the system must be designed, furnished, installed, commissioned and serviced by manufacturer-approved, factory-trained employees.
- F. Single source responsibility of supplier shall be the complete installation and proper operation of the BMS and control system and shall include debugging and proper calibration of each component in the entire system.
- G. Supplier shall have an in-place support facility within 50 miles of the site with technical staff, spare parts inventory and all necessary test and diagnostic equipment.
- H. All electronic equipment shall conform to the requirements of FCC Regulation, Part 15, Section 15, Governing Radio Frequency Electromagnetic Interference and be so labeled.
- I. BMS shall comply with UL 916 PAZX and 864 UDTZ and be so listed at the time of bid.
- J. System devices shall have UL 864 (UUKL smoke control) and shall be so certified at time of bid, if the system is being used for smoke control or life safety.
- K. All system components shall be fault-tolerant. System shall include:

- 1. Satisfactory operation without damage at 110% and 90% of rated voltage and at plus 3 Hertz variation in line frequency.
- 2. Static, transient and short-circuit protection on all inputs and outputs.
- 3. Protection for communication lines against incorrect wiring, static transients and induced magnetic interference.
- 4. Network-connected devices to be AC coupled or equivalent so that any single device failure will not disrupt or halt network communication.
- 5. All real time clocks and data file RAM to be battery-backed for a minimum 100 hours and include local and remote system low battery indication.
- L. The BMS contractor shall be regularly engaged in the installation and maintenance of BMS systems and shall meet the following qualifications.
 - 1. A minimum of 10 years of demonstrated technical expertise and experience in the installation and maintenance of BMS systems similar in size and complexity to this project.
 - 2. A minimum of 10 years experience installing the control system of the manufacturer that is to be proposed.
 - 3. Shall be a certified-to-install, direct representative of a control system manufacturer that has a minimum of 10 years experience producing control systems similar to that which is to be proposed.
 - 4. A maintained service organization consisting of at least 8 competent servicemen, within 50 miles of the project site, for a period of not less than 10 years.
 - 5. The Bidder shall not be considered qualified to bid this project unless they can provide a list of 10 projects, similar in size and scope to this project, completed within the last 4 years.
 - 6. The system manufacturer/installer shall provide an experienced project manager for this work from beginning of control installation until final completion. The project manager is responsible for direct supervision of the design, installation, start-up and commissioning of the BMS as well as attending of project meetings whenever directed by the owner, construction manager and/or mechanical contractor. It shall not be acceptable to change the project manager after the project has begun and before final completion. If the BMS manufacturer wishes to change the project manager, the construction manager and/or owner's representative must be notified immediately and both the new project manager and the previous project manager shall spend three (3) consecutive business days together on-site performing a project management switchover. Exceptions may be allowed for small projects as determined by the construction manager and/or owner's representative.
- M. Comply with all current governing codes, ordinances and regulations including UL, NFPA, the local Building Code, NEC, etc.
- N. The system shall have a documented history of compatibility by design for a minimum of 15 years. Future compatibility shall be supported for no less than 10 years. Compatibility shall be

defined as the ability for any existing control system component including but not limited to primary control panels, secondary control panels, personal operator workstations and portable operator's terminals, to be connected and directly communicate with any new BMS system equipment without bridges, routers or protocol converters.

1.10 DELIVERY, STORAGE AND HANDLING

- A. Factory-Mounted Components: Where control devices specified in this Section are indicated to be factory mounted on equipment, arrange for shipping of control devices to unit manufacturer.
- B. Provide factory shipping cartons for each piece of equipment and control device. Maintain cartons while shipping, storing and handling as required to prevent equipment damage, and to eliminate dirt and moisture from equipment. Store equipment and materials inside and protect from weather. The stored products shall be protected from the weather, humidity and temperature variations, dirt and dust, and other contaminants, within the storage condition limits published by the equipment manufacturer.
- C. System Software: Update to latest version of software at project completion.

1.11 COORDINATION

- A. Coordinate location of temperature sensors, humidity sensors and other exposed control sensors with plans and room details before installation.
- B. Coordinate installation of taps, valves, airflow stations, etc. with the mechanical contractor.
- C. Coordinate BMS equipment with all relevant divisions including, but not limited to, Fire Alarm to achieve compatibility with equipment that interfaces with that system.
- D. Coordinate BMS equipment to achieve compatibility with motor starters and annunciation devices.

1.12 EXTRA MATERIALS

A. Maintenance Materials: One (1) thermostat adjusting key.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Available Manufacturers/Authorized dealers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include:
 - 1. Automated Logic Corporation.
 - 2. Niagara Tridium
 - 3. Approved Niagara Equal

2.2 CONTROL PANELS

A. Fully enclosed, steel-rack-type cabinet with locking doors or locking removable backs. Match finish of panels and provide laminated as-built wiring diagrams, flow diagrams, etc. related to the system being controlled inside the associated cabinet. Each control panel shall be clearly

and permanently labeled with the controller designation and indication of the mechanical equipment served.

- B. Where applicable, existing primary control panel enclosures shall be reused where possible. Replacement of any control panel enclosure and sub-panel shall be included in the base contract.
- C. Unitize cabinet with suitable brackets for wall or floor mounting, located adjacent to each system under automatic control. Provide common keying for all panels.
 - 1. Fabricate panels of furniture-quality steel or extruded-aluminum alloy, totally enclosed, with hinged doors and keyed lock and with manufacturer's standard shop-painted finish. All panels shall have common keying.
 - 2. Primary control panel: Provide minimum NEMA 1 rating for indoor application and NEMA 4 rating for outdoor application or the appropriate NEMA rating for application. Electrical piping and wiring shall be penetrated through the bottom of the panel with 4 inches nipples and 4 inches wiring trough.
 - 3. Secondary control panel: Provide minimum NEMA 1 rating for indoor application.
 - 4. Size control panel enclosures for twenty percent spare mounting capacity for future expansion.
 - 5. Only one controller shall be allowed in a control panel with expansion modules if extra points are needed. The BMS vendor shall utilize the largest controller available in the product line to accommodate the points required. If maxed out, only then should a second controller be installed within the panel.
- D. Control panel shop drawings shall be submitted for each system (air handling unit, chilled water system, hot water system, etc.) for approval prior to fabrication.
- E. Coordinate installation of the control panels with the engineer/architect. Coordinate power for the panels with the electrical contractor.
- F. Control Panel Internal Components:
 - 1. Provide identification sleeves at each termination at the terminal strip.
 - 2. All control panels shall be provided with DIN Rail mounted screw terminal blocks. Field wiring shall be connected to the screw terminal blocks. It is not acceptable to terminate any field wiring directly to the DDC controller or any panel devices such as relay and transducers. The screw terminal blocks located/attached to the DDC controller alone does not comply with this requirement. Terminal blocks shall be rated for 300 volts, medium duty. Provide Phoenix Feed-through terminal block UT 2,5 or pre-approved equal.
 - 3. All control devices such as relays, transformers, transducers, power supplies, associated I/O devices, etc shall be installed inside the panel, not at the starter or electrical junction box.
 - 4. All panel wirings shall in be installed in Panduit and wiring duct. This shall include but not be limited to wiring from the DDC controller to the terminal block, between DDC

controller and relay (and other panel mounted control devices), power wiring for the controller, communication, etc.

- 5. Mounting any control devices on the back of the control panel enclosure door is not acceptable.
- 6. The use of wire nuts in the control panel enclosures is also prohibited.
- G. Power wiring and communication wiring shall be provided in separate conduits with separate hot, neutral, and ground wire runs and separate breakers.
- H. Coordinate installation of the control panels with the engineer/architect. Coordinate power for the panels with the electrical contractor.
- I. Primary Peer-to-Peer Network
 - 1. All operator workstations and primary controllers shall directly reside on a network such that communications (i.e., ability to access, edit, modify, add, delete, back up, report, trend, restore all system point database and all programs) may be executed directly between servers, primary control panels, and operator workstations on a peer-to-peer basis.
 - 2. All operator devices either network resident or connected via intranet and internet, shall have the ability to access all point status and application report data or execute control functions for any and all other devices via the primary network or the secondary network. Access to data shall be based upon logical identification of building equipment. No hardware or software limits shall be imposed on the number of devices with global access to the network data.
 - 3. The primary network shall provide the following minimum performance:
 - a. Provide high-speed data transfer rates for alarm reporting, quick report generation from multiple controllers and upload/download efficiency between network devices. System performance shall insure that an alarm occurring at any Control Panel is displayed at any PC workstation, standalone alarm printer and/or Control Panel within 5 seconds.
 - b. Support of any combination of primary control panels and operator workstations directly connected to the primary network. A minimum of 64 devices and a maximum of 100 devices shall be supported on a single primary network.
 - c. Message and alarm buffering to prevent information from being lost.
 - d. Error detection, correction and re-transmission to guarantee data integrity.
 - e. Synchronization of real-time clocks between server, primary control panels, and operator workstations, including automatic daylight savings time corrections.
 - f. Provide network wiring as required to ensure total system operation and communication without interruption, even if the network wiring is open in one (1) location.

- g. The primary network shall allow the primary control panels to access any data from, or send control commands and alarm reports directly to, any other primary control panel or combination of controllers on the network without dependence upon a central or intermediate processing device. The primary control panel shall send alarm reports to multiple operator workstations without dependence upon a central or intermediate processing device. The peer-to-peer network shall also allow any primary control panel to access, edit, modify, add, delete, back up, restore all system point database and all programs.
- h. The primary network shall allow the primary control panels to assign password access and control priorities to each system individually. The logon password (at any PC workstation or portable operator terminal) shall enable the operator to monitor, adjust and control only the system that the operator is authorized for. All other systems shall not be displayed at the PC workstation or portable terminal. Passwords and priorities for every point shall be fully programmable and adjustable.
- i. Each personal computer operator workstation shall support hardwired and dial up type primary networks.
- J. Secondary Network
 - 1. This network shall connect and support stand-alone secondary control panels and shall communicate bi-directionally with the primary network through primary control panels for transmission of global data. A sufficient number of primary control panels shall be provided for connection of secondary networks based on quantity of secondary controls panels and distance limitations.
 - 2. Secondary control panels shall be arranged on the secondary network in a functional relationship manner with the primary control panels. For example, a VAV secondary control panel on a secondary network of a primary control panel that is controlling the VAV's corresponding AHU.
 - 3. A maximum of 60 secondary control panels may be configured on an individual secondary network to insure adequate global data and alarm response times and future space capacity.
 - 4. The Secondary Network shall be connected to and communicate with the primary control panel independently.

2.3 SECONDARY CONTROL PANEL HARDWARE

- A. ASHRAE 135 Compliance: Secondary control panels shall use the latest version of BACnet/ASHRAE 135 protocol over MS/TP.
- B. Each secondary control panel shall operate as a stand-alone controller capable of performing its user selectable control routines independently of any other controller in the system. Each secondary control panel shall be a microprocessor-based, multi-tasking, real-time digital control processor.
- C. Each Primary Controller shall be able to communicate with secondary controllers over the Secondary Network to control terminal equipment only.

- D. Each secondary controller shall include all point inputs and outputs necessary to perform the specified control sequences. The secondary controller shall accept input and provide output signals that comply with industry standards. Controllers utilizing proprietary control signals shall not be acceptable. Outputs may be utilized either for 2-state, modulating, floating or proportional control, allowing for additional system flexibility.
- E. Provide a secondary control panel for each of the following types of equipment (if applicable):
 - 1. Radiant Panel
- F. Each secondary control panel shall, at a minimum, be provided with:
 - 1. Appropriate NEMA rated enclosure.
 - 2. A stand-alone real-time digital control microprocessor module.
 - 3. Secondary network communications ability.
 - 4. Power supplies as required for all associated modules, sensors, actuators, etc.
 - 5. Input/output points as required.
 - 6. Software as required for all sequences of operation, logic sequences and energy management routines. Relay logic is not acceptable.
 - 7. A portable operator terminal connection port.
 - 8. Auxiliary enclosure for analog output transducers, isolation relays, etc. Auxiliary enclosure shall be part of primary enclosure or mounted adjacent primary enclosure.
- G. Communication. Each controller shall perform its primary control function independent of other Secondary Network communication or if Secondary Network communication is interrupted. Reversion to a fail-safe mode of operation during Secondary Network interruption is not acceptable.
- H. Control Algorithms. The controller shall receive its real-time data from the Primary Controller time clock to insure Secondary Network continuity. Each controller shall include algorithms incorporating proportional, integral and derivative (PID) gains for all applications. All PID gains and biases shall be field-adjustable by the user via room sensor LCD or the portable operator's terminal as specified herein. Controllers that incorporate proportional and integral (PI) control algorithms only shall not be acceptable.
- I. Control Applications. Operating programs shall be field-selectable for specific applications. In addition, specific applications may be modified to meet the user's exact control strategy requirements, allowing for additional system flexibility. Controllers that require factory changes of all applications are not acceptable.
- J. Calibration. Each controller shall include provisions for manual and automatic calibration of the differential pressure transducer in order to maintain stable control and insuring against drift over time.

- 1. Manual calibration may be accomplished by either commanding the actuator to 0% via the POT or by depressing the room sensor override switch. Calibration of the transducer at the controller location shall not be necessary.
- K. Each secondary control panel shall continuously perform self-diagnostics on all hardware and secondary network communications. The secondary control panel shall provide both local and remote annunciation of any detected component failures or repeated failure to establish communication to the system.
- L. Controllers shall include all point inputs and outputs necessary to perform the specified control sequences. As a minimum, 50% of the point outputs shall be of the Universal type; that is, the outputs may be utilized either as modulating or two-state, allowing for additional system flexibility. In lieu of Universal outputs, provide a minimum of 50% spare outputs of each type via additional point termination boards or controllers. Analog outputs shall be industry standard signals such as 24 VAC floating control, allowing for interface to a variety of modulating actuators. Terminal equipment controllers utilizing proprietary control signals and actuators shall not be acceptable.
- M. Provide each secondary control panel with sufficient memory to accommodate point databases, operating programs, local alarming and local trending. All databases and programs shall be stored in non-volatile EEPROM, EPROM and PROM. The controllers shall be able to return to full normal operation without user intervention after a power failure of unlimited duration. Provide uninterruptible power supplies (UPSs) of sufficient capacities for all terminal controllers that do not meet this protection requirement. Operating programs shall be field-selectable for specific applications. In addition, specific applications may be modified to meet the user's exact control strategy requirements, allowing for additional system flexibility. Controllers that require factory changes of all applications are not acceptable. Controller shall have a minimum of 16K EPROM or EEPROM.
- N. The secondary control panels shall be powered from a 24 VAC source provided by this contractor and shall function normally under an operating range of 18 28 VAC (-25% 17%), allowing for power source fluctuations and voltage drops. Install plenum data line and sensor cable in accordance with local code and NEC. The BMS contractor shall provide a dedicated power source and separate isolation transformer for each controller to function normally under the specified operating range. The controllers shall also function normally under ambient conditions of $32^{\circ} 122^{\circ}$ F (0° 50°C) and 10% 95% RH (non-condensing). Provide each controller with a suitable cover or enclosure to protect the intelligence board assembly. Power supply must be rated at a minimum of 125% of power consumption and shall be of the fused or current limiting type. The BMS contractor shall provide 24 VAC power to the terminal units by utilizing:
 - 1. The existing line voltage power trunk and installing separate isolation transformers for each controller.
 - 2. Dedicated line voltage power source and isolation transformers at a central location and installing 24 VAC power trunk to supply multiple controllers in the area.
- O. Environment. The controllers shall function normally under ambient conditions of 32° 122°F (0° 50°C) and 10% 95% RH (non-condensing). Provide each controller with a suitable cover or enclosure to protect the circuit board assembly.

P. Immunity to noise. Operation shall be protected against electrical noise of 5 – 120Hz and from keyed radios up to 5W at 1m (3').

2.4 SECONDARY CONTROL PANEL SOFTWARE

- A. Provide all necessary software for a complete operating system as required. All software shall reside in each secondary control panel. Secondary control panels shall not be dependent upon any higher level computer or another controller for operation.
- B. Secondary control panel software configured for CAV or VAV control algorithms shall include provisions for manual and automatic calibration of attached differential pressure transducer in order to maintain stable control and insuring against drift over time. Calibration shall be accomplished by stroking the terminal unit damper actuator to a 0% position so that a 0 CFM air volume reading is sensed. The controller shall automatically accomplish this whenever the system mode switches from occupied to unoccupied or vice versa. Manual calibration may be accomplished by either commanding the actuator to 0% via the POT or by depressing the room sensor override switch. Calibration of the transducer at the controller location shall not be necessary.
- C. Each secondary controller shall perform its primary control function independent of primary controller LAN communication, or if LAN communication is interrupted. Reversion to a fail-safe mode of operation during LAN interruption is not acceptable. The controller shall receive its real-time data from the primary control panel time clock to insure LAN continuity. Each controller shall include algorithms incorporating proportional, integral and derivative (PID) control for all applications. All PI parameters shall be field-adjustable by the user via a portable operator's terminal.
- D. Secondary control panels shall support pressure independent terminal boxes including VAV cooling only, VAV with hot water or electric reheat, Fan-powered VAV and Fan-powered VAV with hot water or electric reheat. All VAV box control applications shall be field-selectable such that a single controller may be used in conjunction with any of the above types of terminal units to perform the specified sequences of control. This requirement must be met in order to allow for future design and application changes and to facilitate system expansions. Controllers that require factory application changes are not acceptable.

2.5 BACNET DEVICE OBJECTS

- A. The BAS manufacturer's representative shall submit a BACnet Device Object Naming Convention Plan (DONCP) to the owner and consulting engineer during the submittal process. The plan must be approved by the owner and consulting engineer prior to implementation. It is the responsibility of the BAS contractor to coordinate the DONCP with the owner and consulting engineer.
- B. The DONCP shall be designed to eliminate any confusion between individual points in a facility/campus wide BMS system. It will also be designed to allow for future expansion and consistency. Each device on the BACnet network (including other manufacturer's devices) must have a unique device instance. This is a major consideration when adding to an existing system or interconnecting networks. Thorough and accessible site documentation is critical.
- C. A consistent object (point) naming convention shall be used to facilitate familiarity and operational ease across an eventual large campus or inventory of facilities. The following

section is designed as recommendations only. It is the responsibility of the BMS contractor to coordinate the DONCP with the owner and consulting engineer

- D. BACnet requires that all devices have a Device object name that is unique throughout the entire network. To comply with this requirement, all BACnet devices shall be configured with a Device Object Name that is based on the naming conventions described in this section. This includes all physical devices as well as any logical BACnet devices that are represented by gateways. The BMS contractor shall coordinate with the Owner's staff to ensure that the correct names are used. Device Object Name properties shall support strings of at least 50 characters in length.
- E. Every system device has addresses by which any other BACnet device can identify it and route information to and from it. The BMS contractor shall document all addresses and utilize a logical addressing scheme that is coordinated with the Owner.
- F. Adopt a hierarchical and uniform addressing scheme for device instances to help quickly identify the function and location of different devices when troubleshooting. Additionally, document every element of the addressing scheme and update the site documentation with any changes.
- G. Standard BACnet object types supported shall includes as a minimum: Analog value, Binary value, Calendar, Device, File, Group, Notification Class, Program and Schedule object types.

2.6 BMS SERVER

- A. The BMS contractor shall provide an alternate price (ALT-1) to replace the existing BMS server with new.
- B. The BMS Server shall consist of the following, at a minimum:
 - Dual processors, Eight Cores Intel® Xeon®E5-2667 v4 3.2GHZ with 35 MB Cache, 64 GB of RDIMM RAM, xUGA graphics card capable of 1920x1080 pixel resolution (or better) and 64 Bit colors, non-interlaced (70Hz or better vertical refresh rate), 12 function-key keyboard, 2-button Intellimouse pointing device with scrolling wheel, 2X Western Digital VelociRaptor WD6000HLHX SATA Hard Disk Drive (1 TB) in a RAID 1 configuration with SAS 5iR internal RAID Controller. Multiple USB 3.0 ports located in the front and back of Tower. Hot-plug hard drives, redundant power, ECC memory, battery-backed cache. ATAPI DVD+/-RW Drive and Dual NIC (network interface card) for Ethernet Networking compatible with TCP/IP network protocols. Server shall have capability to plug in at least two (2) monitors.
 - 2. Color monitor shall be a minimum of 24", Flat Panel type with height adjustable stand which allows the panel to swivel, tilt and pivot. Separate controls shall be provided for color, contrasts, brightness, size, geometry, position and degauss. The screen shall be non-reflective. The LCD module shall be active matrix, thin film transistor (TFT). The monitor shall support a resolution of 1920x1080 pixels at 60 Hz, at a minimum. Available power supply is 120 VAC at 60Hz.

2.7 WEB BASED OPERATOR INTERFACE

A. Operator Interface. Web server shall reside on high-speed network with primary controllers. Each standard browser connected to server shall be able to access all system information. In

addition to the primary operator interface, the system shall include a secondary interface compatible with a locally available commercial wireless network and viewable on a commercially available wireless device such as a Wireless Access Protocol (WAP) enabled cellular telephone or personal digital assistant (PDA). This secondary interface may be text-based and shall provide a summary of the most important data. As a minimum, the following capabilities shall be provided through this interface:

- 1. An operator authentication system that requires an operator to log in before viewing or editing any data and which can be configured to limit the privileges of an individual operator.
- 2. The ability to view and acknowledge any alarm in the system. Alarms or links to alarms shall be provided on a contiguous list so the operator can quickly view all alarms.
- 3. A summary page or pages for each piece of equipment in the system. This page shall include the current values of all critical I/O points and shall allow the operator to lock binary points on or off and to lock analog points to any value within their range.
- 4. Navigation links that allow the operator to quickly navigate from the home screen to any piece of equipment in the system and then return to the home screen. These links shall be arranged in a hierarchical fashion, such as navigating from the home screen to a particular building, then to a specific floor in the building and then to a specific room or piece of equipment.
- B. Communication. Web server or workstation and controllers shall communicate using BACnet protocol. Web server or workstation and control network backbone shall communicate using ISO 8802-3 (Ethernet) Data Link/Physical layer protocol and BACnet/IP addressing as specified in the latest version of ANSI/ASHRAE 135, BACnet Annex J.
- C. Hardware. Each workstation or web server shall consist of the following:
 - 1. Industry-standard hardware shall meet or exceed DDC system manufacturer's recommended specifications and shall meet requirements included herein. Hard disk shall have sufficient memory to store system software, 1 year of data for trended points and a system database at least twice the size of the existing database at system acceptance. Configure computers and network connections if multiple computers are required to meet specified memory and performance.
 - 2. Modem. Auto-dial modem and associated cables shall transmit over voice-grade telephone lines at a nominal 56,000 baud and shall provide communication between workstation or web server and remote buildings and workstations.
- D. Operator Functions. Operator interface shall allow each authorized operator to execute the following functions as a minimum:
 - 1. Log In and Log Out. System shall require user name and password to log in to operator interface.
 - 2. Point-and-click Navigation. Operator interface shall be graphically based and shall allow operators to access graphics for equipment and geographic areas using point-and-click navigation.

- 3. View and Adjust Equipment Properties. Operators shall be able to view controlled equipment status and to adjust operating parameters such as setpoints, PID gains, on and off controls and sensor calibration.
- 4. View and Adjust Operating Schedules. Operators shall be able to view scheduled operating hours of each schedulable piece of equipment on a weekly or monthly calendar-based graphical schedule display, to select and adjust each schedule and time period and to simultaneously schedule related equipment. System shall clearly show exception schedules and holidays on the schedule display.
- 5. View and Respond to Alarms. Operators shall be able to view a list of currently active system alarms, to acknowledge each alarm and to clear (delete) unneeded alarms.
- 6. View and Configure Trends. Operators shall be able to view a trend graph of each trended point and to edit graph configuration to display a specific time period or data range. Operator shall be able to create custom trend graphs to display on the same page data from multiple trended points.
- 7. View and Configure Reports. Operators shall be able to run preconfigured reports, to view report results and to customize report configuration to show data of interest.
- 8. Manage Control System Hardware. Operators shall be able to view controller status, to restart (reboot) each controller and to download new control software to each controller.
- 9. Manage Operator Access. Typically, only a few operators are authorized to manage operator access. Authorized operators shall be able to view a list of operators with system access and of functions they can perform while logged in. Operators shall be able to add operators, to delete operators and to edit operator function authorization. Operator shall be able to authorize each operator function separately.
- E. System Software.
 - 1. Operating System. Web server shall have an industry-standard professional-grade operating system. Acceptable systems include Microsoft Windows 8.
 - 2. System Graphics. Operator interface shall be graphically based and shall include at least one (1) graphic per piece of equipment, air handling unit or occupied zone, graphics for each chilled water and hot water system and graphics that summarize conditions on each floor. The BMS contractor shall review and standardize these graphics with the owner on site team.
 - 3. Provide links on each graphic to PDF files of the associated sequence of operation, flow diagram, and wiring diagrams.
 - 4. Functionality. Graphics shall allow operator to monitor system status, to view a summary of the most important data for each controlled zone or piece of equipment, to use point-and-click navigation between zones or equipment and to edit setpoints and other specified parameters.
 - 5. Animation. Graphics shall be able to animate by displaying different image files for changed object status.

- 6. Alarm Indication. Indicate areas or equipment in an alarm condition using color or other visual indicator.
- 7. Format. Graphics shall be saved in an industry-standard format such as BMP, JPEG, PNG or GIF. Web-based system graphics shall be viewable on browsers compatible with World Wide Web Consortium browser standards. Web graphic format shall require no plug-in (such as HTML and JavaScript) or shall only require widely available no-cost plug-ins (such as Active-X and Macromedia Flash).
- F. System Tools. System shall provide the following functionality to authorized operators as an integral part of the operator interface or as stand-alone software programs. If furnished as part of the interface, the tool shall be available from each workstation or web browser interface. If furnished as a stand-alone program, software shall be installable on standard IBM-compatible PCs with no limit on the number of copies that can be installed under the system license.
 - 1. Automatic System Database Configuration. Each workstation or web server shall store on its hard disk a copy of the current system database, including controller firmware and software. Stored database shall be automatically updated with each system configuration or controller firmware or software change.
 - 2. Controller Memory Download. Operators shall be able to download memory from the system database to each controller.
 - 3. System Configuration. Operators shall be able to configure the system.
 - 4. Online Help. Context-sensitive online help for each tool shall assist operators in operating and editing the system.
 - 5. Security. System shall require a user name and password to view, edit, add or delete data.
 - 6. Operator Access. Each user name and password combination shall define accessible viewing, editing, adding and deleting functions in each system application, editor and object.
 - 7. Automatic Log Out. Automatically log out each operator if no keyboard or mouse activity is detected. Operators shall be able to adjust automatic log out delay.
 - 8. Encrypted Security Data. Store system security data including operator passwords in an encrypted format. System shall not display operator passwords.
 - 9. System Diagnostics. System shall automatically monitor controller and I/O point operation. System shall annunciate controller failure and I/O point locking (manual overriding to a fixed value).
 - 10. Alarm Processing. System input and status objects shall be configurable to alarm on departing from and on returning to normal state. Operator shall be able to enable or disable each alarm and to configure alarm limits, alarm limit differentials, alarm states and alarm reactions for each system object. Configure and enable alarm points as specified.
 - 11. Alarm Messages. Alarm messages shall use an English language descriptor without acronyms or mnemonics to describe alarm source, location and nature.

- 12. Alarm Reactions. Operator shall be able to configure (by object) actions workstation or web server shall initiate on receipt of each alarm. As a minimum, workstation or web server shall be able to log, print, start programs, display messages, send e-mail, send page and audibly annunciate.
- 13. Alarm Maintenance. Operators shall be able to view system alarms and changes of state chronologically, to acknowledge and delete alarms and to archive closed alarms to the workstation or web server hard disk from each workstation or web browser interface.
- 14. Trend Configuration. Operator shall be able to configure trend sample or change of value (COV) interval, start time and stop time for each system data object and shall be able to retrieve data for use in spreadsheets and standard database programs. Controller shall sample and store trend data and shall be able to archive data to the hard disk. Configure trends as specified or required by the Owner.
- 15. Object and Property Status and Control. Operator shall be able to view and to edit if applicable, the status of each system object and property by menu, on graphics or through custom programs.
- 16. Reports and Logs. Operator shall be able to select, to modify, to create and to print reports and logs. Operator shall be able to store report data in a format accessible by standard spreadsheet and word processing programs.
- 17. Standard Reports. Furnish the following standard system reports:
- 18. Objects. System objects and current values filtered by object type, by status (in alarm, locked, normal), by equipment, by geographic location or by combination of filter criteria.
- 19. Alarm Summary. Current alarms and closed alarms. System shall retain closed alarms for an adjustable period.
- 20. Logs. System shall log the following to a database or text file and shall retain data for an adjustable period:
 - a. Alarm History.
 - b. Trend Data. Operator shall be able to select trends to be logged.
 - c. Operator Activity. At a minimum, system shall log operator log in and log out, control parameter changes, schedule changes and alarm acknowledgment and deletion. System shall date and time stamp logged activity.
- 21. Custom Reports. Operator shall be able to create custom reports that retrieve data, including archived trend data, from the system, that analyze data using common algebraic calculations and that present results in tabular or graphical format. Reports shall be launched from the operator interface.
- 22. Graphics Generation. Graphically based tools and documentation shall allow Operator to edit system graphics, to create graphics and to integrate graphics into the system. Operator shall be able to add analog and binary values, dynamic text, static text and animation files to a background graphic using a mouse.

- 23. Graphics Library. Library graphic file format shall be compatible with graphics generation tools.
- 24. Custom Application Programming. Operator shall be able to create, edit, debug and download custom programs. System shall be fully operable while custom programs are edited, compiled and downloaded. Programming language shall have the following features:
- 25. Language. Language shall be graphically based and shall use function blocks arranged in a logic diagram that clearly shows control logic flow. Function blocks shall directly provide functions listed below and operators shall be able to create custom or compound function blocks.
- 26. Programming Environment. Tool shall provide a full-screen, cursor-and-mouse-driven programming environment that incorporates word processing features such as cut and paste. Operators shall be able to insert, add, modify and delete custom programming code and to copy blocks of code to a file library for reuse in other control programs.
- 27. Independent Program Modules. Operator shall be able to develop independently executing program modules that can disable, enable and exchange data with other program modules.
- 28. Debugging and Simulation. Operator shall be able to step through the program observing intermediate values and results. Operator shall be able to adjust input variables to simulate actual operating conditions. Operator shall be able to adjust each step's time increment to observe operation of delays, integrators and other time-sensitive control logic. Debugger shall provide error messages for syntax and for execution errors.
- 29. Conditional Statements. Operator shall be able to program conditional logic using compound Boolean (AND, OR and NOT) and relational (EQUAL, LESS THAN, GREATER THAN, NOT EQUAL) comparisons.
- 30. Mathematical Functions. Language shall support floating-point addition, subtraction, multiplication, division and square root operations, as well as absolute value calculation and programmatic selection of minimum and maximum values from a list of values.
- 31. Variables: Operator shall be able to use variable values in program conditional statements and mathematical functions.
 - a. Time Variables. Operator shall be able to use predefined variables to represent time of day, day of the week, month of the year and date. Other predefined variables or simple control logic shall provide elapsed time in seconds, minutes, hours and days. Operator shall be able to start, stop and reset elapsed time variables using the program language.
 - b. System Variables. Operator shall be able to use predefined variables to represent status and results of Controller Software and shall be able to enable, disable and change setpoints of Controller Software as described in Controller Software section.

2.8 REMOTE NOTIFICATION PAGING SYSTEM

- A. Workstations shall be configured to send out messages to numeric pagers, alphanumeric pagers, phones (via text to speech technology), SMS (Simple Messaging Service, text messaging) Devices and email accounts based on a point's alarm condition.
- B. There shall be no limit to the number of points that can be configured for remote notification of alarm conditions and no limit on the number of remote devices that can receive messages from the system.
- C. On a per point basis, system shall be configurable to send messages to an individual or group and shall be configurable to send different messages to different remote devices based on alarm message priority level.
- D. Remote devices may be scheduled as to when they receive messages from the system to account for operators' work schedules.
- E. System must be configurable to send messages to an escalation list so that if the first device does not respond, the message is sent on to the next device after a configurable time has elapsed.
- F. Message detail shall be configurable on a per user basis.
- G. During a "flood" of alarms, remote notification messages shall have the ability to optimize several alarms into an individual remote notification message.
- H. Workstation shall have the ability to send manual messages allowing an operator to type in a message to be sent immediately.
- I. Workstation shall have a feature to send a heartbeat message to periodically notify users that they have communication with the system.

2.9 SENSORS

- A. Electronic Sensors: Vibration and corrosion resistant; for wall, immersion or duct mounting as required.
- B. Instruments and control devices shall be provided for all required points detailed herein. Instruments shall have accuracies as stated herein. Instrument characteristics such as hysteresis, relaxation time, span, and maximum and minimum limits, shall be accounted for in applications of instruments and controls. Not all devices specified may be required for this project.
- C. Field wiring for each digital device shall be as per the manufacturer's standard. The details of the wiring shall be included in the submittal.
- D. Outside Air Stations: Assembly shall consist of capacitive type humidity sensing element with 1000 ohm platinum RTD and a solid-state, 2 wire, 4-20 mA transmitter mounted in an integrated ventilated radiation shield suitable for outdoor installation. Assembly shall be factory calibrated to an accuracy of $\pm 2\%$ RH over a range of 0%-90% RH and $\pm 3\%$ over a range of 90-100% RH and an accuracy of $\pm 0.6^{\circ}$ F over entire operating span .Assembly shall be Vaisala HMS112 Series or pre-approved equal.

- E. Sensors for duct locations shall not be affected by vibrations encountered in normal duct systems.
- F. Temperature Sensors
 - 1. Temperature sensors used in duct or space sensing applications shall be thermistors. Temperature sensors shall have the following characteristics.
 - a. Accuracy: $\pm 0.5^{\circ}$ F.
 - b. Wire: Twisted, shielded-pair cable.
 - 2. Insertion Elements in Ducts: Single point; use where not affected by temperature stratification or where ducts are smaller than 9sq ft. (1sq m). The length of the sensor shall be a minimum of one-third of the width of the duct with a maximum length of eighteen (18) inches. Provide duct mounted metal housing with conduit entrance.
 - 3. Averaging Elements in Ducts: Use where prone to temperature stratification or where ducts are larger than 9sq ft (1sq m); length as required. The length of the sensor shall be twelve (12) feet minimum or one (1) linear foot per every one (1) sq ft of cut cross section, whichever is greater. Provide duct mounted metal housing with conduit entrance.
 - 4. Space sensors:
 - a. Set-Point Adjustment: Concealed
 - b. Set-Point Indication: Concealed
 - c. Color: White.
 - d. Orientation: Vertical.
 - e. Provide a communication port for connection of a laptop or other portable interface device.
 - f. Match existing site standard.
- G. Control Relays
 - 1. Mechanical relay: The control relay shall be rated for 24 Vac or 24vdc; maximum contact rating of 10 amp at 30 Vdc or 250 Vac. Outputs shall be true Form C type contacts; solid-state relays are not acceptable.
- H. Control Transformer
 - 1. Control transformers shall be UL listed. Furnish class 2 current-limiting type or furnish over-current protection in primary and secondary circuits for class 2 service in accordance with NEC requirements. Limit connected loads to 80% of rated capacity. Provide step-down transformer for each control panel. Step-down transformer shall be 277/24 Vac or 120/24 Vac. Coordinate with the electrical contractor for available circuit.

2.10 AUTOMATIC CONTROL VALVES

- A. All automatic control valves shall meet the following requirements:
 - 1. Fully proportioning.
 - 2. Capable of operating at varying rates of speed to correspond to the exact dictates of the controllers and variable load requirements.
 - 3. Body pressure rating and connection type construction shall conform to piping and fittings in which the valve is to be installed and to the valve schedules.
 - 4. Isolation valve shall be line size, full port ball valve with stainless steel ball and stem. Isolation valve 4" and large shall be butterfly valves.
 - 5. Control valves 2" and smaller shall have screwed connections.
 - 6. Control valves larger than 2-1/2" shall have flanged connections.
- B. Water Control Valves: Hot water
 - 1. Modulating control valves shall have the following characteristics:
 - a. Valve shall be up to two sizes below pipe size.
 - b. Valve shall have replaceable seat, plug, or disc.
 - c. Equal percentage flow characteristic (characterized ball or globe type valves).
 - d. Valve body shall be bronze, cast iron, forged brass or red brass.
 - e. Ball valve shall have stainless steel stem, stainless steel ball, and PTFE seats.
 - f. Globe valve shall have stainless steel stem and single stainless steel seat.
- C. Provide one (1) control valve for each heating coil at a minimum.
- D. Control valves shall be Belimo, Honeywell, Johnson Controls, Siemens or pre-approved equal.
- E. Control valves 4" and larger shall be butterfly valves for isolation applications and globe valves for modulating applications.
- F. All valve actuators shall meet the following requirements:
 - 1. All valve actuation shall be electric. Pneumatic actuation is not acceptable.
 - 2. Valve actuator shall be by same manufacturer as valve body unless pre-approved.
 - 3. Valve actuators shall:
 - a. Be quiet in operation.
 - b. Provide smooth modulation at design flow and pressure conditions.

- c. Be capable of operating in sequence with other valves and/or damper actuators when required by the sequence of operation.
- d. Be sized to close against a differential pressure equal to the design pump head plus 15%. Where pressure and flow combinations exceed ratings for commercial valves and actuators, industrial class valves and actuators shall be provided.
- e. Valve actuators shall fail-safe in either the normally open or normally closed position in the event of power failure, signal failure or compressed air failure. Fail Safe positions are as follows:
 - 1) Unit Ventilator Hot Water Heating Valves Fail Open
- 4. Electric Valve Actuation
 - a. Actuator shall have electronic, proportional control and shall be direct-coupled with spring return.
 - b. Actuators shall be equipped with a permanent manual override hand wheel and visual and electronic stroke indicators.
 - c. Operating Voltage: 24 VAC.
 - d. Input Signal: 0-10 VDC, 4 20 mA.
 - e. Power Consumption: 18VA maximum (valves 2" and under), 28VA maximum (valves 2-1/2" 4")
 - f. Spring Return Time: 15 seconds maximum
 - g. Spring return position should be field adjustable with a switch.
 - h. Nominal Force: 225lb Minimum (valves 2" and under), 610lb. (valves 2-1/2"-4")
 - i. Stroke: 3/4" (20mm) maximum (valves 2" and under), 1-1/2" (valves 2-1/2"-4")
 - j. For use when the maximum media temperature is 300°F.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install software in control units and operator workstation(s). Implement all features of programs to specified requirements and as appropriate to sequence of operation.
- B. Connect and configure equipment and software to achieve sequence of operation specified.
- C. All control components including automatic control valves, dampers, instruments, sensors, etc shall be tagged for identification. Acceptable methods of tagging are: laminated plastic, stamped metal and engraved plastic.
- D. Install equipment level and plumb.

- E. Verify location of temperature sensors, humidity sensors and other exposed control sensors with plans and room details before installation. Locate all 60" above the floor or as otherwise required by ADA.
- F. Install guards on thermostats in the following locations:
 - 1. Entrances.
 - 2. Public areas.
 - 3. Where indicated.
- G. Install hydronic instrument wells, valves and other accessories according to Division 23.
- H. Install refrigerant instrument wells, valves and other accessories according to Division 23.
- I. Install electronic cables according to Division 26.
- J. Averaging temperature sensors (i.e. freezestats, mixed air temperature sensor, etc.) shall be provided with fasteners or mounting clips to prevent shearing due to vibrations in the ductwork.
- K. Water line mounted sensors shall be removable without shutting down the system in which they are installed.
- L. For duct static pressure sensors, the high pressure port shall be connected to a metal static pressure probe inserted into the duct pointing upstream. The low pressure port shall be left open to the plenum area at the point that the high pressure port is tapped into the ductwork.
- M. Averaging temperature sensors (i.e. freezestats, mixed air temperature sensor, etc.) shall be provided with fasteners or mounting clips to prevent shearing due to vibrations in the ductwork.

3.2 ELECTRICAL WIRING AND CONNECTION INSTALLATION

- A. Install, connect and wire the items included under this Section. This work includes providing required conduit, wire, fittings and related wiring accessories.
- B. All exposed wiring and wiring in mechanical equipment rooms shall be installed in conduit.
- C. Plenum rated cable shall be acceptable in hung ceilings, walls and raised floors.
- D. All wiring located outside shall be installed in rigid conduit, seal tite or EMT with compression fittings.
- E. Conceal cable, except in mechanical rooms and areas where other conduit and piping are exposed.
- F. Install cable in raceway.
- G. Bundle and harness multiconductor instrument cable in place of single cables where several cables follow a common path.
- H. Fasten flexible conductors, bridging cabinets and doors, along hinge side; protect against abrasion. Tie and support conductors.

- I. Number-code or color-code conductors for future identification and service of control system, except local individual room control cables.
- J. Wires and cables shall be as follows:
 - 1. Single Conductor (120 VAC): Type THWN 12AWG stranded copper with 600V insulation.
- K. Primary and Secondary Communications Network Cabling
 - 1. Primary network shall be Ethernet based and shall utilize CAT5, CAT6 or fiber optic cable. All wiring runs longer than 300' shall utilize fiber optic cable.
 - 2. Cable shall be of type recommend by the DDC System Manufacturer and 20AWG at a minimum.
 - 3. Cable shall be shielded.
- L. Cables for 120 VAC wiring and low level signal wiring (i.e., 4 20 mA analog) shall always be run in separate raceways.
- 3.3 CONNECTIONS
 - A. Connect manual-reset limit controls independent of manual-control switch positions. Automatic duct heater resets may be connected in interlock circuit of power controllers.
 - B. Connect HOA selector switches to override automatic interlock controls when switch is in hand position.
 - C. Ground equipment.

3.4 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect field-assembled components and equipment installation, including piping and electrical connections. Report results in writing.
 - 1. Operational Test: After electrical circuitry has been energized, start units to confirm proper unit operation. Remove malfunctioning units, replace with new units and retest.
 - 2. Test and adjust controls and safeties.
- B. Engage a factory-authorized service representative to perform startup service.
- C. Replace damaged or malfunctioning controls and equipment.
 - 1. Start, test and adjust control systems.
 - 2. Demonstrate compliance with requirements, including calibration and testing and control sequences.
 - 3. Adjust, calibrate and fine tune circuits and equipment to achieve sequence of operation specified.

D. Verification

- 1. Verify that instruments are installed before calibration, testing and loop or leak checks.
- 2. Check instruments for proper location and accessibility.
- 3. Check instrument installation for direction of flow, elevation, orientation, insertion depth and other applicable considerations.
- 4. Check instrument tubing for proper fittings, slope, material and support.
- 5. Check installation of air supply for each instrument.
- 6. Check flow instruments. Inspect tag number and line and bore size and verify that inlet side is identified and that meters are installed correctly.
- 7. Check pressure instruments, piping slope, installation of valve manifold and selfcontained pressure regulators.
- 8. Check temperature instruments and material and length of sensing elements.
- 9. Check control valves. Verify that they are in correct direction.
- 10. Check air-operated dampers. Verify that pressure gages are provided and that proper blade alignment, either parallel or opposed, has been provided.
- 11. Check DDC system as follows:
 - a. Verify that DDC controller power supply is from emergency power supply, if applicable.
 - b. Verify that wires at control panels are tagged with their service designation and approved tagging system.
 - c. Verify that spare I/O capacity has been provided.
 - d. Verify that DDC controllers are protected from power supply surges.

3.5 COMMISSIONING

A. Prior to full operation, the contractor in the presence of the owner's representative and engineer shall perform a complete demonstration and testing of the system operating functions and alarms. This testing shall take place after having satisfactorily met the requirements of shop drawing acceptance. Upon successful completion of system operation, the contractor shall submit a statement in writing stating that the full operation of all systems, functions and alarms has been demonstrated and are operational as well as a listing of all systems, alarms and functions that have been commissioned. All items shall be submitted for review and acceptance to the owner, owner's representative and engineer before final acceptance can take place.

3.6 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate and maintain HVAC instrumentation and controls. Refer to Division 1 Section "Closeout Procedures" and "Demonstration and Training."

3.7 TRAINING

- A. The BMS contractor shall provide competent instructors to give full instruction to designated personnel in the adjustment, operation and maintenance of the system installed rather than a general training course. Instructors shall be thoroughly familiar with all aspects of the subject matter they are to teach. All training shall be held during normal work hours of 8:00 a.m. to 4:30 p.m. weekdays.
- B. Provide twenty-four (24) hrs of training for Owner's operating and maintenance personnel. All training shall be on-site training. Videotape all sessions and edit each session to 1-hour DVDs. Turn over two (2) copies each unedited and edited DVD to the Owner. Training shall include:
 - 1. Explanation of drawings, operators and maintenance manuals.
 - 2. Walk-through of the job to locate all control components.
 - 3. Operator workstation and peripherals.
 - 4. DDC Controller operation/function.
 - 5. Operator control functions including graphic generation, if design includes color graphics and field panel programming.
 - 6. Explanation of adjustment, calibration and replacement procedures.
- C. The BMS contractor shall also create a color PDF reference guide for the use of the Owner and the operating staff which provide graphical step-by-step instructions on how to perform basic tasks at the BMS that are part of the owner's operating staff's daily duties. This shall include, but not be limited to, navigating the BMS screens, setpoint adjustment, turning units on/off, turning systems on/off, overriding commands, acknowledging alarms, adjusting time schedules, etc. Coordinate with the Owner's operating staff as required.
- D. Since the Owner may require personnel to have more comprehensive understanding of the hardware and software, additional training must be available from the Contractor. If the Owner requires such training, it will be contracted at a later date. Provide description of available local and factory customer training. Provide costs associated with performing training at an off-site classroom facility and detail what is included in the manufacturer's standard pricing such as transportation, meals, etc.
- E. The BMS Contractor shall provide phase training to ensure that when the new BMS workstation is installed, the facility staff are able to utilize the new workstation/software as equipment is switched over from the existing BMS to the new BMS. Below is a timeline of how to phase the training schedule:
 - 1. After cut-over of first system to the new BMS:
 - a. Familiarize the owner and their operating staff with the new BMS workstation, BMS software and how an overview of operator control functions including but not limited to:
 - 1) Navigating the new BMS software screens
 - 2) Setpoint adjustment

- 3) Alarm notifications and acknowledgment
- 4) Adjusting the occupancy schedule
- 5) Overriding commands and setpoints
- b. Familiarize the Owner and the Owner's operating staff with the new DDC controllers and their functions
- c. Provide a simple navigation and basic operator control function tutorial in color in PDF for easy reference for the owner and the operating staff. The tutorial shall include how to access data and complete all operator control functions required for the owner's operating staff to perform their duties.
- 2. After the major hydronic systems (chiller plant, hot water system) have been cut over:
 - a. Provide a more detailed version of the training that occurred after the cut-over of the first system.
 - b. Familiarize the Owner and the Owner's operating staff with the new DDC controllers and their functions
 - c. Update the navigation and basic operator control function as necessary
- 3. At the conclusion of the project, the BMS contractor shall provide a formal training that includes all items listed in this section along with any items recommended by the manufacturer of the BMS software/hardware. Update the navigation and basic operator control function as necessary.
- 4. The BMS Contractor shall also include training to be provided before the first heating season and before the first cooling season to assist the Owner's operating staff with switch-over of equipment and systems. This training shall be scheduled with the owner.

3.8 ON-SITE ASSISTANCE

A. Occupancy Adjustments: Within 1 year of date of Substantial Completion, provide up to three (3) Project-site visits, when requested by Owner, to adjust and calibrate components and to assist Owner's personnel in making program changes and in adjusting sensors and controls to suit actual conditions.

3.9 RECORD DOCUMENTATION

- A. Operation and Maintenance Manuals
 - 1. Three (3) copies of the Operation and Maintenance Manuals shall be provided to the Owner's Representative upon completion of the project. The entire Operation and Maintenance Manual shall be furnished on Compact Disc media and include the following for the BMS provided:
 - a. Table of contents.

- b. As-built system record drawings. Record drawings shall represent the as-built condition of the system and incorporate all information supplied with the approved submittal.
 - 1) BMS network riser diagram
 - 2) Wiring diagrams
 - 3) Electrical drawings
 - 4) Flow diagrams and device locations
 - 5) Hardware and software points list
 - 6) Bill of materials
 - 7) Sequence of operations.
 - 8) I/O point lists
 - 9) Cut sheets of all equipment installed
- c. Manufacturer's product data sheets or catalog pages for all products including software.
- d. System Operator's manuals.
- e. Archive copy of all site-specific databases and sequences.
- f. BMS network diagrams.
- g. Interfaces to all third-party products and work by other trades.
- h. Training course list.
- B. The Operation and Maintenance Manual CD shall be self-contained and include all necessary software required to access the product data sheets. A logically organized table of contents shall provide dynamic links to view and print all product data sheets. Viewer software shall provide the ability to display, zoom and search all documents.

3.10 WARRANTY

- A. The BMS shall include a one (1) year parts and labor warranty to begin upon system acceptance that covers the entire system to correct any operational issues at no additional cost to the Owner. The warranty shall cover adjustment and calibration of components and assistance to building personnel in making program changes and in adjusting sensors and controls to suit actual conditions. System acceptance shall be determined by the Owner.
- B. During the warranty period, the Contractor shall guarantee the following in a form satisfactory to the Owner:
 - 1. All work installed will be free from any and all defects in workmanship and or materials.
 - 2. All devices will operate as per the capacities and performance characteristics specified.

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- 3. The systems shall operate without malfunction.
- C. Maintain an adequate supply of materials within 100 miles of the Project site

END OF SECTION 23 09 00

SECTION 230993 SEQUENCES OF OPERATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes control sequences for HVAC systems, subsystems and equipment.

1.3 DEFINITIONS

- A. AI: Analog Input.
- B. AO: Analog output.
- C. ATC: Automatic Temperature Control.
- D. BMS: Building Management System.
- E. CFM: Cubic Feet per Minute.
- F. DDC: Direct-digital controls.
- G. DI: Digital Input.
- H. DO: Digital Output.
- I. FAS: Fire Alarm System.
- J. HVAC: Heating, Ventilating and Air Conditioning.
- K. LAN: Local area network.
- L. LCD: Liquid Crystal Display
- M. MER: Mechanical Equipment Room.
- N. PID: Proportional Integral Derivative.
- O. VAV: Variable air volume.
- P. VFD: Variable Frequency Drive.
- 1.4 GENERAL
 - A. All safety devices shall be hardwired to the starter and shall have a second contact for monitoring via the BMS.
 - B. A failure alarm, as included in the point list, shall indicate the type of equipment that has failed (fan, valve, etc.) including the specific designation of the piece of equipment (e.g., supply fan SF-1). It is not acceptable to generate a general failure alarm.

- C. Alarming devices such as pressure safeties, etc. shall be wired so the contacts open in the alarm condition. All alarm points shall be annunciated at the BMS audibly and visually. All alarm points associated with varying values shall be provided with adjustable limits.
- D. All setpoints including setpoints internal to control algorithms shall be adjustable from all BMS operator interfaces. All commands shall be overrideable from all BMS operator interfaces. All control points shall be adjustable or overrideable from the same graphic page that displays the points.
- E. All points for a specific mechanical system shall be connected to and controlled by the same DDC controller unless otherwise specified. For example, it is not acceptable to control a supply fan with one (1) DDC controller located at a motor control center and to control the rest of the air-handling unit points with a DDC controller located at the air-handling unit.
- F. All points required by the sequence of operation including, but not limited to, the points listed in the sequences of operation below, as well as all of the points' associated values, shall be connected to the BMS and available to the BMS operators on all operator workstations and all operator interface devices as part of a graphical display that depicts the mechanical system controlled.
- G. The installed BMS shall have dedicated, LAN based communication buses independent of the building IT network for both primary and secondary buses.
- H. All valves, dampers, controllers, control devices, etc. exposed to outside air conditions shall be specifically designed for outside air conditions including, but not limited to, NEMA 4X enclosures, weatherproof enclosures, heater and all other weather precautions recommended by the manufacturer.
- I. No part of the programming specified herein shall be programmed into operator priority.
- J. All alarms associated with equipment that is disabled shall be inhibited.
- K. All initial field settings applied shall be saved as the default values. These values shall be downloaded to the controller such that they are the default value if the controller loses power. A printed copy shall also be provided to the owner as part of the O & M manuals.
- L. When the motor controller is equipped with an HOA, the motors shall only be controlled by the BMS when the HOA switch is in the auto position.
- M. Leak detectors, pressure safeties, etc. shall be wired to shutdown motors when the HOA switch is in both the hand and auto positions. It shall not be possible to override these or any other safety devices or any fire alarm system control functions.
- N. The point lists are provided for convenience and are not intended to be all-inclusive. All points required to provide the Sequence of Operation shall be included as if listed.

1.5 RADIANT PANELS (TYPICAL FOR RP-1)

- A. General
 - 1. If a radiant heating panel serves a space also served by VAV/FPB, the radiant panel shall be connected to the associated VAV/FPB controller and shall operate in sequence with the boxes. The radiant heating panel shall be utilized as the first source of heating.
- B. The BMS contractor shall:
 - 1. Furnish, install and wire a space thermostat and an automatic control valve to control the radiant panel. On a fall in space temperature below setpoint, the thermostat shall open the control valve to

maintain the space temperature setpoint. On a rise in space temperature, the control valve shall remain closed.

- C. Enabled Mode
 - 1. When outdoor air temperature drops below 65°F (adj.), the BMS shall allow the radiant panel to operate.
 - 2. The radiant panel shall be enabled based upon a time of day schedule, or manual command at the BMS. During occupied time, the radiant panel control valve shall modulate as necessary to maintain the occupied space temperature setpoint (adj.).
 - 3. During unoccupied mode, the radiant panel control valve shall modulate as necessary to maintain the night setback space temperature setpoint (adj.).
- D. Disable Mode
 - 1. When the outdoor air temperature is above 60°F (adj.) plus a differential, the BMS shall disable the radiant panel. The control valve shall close.
- E. Provide the following points hardwired to the BMS:
 - 1. AI Space temperature.
 - 2. AO Radiant panel valve control (0-100%).
- F. Provide the following points on the associated equipment graphic in addition to the hardwired points indicated above:
 - 1. High and low space temperature alarms.
 - 2. Occupied/unoccupied command.
 - 3. Occupied/unoccupied, heating space temperature setpoints.
 - 4. Space/area served.

END OF SECTION 230993

SECTION 232113

HYDRONIC PIPING

PART 1 - GENERAL

1.01 WORK INCLUDED

- A. Work in this Section includes the providing of labor, materials, equipment and services necessary for a complete and safe installation in accordance with the contract documents and all applicable codes and authorities having jurisdiction for the following:
 - 1. Pipe.
 - 2. Fittings.
 - 3. Valves.
 - 4. Motorized valve operators.
 - 5. Strainers.
 - 6. Hangers, supports, guides.
 - 7. Sleeves.
 - 8. Hydronic Specialties and Accessories.

1.02 RELATED WORK AND REQUIREMENTS

A. Requirements of GENERAL CONDITIONS, DIVISION NO. 1 and Section GENERAL PROVISIONS FOR HEATING, VENTILATING AND AIR CONDITIONING WORK apply to all work in this Section.

1.03 REFERENCE STANDARDS

- A. Published Specifications' standards, tests or recommended methods of trade, industry or governmental organizations apply to work in this Section.
- B. Comply with all applicable national, state and local codes and refer to Section GENERAL PROVISIONS FOR HEATING, VENTILATING AND AIR CONDITIONING WORK for additional Reference Standards.
- C. In addition, comply with all standards or associations as specified herein including, but not limited to, the following, as applicable:
 - 1. American Society for Mechanical Engineers (ASME).
 - 2. American Society for Testing and Materials (ASTM).
 - 3. American national Standards Institute (ANSI).
 - 4. Manufacturers Standardization Society of the Valve and Fitting Industry (MSS).

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1.04 QUALITY ASSURANCE

A. Refer to Section GENERAL PROVISIONS FOR HEATING, VENTILATING AND AIR CONDITIONING WORK for Guarantee and other Quality Assurance requirements.

1.05 SUBMITTALS

- A. Submit shop drawings for piping and all related accessories in accordance with the Contract Documents.
- B. Prepare general layout drawings, as follows:
 - 1. Minimum 1/4 inch scale piping layout with fittings, valve and equipment, use single line below 4 inches and above.
 - 2. Minimum 3/8 inch scale, double line layout and sections where required for coordination drawings.
 - 3. Indicate location of hangers, supports, guides and anchors, expansion joints and sleeves.
- C. Submit catalog cuts for fittings, flanges, unions, bolts, nuts, gaskets, hangers, guides and anchors.
- D. Submit schedule of pipe type and rating for each system.
- E. Submit schedule listing type make and model number, size and service for valves, motorized valve operators, strainers, flanges, fittings and equipment.

PART 2 - PRODUCTS

2.01 BASE BID MANUFACTURERS

- A. Valves:
 - 1. Gate, globe and check: Crane Co., Jenkins Bros., Powell Valve Co., Walworth Co., Lunkenheimer Co., Hammond Valve Corp. (Industrial), Milwaukee Valve Co., Inc., Stockham Co. and Nibco Inc.
 - 2. Silent check: Mission Valve and Pump Co., Mueller Steam specialty, Williams-Hager (Williams Gauge Co.), M.C.C. Centerline and The Smolensky Valve Co.
 - 3. Lubricated tapered plug: Rockwell International and Walworth Co.
 - 4. Eccentric plug: De Zurick Corp and Homestead Valve Co.
 - 5. Butterfly: Allis-Chalmers, B.I.F., M.C.C. centerline, Henry Pratt, Demco and NIBCO Inc.
 - 6. High performance butterfly (Trunnion): Jamesbury Corp., Hills-McCanna Co., Posi-Seal International, Inc. and DeZurick Corp.
 - 7. Ball: Cameron Co., Grove Valve and regulator Co., Hills-McCanna Co., Jamesbury Corp., Jenkins Bros., Lunkenheimer Co., Powell Valve Co. and Worcester.
- B. Motorized valve operators: E.I.M. Co., Limitorque Corp. and Rotork Controls Inc.

- C. Strainers:
 - 1. Y-type and basket: Elliot Div. (Carrier Corp.), McAlear, Mueller Steam Specialty, Sarco Co. and Zurn Industries, Inc.
 - 2. Duplex: Elliot Div. (Carrier Corp) and Zurn Industries, Inc.
- D. Expansion joints:
 - 1. Packless: ADSCO Manufacturing Corporation, Zallea Bros., Inc., Fulton-Sylphon Div. Controls, Tube Turns Div (Chemetrom Corp.) and Atlantic Metal Hose Co., Inc./Aero-Flex Div.
 - 2. Packed: Advanced Thermal Systems Inc., ADSCO manufacturing Corporation and Yarway Corp.
 - 3. Ball joints: Barco Div. (Aeroquip Corp.)
- E. Welded fittings: Babcock & Wilcox, Bonney Forge Foundry, Inc., Ladish Co., Taylor Co. and Tube Turns Div (Chemetron Corp.)
- F. Mechanical couplings and fittings: Certain Teed Products Corp. and Victaulic Company of America.
- G. Flange gaskets: Garlock, Inc., Manville Corp. RM Industries and Klinger.
- H. Unions: Dart Corp.
- I. Hangers and Supports.
 - 1. ITT Grinnell.
 - 2. Carpenter & Patterson Inc.
 - 3. B-line Systems, Inc.

2.02 COPPER TUBE AND FITTINGS

- A. Drawn-Temper Copper Tubing: ASTM B 88, Type L.
- B. Annealed-Temper Copper Tubing: ASTM B 88, Type K.
- C. Grooved, Mechanical-Joint, Wrought-Copper Fittings: ASME B16.22.
- D. Wrought-Copper Unions: ASME B16.22.
- 2.03 STEEL PIPE
 - A. Steel pipe shall be black and hot dipped galvanized of weight and wall thickness as noted, in accordance with ASTM specifications as follows:

- 1. A 120: Continuous, butt welded.
- 2. A 53: Continuous furnace butt welded, Type F.
- 3. A 53 Grades A and B: Type S seamless or Type E electric resistance welded.
- 4. A 106 Grades A and B: seamless.

2.04 JOINING MATERIALS

- E. Pipe-Flange Gasket Materials: Suitable for chemical and thermal conditions of piping system contents.
 - 1. ASME B16.21, nonmetallic, flat, asbestos free, 1/8-inch maximum thickness unless otherwise indicated.
 - a. Full-Face Type: For flat-face, Class 125, cast-iron and cast-bronze flanges.
 - b. Narrow-Face Type: For raised-face, Class 250, cast-iron and steel flanges.
- F. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.
- G. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.

2.05 FLANGES AND PIPE FITTINGS

- A. Steel flanges and pipe fittings shall be in accordance with ASTM A 105 and A 216.
- B. Cast-Iron Threaded Fittings: ASME B16.4; Classes 125, 150, and 300 as indicated in piping applications articles.
- C. Malleable-Iron Threaded Fittings: ASME B16.3; Classes 150 and 300 as indicated in piping applications articles.
- D. Malleable-Iron Unions: ASME B16.39; Classes 150, 250, and 300 as indicated in piping applications articles.
- E. Cast-Iron Threaded Flanges and Flanged Fittings: ASME B16.1, Classes 125 and 250 as indicated in piping applications articles; raised ground face, and bolt holes spot faced.

2.06 DIELECTRIC FITTINGS

H. General Requirements: Assembly of copper alloy and ferrous materials with separating nonconductive insulating material. Include end connections compatible with pipes to be joined.

I. Dielectric Unions:

- 1. Description:
 - a. Standard: ASSE 1079.
 - b. Pressure Rating: 125 psig minimum at 180 deg F.

2.07 SERVICES

- A. The following pipe applies to systems specified except as noted:
 - 1. LP steam piping:
 - a. LP Steam Piping: Schedule 40, Type S, Grade B, steel pipe; Class 125 cast-iron fittings; and threaded joints.
 - b. Condensate Piping above Grade: Schedule 80, Type S, Grade B, steel pipe; Class 125 cast-iron fittings; and threaded joints.
 - 2. Instrument piping:
 - a. As specified for system piping to which connected.
 - 3. Hot-water heating piping, aboveground, NPS 2 and smaller, shall be any of the following:
 - a. Type L drawn-temper copper tubing, wrought-copper fittings, and soldered joints.
 - b. Schedule 40, Grade B, steel pipe; Class 150, malleable-iron fittings; cast-iron flanges and flange fittings; and threaded joints.

2.08 FITTINGS

- A. For steel pipe:
 - 1. To 2 inch:
 - a. Steel fittings shall be socket weld ends in accordance with ANSI B 16.11
 - b. Cast iron threaded fittings shall be in accordance with ANSI B 16.4.
 - c. Cast iron flanged hinges shall be in accordance with ANSI B 16.1.
 - 1) 125 lb wsp.
 - d. Malleable iron fittings shall be in accordance with ANSI B 16.3.
 - 1) 150 lb wsp, galvanized, for fill and make-up piping.
 - e. Cast iron drainage fittings shall be in accordance with ANSI B 16.12.
 - f. Galvanized fittings for galvanized piping.
 - g. Ductile iron shall be in accordance with ASTM A 445. Contractor has option to furnish 300 lb ductile iron in lieu of 250 lb cast iron or 300 lb malleable iron.
 - 2. 2-1/2 inch and larger welded:
 - a. Butt weld fittings same weight as piping and in accordance with ANSI B 16.9.
 - b. Branch connections:

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- 1) Equal to main and to 2 pipe sizes smaller, use weld tees.
- 2) Three or more pipe sizes smaller than main, but 2-1/2 inch and larger, use Bonney Weld-o-lets.
- 3) To 2 inch: Bonney Weld-o-lets, Thread-o-lets, threaded Ni-o-lets, or steel couplings.

B. Flanges:

- 1. For steel pipe flanges shall be of matching quality, grade and thickness.
 - a. Welded: welding neck, slip-on, socket welded in accordance with ANSI B 16.5, slip-on flanges shall be back welded.
 - 1) 150 lb wsp.
 - 2) 300 lb wsp.
- 2. Screwed flanges shall be standard cast or extra heavy cast iron in accordance with ANSI B 16.4.
- 3. Match connecting flange:
 - a. Class.
 - b. Facing.
- C. Flange gaskets shall be one-piece ring type 1/16 inch thick (minimum), except as noted, suitable for temperature, pressure (operating and test) and service of system.
 - 1. Non-asbestos elastometer for 250 F and under.
 - 2. Non-asbestos spiral wound 304 stainless steel for above 250 deg F, similar to Flexitallic.
 - 3. For joints of dissimilar metals, provide isolating gaskets, sleeves and washers between flanges, bolts and nuts. Gaskets shall be similar to DuPont Teflon.
- D. Unions:
 - 1. For steel pipe:
 - a. Malleable iron 300 lb wsp.
 - 1) Ground jacket seat: Brass-to-iron, black or galvanized to match piping.
 - b. A.A.R. malleable iron 300 lb wsp.

2.09 BOLTS AND NUTS

A. Bolts shall be chrome-molybdenum bolt stud in accordance with ASTM A 193 grade B7 with full length threads in accordance with ANSI B 1.1. Threaded Length shall be sufficient to project beyond nuts one complete thread when joint is made.

B. Nuts shall be carbon steel in accordance with ASTM A 194 Grade 2. Nuts shall be hexagon heavy series type. Threads shall be the same as for bolts.

2.10 VALVES

- A. The following valves shall be of the same manufacture:
 - 1. Gate, globe and swing check: Similar to Jenkins Bros. of figure numbers except as noted.
 - 2. Lubricated plug valves: Similar to Rockwell-Nordstrom of figure numbers noted.
 - 3. Butterfly valves: Similar to Center Line and Posi-seal of figure numbers noted.
 - 4. Ball valves: Similar to Jenkins Bros., and Cameron of figure numbers noted.
- B. Valve ends, except as noted, shall be:
 - 1. Screwed ends: Valves 2 inch and smaller in screwed steel piping.
 - 2. Socket weld ends: Valves 2 inch and smaller in all-welded piping.
 - 3. Butt welding ends shall be as noted.
 - 4. Flanged ends shall be for all other valves.
- C. By-pass globe valves: 3/4 inch for 8 inch gate valves, 1 inch for 10 inch and larger gate valves. By-pass valves shall be of same pressure rating as gate valves.
- D. The following valves shall be provided with chain operated handwheels, rustproof chain and chain guide:
 - 1. Valves located 8 ft or more above operating floor or as noted.
- E. Pressure classes for low temperature water systems 40 to 220 deg F:
 - 1. Gate, globe and check valves:
 - a. to 2 inch:
 - 1) To 240 psig maximum system pressure: 150 lb wsp (300 lb wog), bronze.
 - b. 2-1/2 to 12 inch:
 - 1) To 145 psig maximum system pressure: 125 lb wsp (200 lb wog), cast iron.
 - 2. Plug valves.
 - a. To 12 inch:
 - 1) To 125 psig maximum system pressure: 200 lb wog, cast iron.
 - 3. Other valves shall be the same for gate valves, unless otherwise noted.
- F. Gate valves:

- 1. To 2 inch:
 - a. Bronze, threaded ends, solid wedge, inside screw, traveling stem union bonnet.
 - 1) 150 lb wsp: Fig. 47U.
 - b. Bronze, solder ends, solid wedge, inside screw, traveling stem, screw-in bonnet, for use with copper tubing, 300 lb wog: fig. 1242.
 - c. Iron body, stainless steel mounted, OS&Y, rising spindle, screwed ends, u-bolt held bonnet, 150 lb wsp (200 lb wog): Fig. 3651 A.
 - d. Forged steel, bolted bonnet, solid wedge, OS&Y, rising stem: Minimum 800 ANSI, Walworth Fig. W950S threaded, Walworth Fig. W950 SW socket welded.
- 2. 2-1/2 inch and larger:
 - a. Iron body, bronze mounted, solid wedge OS&Y, rising spindle, flanged.
 - 1) 125 lb wsp: Fig. 651-C.
 - b. Cast steel, stainless steel trim, solid wedge, OS&Y, rising stem, flanged:
 - 150 ANSI: welding ends, walworth Fig. 5202WE. Flanged ends Walworth Fig. 5202F.
- G. Globe and angle valves:
 - 1. To 2 inch:
 - a. Bronze, regrind-renew, 500 Brinell stainless steel plug disc and 425 Brinell seat ring, union bonnet.
 - 1) 150 lb wsp globe: Fig. 546P.
 - 2) 150 lb wsp angle: Fig. 548P.
 - b. Bronze, solder ends, composition disc, screw-in bonnet, for use with copper tubing:
 - 1) 300 lb wog globe: Fig. 1200.
 - 2) 300 lb wog angle: Fig. 1202.
 - c. Forged steel, bolted bonnet, plug type disc of 500 Brinell stainless steel with stiletted seat, OS&Y: minimum 800 ANSI Walworth Fig. W5520S, threaded: Walworth Fig. W5520SW socket welded.
 - 2. 2-1/2 inch and larger:
 - a. Regrind-renew, iron body, level bronze disc and seat ring, OS&Y, flanged:
 - 1) 125 lb wsp globe: Similar to Fig. 613C.
 - b. Cast steel, stainless steel trim OS&Y, rising stem, flange:

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- 1) 150 ANSI: Welding ends, Walworth Fig. 5272WE. Flanged ends Walworth Fig. 5275F.
- c. For steam throttling and steam bypass service:
 - 1) To 4 inch: 250 lb wsp, regrind-renew, iron body globe, 500 Brinell, stainless steel plug and disc OS&Y, flanged, Fig. No. 923P.
 - 2) 6 and 8 inch: 300 lb wsp, cast steel, Walworth Fig. 5281F.

H. Swing check valves:

- 1. Access to elements:
 - a. To 2 inch except as noted: Screwed caps or bonnets.
 - b. 2-1/2 inch and larger: Bolted covers.
- 2. Water, except at pump discharge and as noted:
 - a. To 2 inch:
 - 1) 150 lb wsp: Bronze body, screwed ends regrind bronze disc, Fig. 92A.
 - 2) Minimum 800, ANSI: Forged steel, screwed and socket weld ends lift type, bolted bonnet, Walworth Fig. W5540S and W5540SW.
 - 3) 300 lb wog: Bronze body solder ends, regrind Bronze disc, to be used with copper tubing, Fig. 1222.
 - b. 2-1/2 inch and larger:
 - 1) 125 lb wsp: Iron body, regrind-renew bronze disc, flanged, Fig. 624.
 - 2) 150 ANSI: Cast steel, swing type, bolted cover, stainless steel trim, flanged, Walworth Fig. 5341F.
- I. Silent check valves, spring loaded, globe type, flanged:
 - 1. To 250 psig check valves shall be iron body, bronze trim. Similar to Muessco type, 103AP or 107-AP.
 - 2. Above 250 psig check valves shall be cast steel body, stainless steel trim. Similar to muessco types 103-DT or 131-DT, or 109-DT or 113-DT.
- J. Lubricated plug valves shall be:
 - 1. Screwed ends up to 2 inch, flanged 2-1/2 inch and larger.
 - 2. Maximum port opening tapered plug suitable for lubrication under service pressure with plug in any position.
 - 3. Lubricating guns shall be:
 - a. 1 for every 10 valves.

- b. 1 for every 50 valves.
- c. Extra heavy, lever type, hydraulic hand gun.
- d. 15,000 psig gauge and 12 inch long connection hose, similar to Rockwellnordstrom model No. 400-D.
- 4. Lubricant shall be similar to Rockwell Sealant No. 421 with 1 year supply, each valve.
- 5. Operators:
 - a. Up to 6 inch shall be wrench, except as noted.
 - 1) Provide wrench set for each size valve.
 - 2) Provide wrench for every 10 valves, each size.
 - b. 8 inch and larger shall be gear operated with permanently installed handwheel. Where noted for inaccessible overhead valves, provide chain operated handwheel with rustproof chain and chain guide.
 - c. Provide motor operated where noted.
- 6. For piping less than 100 psig valves shall be minimum 200 lb wog class, cast iron body.
 - a. To 2 inch: Screwed.
 - b. 2-1/2 inch and larger: Flanged, 125 ANSI.
- 7. For piping 100 psig to 250 psig valves shall be minimum 400 lb wog class, cast iron body.
 - a. To 2 inch: Screwed.
 - b. 2-1/2 inch and larger: Flanged, 250 ANSI.
- K. Balancing valves:
 - 1. Manually adjusted cocks: Use lubricated plug valves as hereinbefore specified.
 - 2. Automatic pressure compensating valve with two pressure and temperature taps shall be Griswold Controls or Autoflow Inc., factory calibrated, direct acting.
 - a. 200 psig, 250 deg F rating: Gray iron, ASTM A 48 Clamp 3
 - 1) To 2 inch: Threaded.
 - 2) 3 inch and above: Flange mounted.
 - b. 500 psig, 400 deg F rating: Ductile iron ASTM A 536 grade 65-45-12.
 - 1) 3 inch and above: Flange mounted.
 - 3. For direct radiation and unit heaters, refer to Section "HOT WATER SYSTEMS".
- L. Ball valves:

- 1. To 2 inch IPS:
 - a. Provide ball valves with bronze body, ball and stem and Teflon seats and stem seals constructed of Teflon impregnated non-asbestos 2 packing rings or equivalent.
 - b. Provide handle for actuating valve through quarter turn stop.
 - c. Provide valves with 150 lb wsp (400 lb wog) ratings, similar to Jenkins Fig. 32-A.
- M. Motorized valve operators, provide as follows:
 - 1. Mount operators on side or top at factory or at site under manufacturer's supervision. Provide gear operated single or double reduction. For 90 deg application, adjustable mechanical stops shall prevent travel of more than 90 deg.
 - 2. Grease or oil lubricated.
 - 3. 120 volt, 1 phase, 60 hertz.
 - 4. Control circuit: 24 volt, transformer as required.
 - 5. Assembly:
 - Motor shall be high speed, high torque, totally enclosed non-ventilated, Class B or F insulation and operational at up to 10 percent above or below nominal voltage. Motor shall be prelubricated, anti-friction bearing type with thermal overload protection.
 - b. Limit switches shall be integral to the unit. Gearing shall be bronze or stainless steel. Steel switches shall be fully adjustable and shall trip anywhere between full open and full closed, as required. Switches shall be heavy duty, open contact type with rotary wiping action. Provide minimum spare contacts 2 normally open, 2 normally closed.
 - c. Torque switch shall have torque protection either direction, fully adjustable and shall shut off actuator motor when a predetermined amount of torque is reached.
 - d. Stem nut shall be high tensile bronze or material compatible to the valve stem and shall be constructed for easy removal without disassembling gear case.
 - e. Handwheel for manual operation: Handwheel shall declutch automatically when motor is energized. Rimpull shall not exceed a maximum of 80 lb. Handwheel shall be similar to Limitorque SMB and SMC.
 - 6. Open/closed operation: All valves shall have integral control package including control transformer with fused secondary, motor reversing contactor (mechanically interlocked), limit switch compartment heater and terminal strip.
 - a. Indicating lights shall be:
 - 1) Red light glows when valve closed.
 - 2) Green light glows when valve open.

- 3) Intermediate position indication.
- b. Pushbutton station: Provide selector switch if required and momentary or maintained contacts as required.
- 7. Modulating service shall be controlled by analog signal 4-20 ma DC with momentary pushbuttons.
 - a. Controls shall be mounted inside the actuator.
 - b. Provide three phase power supply:
 - 1) Solid state reversing controller.
 - 2) Comparator circuit module.
 - 3) Transformer.
 - 4) 2 position selector switch (auto/manual).
 - 5) Limit switch compartment heater.
 - 6) Mechanical dial position indicator with 1,000 ohm potentiometer.
 - 7) Class F insulation motor.
 - 8) Mounted and wired.
 - 9) Similar to Limitorque Modutronic 30.
 - c. Provide single phase power supply:
 - 1) Comparator circuit module.
 - 2) Mechanical dial position indicator with 1,000 ohm potentiometer feedback.
 - 3) 2 position (auto/manual) selector switch.
 - 4) Limit switch compartment heater.
 - 5) Motor: 2100 rpm D.C. in lieu of A.C.; class F insulation; 20 percent run valve duty.
 - 6) Mounted and wired, similar to Limitorque Modutronic 10A and 10B.

8. Closing time:

- a. Gate shall be 12 inch per minute, minimum 1 minute.
- b. Globe shall be 4 inch per minute, minimum 1 minute.
- c. Butterfly shall be 1/4 turn per minute.

- 9. Provide remote open-close buttons and open-close indicating lights for installation on control board in Section "Automatic Controls System."
- 10. Final field adjustment of valve operation shall be made by manufacturer's representative.

2.11 STRAINERS

- A. Provide screwed ends to 2 inch and flanged 2-1/2 inch and larger with body as follows:
 - 1. To 110 psig: 125 lb wsp class, cast iron.
 - 2. 100 psig to 250 psig: 250 lb wsp class, cast iron.
- B. Screen: Provide 316 stainless steel or monel screens with free area not less that 2-1/2 times inlet area with perforations as follows:
 - 1. Water:
 - a. To 8 inch: 1/8 inch.
 - b. 10 inch and larger: 5/32 inch.
 - 2. Construction: Provide reinforced screen wire gauge to suit size and service.
 - 3. Provide magnets except for handwheel operated type. Provide water strainers:
 - a. All 8 inch and larger.
 - b. Each pump suction.
 - c. Provide continuous magnetic field around entire circumference of screen.
 - d. Provide removable cast Alnico No. 5 channel magnets acceptable baskets constructed of magnetic alloy.
 - e. Secure magnets with stainless steel retaining lugs and threaded rods.
- C. Y-type: Provide screwed with faced cap, straight thread and gasket, similar to Mueller Steam Specialty Muessco No. 11. Provide flanged with bolted cover, similar to Mueller Steam Specialty Muessco No. 751 or No. 752.
- D. Provide basket type with bolted cover, bottom drain connection, similar to Mueller Steam specialty Muessco No. 165.

2.12 SLEEVES AND PACKING

- A. Provide cast iron or steel with or without welded center flange as noted.
- B. Provide No. 20 USSG galvanized iron.
- C. Provide cast iron flashing, type S with integral center flashing flange, and clamping ring.
- D. Extended sleeves shall be similar to Josam No. 1880.
 - 1. Flush sleeves shall be similar to Josam No. 1870.

- 2. Provide galvanized cast iron flashing type for Dex-O-Tex type waterproofing with integral bottom, flanged, similar to Smith DX-935.
- E. For smoke resistant interior walls, partitions, and floor use:
 - 1. No. 18 gauge galvanized steel or standard weight galvanized steel pipe.
 - 2. Space between pipe or pipe covering and sleeve shall be caulked with an incombustible, permanently plastic, waterproof non-staining compound leaving a finished smooth appearance or pack with incombustible fibrous glass to within 2 inches of both wall faces and provide caulking compound as per above, on floors provide caulking compound on inside face only. All work shall be UL listed and State of New York approved.
 - 3. Refer to Architectural Specifications (07841 Through Penetrations Fire Stop Systems, Section 1.3 and 1.5 for approved listings.

2.13 HANGERS, SUPPORTS, GUIDES AND ANCHORS

A. Provide as noted in Subsection Installation.

2.14 ESCUTCHEONS

- A. Provide stamped sheet metal with satin finish chromium plating over copper and deep type to cover projecting sleeves.
- B. For flush fit, use set screws on bare pipe and internal spring on covered pipe.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Piping: Install piping approximately as indicated and modify to suit building conditions, to avoid interference with other trades and to maintain access and clearance and to maintain pitch.
 - 1. Where modifications are required, provide offsets, drains, vents, valves and required pipe and fittings.
 - 2. Connect equipment in accordance with each manufacturer's standard details and recommendations, as approved, except as noted, with accessory piping, vents, drains, reliefs and by-passes.
 - 3. Install piping parallel with or at right angle to walls and other piping, neatly spaced and with plumb risers.
 - 4. Maintain maximum headroom and ceiling height, offset as necessary and coordinate with work of other trades.
 - 5. Maintain minimum 1 inch clearance from adjacent work, including insulation, except as noted or approved.
 - 6. Install no piping in elevator machine rooms, electric rooms and closets and telephone rooms and closets.

- 7. Install valves to be accessible, but install no valve handles pointing down below horizontal position. Install valves to be removable without separating or lifting piping in which installed. On threaded bodies provide cap screws. Where abutting flanged strainers or similar devices, position valve with respect to device so as to permit removal of bolts.
- 8. Provide reducing fittings for changes in pipe sizes. Bushings will not be permitted.
- 9. Provide extra heavy pipe for nipples where unthreaded portions of pipe is less than 1-1/2 inch long. Close nipples not permitted.
- 10. Provide screwed piping with clean threads, cut to exact length and ream after cutting and threading. Apply acceptable compound or teflon tape thread sealant on male threads only. No lamp wick in joints.
- 11. Pitch, except as noted:
 - a. Water piping:
 - 1) Up to 1 inch pipe: 1 inch in 40 ft.
 - 2) 1-1/4 inch and larger: 1 inch in 100 ft.
 - b. Condensation drainage:
 - 1) 1/4 inch per ft preferred.
 - 2) 1/8 inch per ft minimum.
- 12. Drain connection at low points in water piping and where noted:
 - a. In equipment rooms:
 - 1) To 3 inch pipe: 3/4 inch gate valve.
 - 2) 4 inch to 8 inch: 1-1/2 inch gate valve.
 - 3) 10 inch and larger: 2-1/2 inch gate valve.
 - b. Except in equipment rooms: 1/2 inch drain valve with capped hose connection.
- 13. Install manual air vents at high points and where water flow direction changes from horizontal to downward.
 - a. To 3 inch pipe: Line size air chamber, 12 inch long 1/2 inch globe valve.
 - b. 4 inch to 8 inch: Line size air chamber, 6 inch long 1/2 inch globe valve.
 - c. 10 inch and larger: Line size pipe cap, 1/2 inch globe valve.
 - d. For medium and high temperature water systems use same as above with two 1/2 inch globe valves in series.
- 14. Provide automatic air vents where indicated.
- 15. Close open ends of pipes during construction to prevent entry of debris.

B. Hangers, supports and guides:

- 1. Assure adequate support for pipe and contents.
- 2. Prevent vibration or swaying.
- 3. Provide for expansion and contraction.
- 4. Supports of wire, rope, wood, chain, strap perforated bar or any other makeshift device will not be permitted.
- 5. Support piping independently so that equipment is not stressed by piping weight or expansion.
- 6. Refer to Section VIBRATION ISOLATION for hangers, guides, anchors and supports requiring vibration isolation units.
- 7. For uninsulated copper pipe or tubing, use clamps and supports, with electroplated copper finish.
- 8. Uncoated hangers, rods and supports: Dip in zinc chromate primer before installation.
- 9. Maximum spacing for horizontal piping:
 - a. Steel 1 inch and smaller: 6 ft.
 - b. Steel 1-1/4 inch and larger: 10 ft.
 - c. Provide additional supports at changes in direction, branch piping and runouts over 5 ft and concentrate loads due to valves, strainers and other similar items.
- 10. Provide type for horizontal piping, except as noted.
 - a. Provide forged steel adjustable clevis type, rod support for all services except services operating above 250 deg F.
 - b. Rollers or slide bases: Provide pipe stand, bracket, trapeze or other equivalent structural support for the following services for piping 2 inch and larger: High pressure steam and condensate return and medium pressure steam and condensate return.
 - c. For pipe and covering, provide saddles for rollers on slide bases and protective shields or saddles for all other type supports.
 - d. Provide threaded steel rods:
 - 1) 2 inch vertical adjustment with 2 nuts each end for positioning and locking.

Rod

3/8 inch

2) Size to 12 inch IPS:

Pipe, IPS

To 2 inch

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| 2-1/2 inch and 3 inch | 1/2 inch |
|-----------------------|----------|
| 4 inch | 5/8 inch |
| 6 inch and 8 inch | 3/4 inch |
| 10 inch and 12 inch | 7/8 inch |

- 3) For double rod hangers use 1 size smaller than above.
- 4) Connection to structure for piping to 2 inch: use concrete inserts or expansion shields in shear into sides of beams.
- 5) Connection to structure for piping 2-1/2 inch and larger: use concrete inserts, beam clamps or suitable bridging.

11. Vertical piping:

- a. Base elbow support: Provide bearing plate on structural support, similar to F&S Manufacturing Co. Fig. 720 or 721.
- b. Provide guides at every third floor but not exceed:
 - 1) 25 ft for piping to 2 inch.
 - 2) 36 ft for piping 2-1/2 inch to 12 inch.
 - 3) 50 ft for piping 14 inch and larger.
- c. Top support: Provide special hanger or saddle in horizontal connection and make provisions for expansion.
- d. Intermediate supports: Steel pipe clamp at floor. Bolt and weld to pipe with extension ends bearing on structural steel or bearing plates.
- e. For multiple pipes, coordinate guides, bearing plates and accessory steel.
- 12. Insulated piping: Provide horizontal pipe shields at supports:
 - a. Minimum 120 deg arc and length equal to diameter of insulation, 12 inch minimum.
 - b. To 6 inch pipe size: No. 18 USSG galvanized steel and 8 inch and larger: No. 14 USSG galvanized steel.
 - c. Provide vertical pipe shields at guides.
 - 1) Full 360 deg arc, securely banded and length equal to diameter of insulation, 12 inch minimum.
 - To 6 inch pipe size: No. 18 USSG galvanized steel and 8 inch and larger: No. 14 USSG galvanized steel.
- 13. Hydronic Specialties Installation
 - a. Install manual air vents at high points in piping, at heat-transfer coils, and elsewhere as required for system air venting.

- b. Install automatic air vents in mechanical equipment rooms only at high points of system piping, at heat-transfer coils, and elsewhere as required for system air venting.
- c. Install in-line air separators in pump suction lines. Install piping to compression tank with a 2 percent upward slope toward tank. Install drain valve on units NPS 2 and larger.
- d. Install combination air separator and strainer in pump suction lines. Install piping to compression tank with a 2 percent upward slope toward tank. Install blowdown piping with gate valve; extend to nearest drain.
- e. Install expansion tanks on floor. Vent and purge air from hydronic system, and ensure tank is properly charged with air to suit system design requirements.
- C. Connections to apparatus:
 - 1. Final connections to apparatus, equipment, steam traps, automatic control valves, pressure reducing valves: Provide unions or flanges between shutoff valve and connection:
 - a. Screwed piping to 2 inch: Unions.
 - b. Other piping: Flanges.
 - 2. Provide flanged connections to heads of heat exchangers, convertors, chillers, condensers and locate flanges adjacent to equipment connections and to clear tube pull to avoid dismantling of extensive piping for pulling out tube bundle.
- D. Expansion: Install piping to permit free expansion and contraction without damaging piping or construction.
 - 1. Provide offsets, expansion loops, anchors, guides and supports to permit expansion, within stress limits of ANSI Code for Pressure Piping for temperature range of 40 deg F to minimum of 20 deg F above maximum system temperature.
 - 2. Where pipe loops or changes in direction of piping cannot be employed to absorb expansion and contraction, provide expansion joints. Install anchors and guides on both sides of expansion joint in accordance with manufacturers specification, to provide safe installation and trouble-free operation.
- E. Fittings: For changes in pipe size, utilize bushings only where noted and specially permitted and utilize reducers, except as noted, on horizontal and vertical piping:
 - 1. Horizontal water systems: Eccentric, flat on top for venting.
 - 2. Vertical piping: Concentric, if no more than 2 pipe sizes.
 - 3. Elbows: Provide long radius elbows, except where space conditions do not permit. At pump inlet, provide long radius base supported or pump suction diffuser. At pump discharge, provide long radius base supported elbow.
 - 4. Screwed joints: Cut pipe ends square and clean and thread to correct length.
 - a. To 1-1/2 inch pipe: 1-1/2 exposed threads when made tight.

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- b. 2 inch to 6 inch: 2 exposed threads.
- c. 8 inch and larger: 2-1/2 exposed threads.
- d. Ream after threading. Use joint compound or teflon tape thread sealant on male thread only. Apply graphite to threads of drain plugs.
- 5. Nipples: Use close type only where specially permitted as shoulder type of extra heavy pipe where less than 1-1/2 inch is unthreaded.
- F. Welding: Before proceeding, submit the following for review and approval:
 - 1. Proposed procedures conforming to latest revision of:
 - a. ANSI B31.1, Code for Pressure Piping, Chapter V.
 - b. ANSI Z49.1, Safety in Welding and Cutting.
 - c. API code for fuel and other API governed piping.
 - 2. List of welders qualified per Section IX of ASME, Boiler and Pressure Vessel Code.
 - 3. Field procedures: Clean pipe free from rust, scale and oxide. Bevel pipe on each end per acceptable procedures. Provide backing rings on steam and not water over 100 psig. Utilize mitered pipe and field fabricated fittings only where noted and where specially permitted. Hammer clean and flush out piping after welding to remove scale, welding slag and other debris.
- G. Valves: Provide valves as noted. Provide shutoff valves on inlets and outlets of equipment, on branch connections to main and as noted. Provide silent check valves on pump discharges and provide other types at locations as noted.
- H. Motorized valve operators: Provide as noted.
- I. Strainers: Provide as noted.
 - 1. Valved for blow-off with nipple and cap.
 - 2. Provide line size, except as noted.
 - 3. Locate upstream of pumps, automatic control valves, drip traps, pressure reducing valves and other equipment as noted.
- J. Sleeves: Provide for piping through walls, floors and partitions.
 - 1. Type: Provide cast iron flashing type:
 - a. Membrane waterproofed walls and floors.
 - b. Adjust to construction with galvanized pipe nipples extending 2 inches above finished floor and flush with walls and ceilings.
 - c. Extend lead flashing extending 10 inches beyond clamping device.

d. Provide galvanized steel pipe:

- 1) Integral waterproofed walls and floors:
 - a) Welded center flanged, buried.
 - b) Extending 2 inch above finished floor.
 - c) 1/2 inch projection beyond walls.
 - d) Caulked watertight.
- 2) Concrete floors and masonry walls:
 - a) 2 inch above finished floor.
 - b) Flush with ceiling.
 - c) 1/2 inch projection beyond walls.
- e. Provide galvanized sheet metal: For locations except where other type sleeves are specified shall be not less than No. 22 USSG except sleeves for piping 4 in. and larger, use No. 18 USSG. For piping run in floor fill, provide No. 22 USSG galvanized sheet metal, U-shaped covers with clearance for expansion.
- 2. Size: For bare pipe, provide sleeve a minimum 1/2 inch larger than pipe and pass fittings as required. For insulated pipe, except as noted, provide flashing sleeve the same as for bare pipe or sheet metal sleeve 1/2 inch larger than covering.
- 3. Caulking: Seal openings between sleeves and pipe or pipe insulation. Provide depth of caulking the full length of sleeve.
 - a. Material for fire barrier: Provide mineral wool or equivalent non-asbestos, noncombustible material.
 - b. For acoustical barrier, refer to Section "NOISE CONTROL".
 - c. Utilize the following for sleeves through waterproof construction:
 - 1) Interior: Non-asbestos ceramic fiber packing and hot poured mastic.
 - 2) Exterior: Non-asbestos ceramic fiber packing and caulking lead.
- K. Escutcheons: Provide at surfaces where exposed piping penetrates walls, ceilings, floors or partitions and at fire barrier caulking.

3.02 ADJUSTMENT AND CLEANING

- A. Cleaning.
 - 1. During construction, prevent entry of foreign matter, clean pipe, fittings and valves internally and hammer welds to remove slag and weld beads. Flush piping system with clear water prior to connection to coils, control valves, and equipment. Install temporary

bypass piping around coils, control valves and equipment where piping system is not flushed prior to connection.

- 2. After erection, flush with clear water and seal ends after cleaning.
- 3. Water systems:
 - a. Upon start-up fill with clean water, add alkaline detergent, as follows:
 - 1) Sodium silicate and/or sodium phosphate with nonfoaming wetting agent.
 - Phenolphthalein alkalinity to 2000 to 5000 ppm as CaCO/3, supplied and supervised by water treatment company. Refer to Section: WATER TREATMENT.
 - b. Temporary equipment for condenser water system: Remove straightening vanes and metering orifices from condenser water piping system and replace after cleaning.
 - 1) Place temporary flat screen type strainer in each cooling tower cell inlet during cleaning period and remove after cleaning period.
 - c. Circulate water of each system at respective design flow rates.
 - 1) Three 8-hour days.
 - 2) At end of each 8-hour period, remove and clean strainers and blow off low points.
 - d. After third day of pumping, completely drain out entire systems of cleaning solution and clean out cooling tower basins and hose down.
 - e. Refill systems with clean water and circulate for an additional 8-hour period and at the end of that interval, completely drain systems.
 - f. Drain, refill with clear water and circulate.
 - g. Test for alkalinity, not more than 200 ppm in excess of alkalinity of rinsing water.
 - h. Repeat (circulation of water of each system at respective design flow rates minimum) as described above, until 200 ppm or less, are maintained for 10 days.
 - i. Protect against damage from freeze-up or discharge of water.
 - j. Equipment by-passing:
 - 1) Remove or by-pass control valves, coil and all equipment subject to damage from high alkalinity.
 - 2) Provide for all sub mains to by-pass:
 - a) Cabinet heaters.

- 3) Provide bypassing between supply and return risers to avoid flushing water coils or control valves.
- B. Balancing and adjusting water systems: Refer to Section BALANCING AIR AND WATER SYSTEMS.
 - 1. Balance and adjust water systems to provide required quantity to or through each component.
 - 2. Examine systems and position valves and cocks in open position, as required.
 - a. Position automatic control valves for full flow through the heat transfer equipment of the system during the balancing.
 - b. Maintain moving equipment lubricated and strainers clean and perform other maintenance and inspection tasks for proper system operation.
 - 3. Make adjustments required to balance systems. Adjust balancing valves or cocks to satisfaction of Architect and/or Engineer.
 - 4. Mark valve tag of each valve or cock used for balancing to indicate position of valve stem.
 - 5. Pumps: Demonstrate performance as noted.
 - 6. Test reports: Submit in bound folder with accompanying sketches.
 - a. Additional report information: Submit method of balancing and details of instruments used and submit copies of readings with piping layout showing where readings were taken.

3.03 FIELD QUALITY CONTROL.

- A. Tests:
 - 1. Provide materials, equipment, labor and power as required to perform tests per approved schedule and project requirements.
 - 2. Piping systems: Less than 100 psig operating pressure, test hydrostatically to 150 psig. Over 100 psig operating pressure, test hydrostatically to 1-1/2 times operating pressure but never exceed test pressure as per ANSI B16 basis.
 - 3. Duration: Test for 2 hours with system valves capped and pressure apparatus disconnected.
 - a. Pressure change: None.
 - 4. Repair or replace leaks and defects as directed without additional cost.

END OF SECTION

SECTION 232300

REFRIGERANT PIPING

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. Refrigerant pipes and fittings.
 - 2. Refrigerant piping valves and specialties.
 - 3. Refrigerants.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of valve, refrigerant piping, and piping specialty.
 - 1. Include pressure drop, based on manufacturer's test data, for the following:
 - a. Thermostatic expansion valves.
 - b. Solenoid valves.
 - c. Filter dryers.
 - d. Strainers.
- B. Shop Drawings:
 - 1. Show layout of refrigerant piping and specialties, including pipe, tube, and fitting sizes; flow capacities; valve arrangements and locations; slopes of horizontal runs; oil traps; double risers; wall and floor penetrations; and equipment connection details.
 - 2. Show piping size and piping layout, including oil traps, double risers, specialties, and pipe and tube sizes to accommodate, as a minimum, equipment provided, elevation difference between compressor and evaporator, and length of piping to ensure proper operation and compliance with warranties of connected equipment.
 - 3. Show interface and spatial relationships between piping and equipment.
 - 4. Shop Drawing Scale: 1/4 inch equals 1 foot .

1.4 INFORMATIONAL SUBMITTALS

A. Welding certificates.

B. Field quality-control reports.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For refrigerant valves and piping specialties to include in maintenance manuals.

1.6 QUALITY ASSURANCE

- A. Welding Qualifications: Qualify procedures and personnel according to 2010 ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."
- B. Comply with ASHRAE 15, "Safety Code for Refrigeration Systems."
- C. Comply with ASME B31.5, "Refrigeration Piping and Heat Transfer Components."

1.7 PRODUCT STORAGE AND HANDLING

A. Store piping with end caps in place to ensure that piping interior and exterior are clean when installed.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Line Test Pressure for Refrigerant R-410A:
 - 1. Suction Lines for Air-Conditioning Applications: 300 psig.
 - 2. Suction Lines for Heat-Pump Applications: 535 psig.
 - 3. Hot-Gas and Liquid Lines: 535 psig.

2.2 COPPER TUBE AND FITTINGS

- A. Copper Tube: ASTM B 280, Type ACR.
- B. Wrought-Copper Fittings: ASME B16.22.
- C. Wrought-Copper Unions: ASME B16.22.
- D. Solder Filler Metals: ASTM B 32. Use 95-5 tin antimony or alloy HB solder to join copper socket fittings on copper pipe.
- E. Brazing Filler Metals: AWS A5.8/A5.8M.
- F. Flexible Connectors:
 - 1. Body: Tin-bronze bellows with woven, flexible, tinned-bronze-wire-reinforced protective jacket.

- 2. End Connections: Socket ends.
- 3. Offset Performance: Capable of minimum 3/4-inch misalignment in minimum 7-inch- long assembly.
- 4. Working Pressure Rating: Factory test at minimum 500 psig.
- 5. Maximum Operating Temperature: 250 deg F.

2.3 VALVES AND SPECIALTIES

- A. Diaphragm Packless Valves:
 - 1. Body and Bonnet: Forged brass or cast bronze; globe design with straight-through or angle pattern.
 - 2. Diaphragm: Phosphor bronze and stainless steel with stainless-steel spring.
 - 3. Operator: Rising stem and hand wheel.
 - 4. Seat: Nylon.
 - 5. End Connections: Socket, union, or flanged.
 - 6. Working Pressure Rating: 500 psig.
 - 7. Maximum Operating Temperature: 275 deg F.
- B. Service Valves:
 - 1. Body: Forged brass with brass cap including key end to remove core.
 - 2. Core: Removable ball-type check valve with stainless-steel spring.
 - 3. Seat: Polytetrafluoroethylene.
 - 4. End Connections: Copper spring.
 - 5. Working Pressure Rating: 500 psig.
- C. Solenoid Valves: Comply with AHRI 760 and UL 429; listed and labeled by a National Recognized Testing Laboratory (NRTL).
 - 1. Body and Bonnet: Plated steel.
 - 2. Solenoid Tube, Plunger, Closing Spring, and Seat Orifice: Stainless steel.
 - 3. Seat: Polytetrafluoroethylene.
 - 4. End Connections: Threaded.
 - 5. Electrical: Molded, watertight coil in NEMA 250 enclosure of type required by location with 1/2-inch conduit adapter, and 24-V ac coil.
 - 6. Working Pressure Rating: 400 psig.
 - 7. Maximum Operating Temperature: 240 deg F.
- D. Thermostatic Expansion Valves: Comply with AHRI 750.
 - 1. Body, Bonnet, and Seal Cap: Forged brass or steel.
 - 2. Diaphragm, Piston, Closing Spring, and Seat Insert: Stainless steel.
 - 3. Packing and Gaskets: Non-asbestos.
 - 4. Capillary and Bulb: Copper tubing filled with refrigerant charge.
 - 5. Suction Temperature: 40 deg F.
 - 6. Superheat: Adjustable.
 - 7. Reverse-flow option (for heat-pump applications).
 - 8. End Connections: Socket, flare, or threaded union.
 - 9. Working Pressure Rating: 450 psig.
- E. Angle-Type Strainers:
 - 1. Body: Forged brass or cast bronze.
 - 2. Drain Plug: Brass hex plug.
 - 3. Screen: 100-mesh monel.
 - 4. End Connections: Socket or flare.
 - 5. Working Pressure Rating: 500 psig.

- 6. Maximum Operating Temperature: 275 deg F.
- F. Moisture/Liquid Indicators:
 - 1. Body: Forged brass.
 - 2. Window: Replaceable, clear, fused glass window with indicating element protected by filter screen.
 - 3. Indicator: Color coded to show moisture content in parts per million (ppm).
 - 4. Minimum Moisture Indicator Sensitivity: Indicate moisture above 60 ppm.
 - 5. End Connections: Socket.
 - 6. Working Pressure Rating: 500 psig.
 - 7. Maximum Operating Temperature: 240 deg F.
- G. Replaceable-Core Filter Dryers: Comply with AHRI 730.
 - 1. Body and Cover: Painted-steel shell with ductile-iron cover, stainless-steel screws, and neoprene gaskets.
 - 2. Filter Media: 10 micron, pleated with integral end rings; stainless-steel support.
 - 3. Desiccant Media: Activated alumina.
 - 4. Designed for reverse flow (for heat-pump applications).
 - 5. End Connections: Socket.
 - 6. Access Ports: NPS 1/4 connections at entering and leaving sides for pressure differential measurement.
 - 7. Maximum Pressure Loss: 2 psig.
 - 8. Working Pressure Rating: 500 psig.
 - 9. Maximum Operating Temperature: 240 deg F.
- H. Permanent Filter Dryers: Comply with AHRI 730.
 - 1. Body and Cover: Painted-steel shell.
 - 2. Filter Media: 10 micron, pleated with integral end rings; stainless-steel support.
 - 3. Desiccant Media: Activated alumina.
 - 4. Designed for reverse flow (for heat-pump applications).
 - 5. End Connections: Socket.
 - 6. Access Ports: NPS 1/4 connections at entering and leaving sides for pressure differential measurement.
 - 7. Maximum Pressure Loss: 2 psig.
 - 8. Working Pressure Rating: 500 psig.
 - 9. Maximum Operating Temperature: 240 deg F.
- I. Mufflers:
 - 1. Body: Welded steel with corrosion-resistant coating.
 - 2. End Connections: Socket or flare.
 - 3. Working Pressure Rating: 500 psig.
 - 4. Maximum Operating Temperature: 275 deg F.
- J. Receivers: Comply with AHRI 495.
 - 1. Comply with 2010 ASME Boiler and Pressure Vessel Code; listed and labeled by an NRTL.
 - 2. Comply with UL 207; listed and labeled by an NRTL.
 - 3. Body: Welded steel with corrosion-resistant coating.
 - 4. Tappings: Inlet, outlet, liquid level indicator, and safety relief valve.
 - 5. End Connections: Socket.
 - 6. Working Pressure Rating: 500 psig.
 - 7. Maximum Operating Temperature: 275 deg F.
- K. Liquid Accumulators: Comply with AHRI 495.
 - 1. Body: Welded steel with corrosion-resistant coating.

- 2. End Connections: Socket or threaded.
- 3. Working Pressure Rating: 500 psig.
- 4. Maximum Operating Temperature: 275 deg F.

2.4 REFRIGERANTS

A. ASHRAE 34, R-410A: Pentafluoroethane/Difluoromethane.

PART 3 - EXECUTION

3.1 PIPING APPLICATIONS FOR REFRIGERANT R-410A

A. Hot-Gas and Liquid Lines, and Suction Lines for Heat-Pump Applications: Copper, Type ACR, annealed- or drawn-temper tubing and wrought-copper fittings with brazed joints.

3.2 VALVE AND SPECIALTY APPLICATIONS

- A. Install diaphragm packless valves in suction and discharge lines of compressor.
- B. Install service valves for gage taps at inlet and outlet of hot-gas bypass valves and strainers if they are not an integral part of valves and strainers.
- C. Install a check valve at the compressor discharge and a liquid accumulator at the compressor suction connection.
- D. Except as otherwise indicated, install diaphragm packless valves on inlet and outlet side of filter dryers.
- E. Install solenoid valves upstream from each expansion valve. Install solenoid valves in horizontal lines with coil at top.
- F. Install thermostatic expansion valves as close as possible to distributors on evaporators.
 - 1. Install valve so diaphragm case is warmer than bulb.
 - 2. Secure bulb to clean, straight, horizontal section of suction line using two bulb straps. Do not mount bulb in a trap or at bottom of the line.
 - 3. If external equalizer lines are required, make connection where it will reflect suction-line pressure at bulb location.
- G. Install safety relief valves where required by 2010 ASME Boiler and Pressure Vessel Code. Pipe safety-relief-valve discharge line to outside according to ASHRAE 15.
- H. Install moisture/liquid indicators in liquid line at the inlet of the thermostatic expansion valve or at the inlet of the evaporator coil capillary tube.
- I. Install strainers upstream from and adjacent to the following unless they are furnished as an integral assembly for the device being protected:
 - 1. Solenoid valves.

- 2. Thermostatic expansion valves.
- 3. Compressor.
- J. Install filter dryers in liquid line between compressor and thermostatic expansion valve, and in the suction line at the compressor.
- K. Install receivers sized to accommodate pump-down charge.
- L. Install flexible connectors at compressors.

3.3 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. Identify refrigerant piping and valves according to Section 230553 "Identification for HVAC Piping and Equipment."
- R. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 230517 "Sleeves and Sleeve Seals for HVAC Piping."
- S. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Section 230517 "Sleeves and Sleeve Seals for HVAC Piping."
- T. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 230518 "Escutcheons for HVAC Piping."

3.4 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."
 - 1. Use Type BCuP (copper-phosphorus) alloy for joining copper socket fittings with copper pipe.
 - 2. Use Type BAg (cadmium-free silver) alloy for joining copper with bronze or steel.

3.5 HANGERS AND SUPPORTS

- A. Comply with requirements for pipe hangers and supports specified in Section 230529 "Hangers and Supports for HVAC Piping and Equipment."
- B. Install the following pipe attachments:
 - 1. Adjustable steel clevis hangers for individual horizontal runs less than 20 feet long.
 - 2. Copper-clad hangers and supports for hangers and supports in direct contact with copper pipe.
- C. Install hangers for copper tubing with the following maximum spacing and minimum rod diameters:
 - 1. NPS 1/2: Maximum span, 60 inches; minimum rod, 1/4 inch.

- 2. NPS 5/8: Maximum span, 60 inches; minimum rod, 1/4 inch.
- 3. NPS 1: Maximum span, 72 inches; minimum rod, 1/4 inch.
- D. Support multifloor vertical runs at least at each floor.

3.6 FIELD QUALITY CONTROL

- A. Perform the following 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 "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.
- B. Prepare test and inspection reports.

3.7 SYSTEM CHARGING

- A. Charge system using the following procedures:
 - 1. Install core in filter dryers after leak test but before evacuation.
 - 2. Evacuate entire refrigerant system with a vacuum pump to 500 micrometers. If vacuum holds for 12 hours, system is ready for charging.
 - 3. Break vacuum with refrigerant gas, allowing pressure to build up to 2 psig.
 - 4. Charge system with a new filter-dryer core in charging line.

3.8 ADJUSTING

- A. Adjust thermostatic expansion valve to obtain proper evaporator superheat.
- B. Adjust high- and low-pressure switch settings to avoid short cycling in response to fluctuating suction pressure.
- C. Adjust set-point temperature of air-conditioning controllers to the system design temperature.
- D. Perform the following adjustments before operating the refrigeration system, according to manufacturer's written instructions:
 - 1. Verify that compressor oil level is correct.
 - 2. Open compressor suction and discharge valves.
 - 3. Open refrigerant valves except bypass valves that are used for other purposes.
 - 4. Check open compressor-motor alignment and verify lubrication for motors and bearings.

E. Replace core of replaceable filter dryer after system has been adjusted and after design flow rates and pressures are established.

END OF SECTION 232300

GREENWICH PUBLIC SCHOOLS GREENWICH HIGH SCHOOL LOCKER ROOM RENOVATIONS PHASE II METAL DUCTS

SECTION 233113 METAL DUCTS

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. Single-wall rectangular ducts and fittings.
 - 2. Sheet metal materials.
 - 3. Duct liner.
 - 4. Sealants and gaskets.
 - 5. Hangers and supports.
 - 6. Seismic-restraint devices.
- B. Related Sections:
 - 1. Division 23 Section "Testing, Adjusting, and Balancing for HVAC" for testing, adjusting, and balancing requirements for metal ducts.
 - 2. Division 23 Section "Air Duct Accessories" for dampers, sound-control devices, duct-mounting access doors and panels, turning vanes, and flexible ducts.

1.3 PERFORMANCE REQUIREMENTS

- A. Duct construction, including sheet metal thicknesses, seam and joint construction, reinforcements, and hangers and supports, shall comply with SMACNA's "HVAC Duct Construction Standards Metal and Flexible, latest edition" and performance requirements and design criteria indicated.
 - 1. DESIGN STATIC PRESSURE PRESSURE CLASS 2 IN. W.G

OPERATING PRESSURE UP TO 2 IN. W.G.

- a. Based on the following:
 - 1) Single duct system: Static pressure at respective point in ductwork during normal operation.
 - 2) Variable volume and dual duct systems: Static pressure at beginning of fan discharge duct.
- b. Description of ductwork pressure class and equipment:

- 1) 3" Duct Class: All suction and discharge of exhaust ductwork. Seal Class "B", leakage class 12 *rectangular metal or Class 6 (round)
- 2) 2" Duct Class and less: All other low pressure ductwork. Seal Class "C", leakage Class 24 (rectangular) or Class 12 (round).
- B. Structural Performance: Duct hangers and supports shall withstand the effects of gravity loads and stresses within limits and under conditions described in SMACNA's "HVAC Duct Construction Standards Metal and Flexible".

1.4 EXISTING DUCTWORK TO BE REUSED:

1. This contractor shall inspect, seal per SMACNA requirements, leak test, and insulate all existing ductwork to be reused. Existing ductwork to be reused shall conform to specifications for new ductwork listed herein. All required work shall be part of bid.

1.5 SUBMITTALS

- A. Product Data: For each type of the following products:
 - 1. Liners and adhesives.
 - 2. Sealants and gaskets.
 - 3. Seismic-restraint devices.
- B. Shop Drawings (CAD Generated and Drawn to 3/8 scale):
 - 1. Sheetmetal shop standards shall be compiled directly from the "SMACNA DUCT CONSTRUCTION STANDARDS- Metal and Flexible" manual. Modifications for a specific project, if any, shall be indicated directly on the SMACNA templates. Modified shop standards not taken directly from the SMACNA templates will not be accepted. Any deviations from SMACNA shall be noted.
 - 2. Fabrication, assembly, and installation, including plans, elevations, sections, components, and attachments to other work.
 - 3. Factory- and shop-fabricated ducts and fittings.
 - 4. Duct layout (double line) indicating sizes, transitions, configuration, liner material, and staticpressure classes.
 - 5. Elevation of top of ducts.
 - 6. Dimensions of main duct runs from building grid lines.
 - 7. Sheet metal thicknesses
 - 8. Fittings.
 - 9. Reinforcement details and spacing.
 - 10. Seam and joint construction and sealing
 - 11. Materials, fabrication, assembly, and spacing of hangers and supports.
 - 12. Penetrations through fire-rated and other partitions.
 - 13. Equipment installation based on equipment being used on Project.
 - 14. Access clearance for all equipment and accessories
 - 15. Locations for duct accessories, including dampers, turning vanes, and access doors and panels.
 - 16. Hangers and supports, including methods for duct and building attachment and vibration isolation.
- C. Coordination Drawings: Plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

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- 1. Duct installation in congested spaces, indicating coordination with general construction, building components, and other building services. Indicate proposed changes to duct layout.
- 2. Suspended ceiling components.
- 3. Structural members to which duct will be attached.
- 4. Size and location of initial access modules for acoustical tile.
- 5. Penetrations of smoke barriers and fire-rated construction.
- 6. Items penetrating finished ceiling including the following:
 - a. Lighting fixtures.
 - b. Air outlets and inlets.
 - c. Speakers.
 - d. Sprinklers.
 - e. Access panels.

PART 2 - PRODUCTS

2.1 SINGLE-WALL RECTANGULAR DUCTS AND FITTINGS

- A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards Metal and Flexible", latest edition, based on indicated static-pressure class unless otherwise indicated.
- B. The following fitting connections and duct construction gauges are NOT acceptable
 - 1. Drive slip fitting connections
 - 2. 26 gauge ductwork.
- C. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards Metal and Flexible,"Transverse (Girth) Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards Metal and Flexible." Fittings and/or joints of two different gauges, connected joint rating shall meet more stringent conditions
 - 1. Use the following SMACNA Transverse (Girth) Joints
 - a. Duct construction as follows for 2" w.g. class:
 - 1) Up to 12" wide use T-6 or T-7
 - 2) 13" to 28" wide use T-11 or T12
 - 3) 29" wide and up use TDC or TDF
 - b. Duct construction as follows for 3" w.g. class:
 - 1) Up to 20" wide use T-6 or T-7
 - 2) 21" to 24" wide use T-11 or T12
 - 3) 25" wide and up use TDC or TDF
 - c. Duct construction as follows for 6" w.g. class:
 - 1) Up to 12" wide use T-6 or T-7
 - 2) 13" to 18" wide use T-11 or T12
 - 3) 19" wide and up use TDC or TDF

- D. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible "Longitudinal Seams - Rectangular Ducts," for staticpressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
- E. Elbows, Transitions, Offsets, Branch Connections, and Other Duct Construction: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards Metal and Flexible,"Fittings and Other Construction," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards Metal and Flexible."

2.2 SHEET METAL MATERIALS

A. General Material Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible", latest edition for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.

B. EXPOSED DUCTWORK

- 1. Where ductwork is indicated to be exposed to view in occupied spaces, provide materials which are free from visual imperfections, including pittings, seam marks, stains, discolorations, and other imperfections. Provide finishes which will allow painting. Provide flat type seams and joints for all exposed duct construction
- C. Galvanized Sheet Steel: Comply with ASTM A 653/A 653M.
 - 1. Galvanized Coating Designation: [G60 (Z180)].
 - 2. Finishes for Surfaces Exposed to View: Mill phosphatized.
- D. Factory- or Shop-Applied Antimicrobial Coating:
 - 1. Apply to the surface of sheet metal that will form the interior surface of the duct. An untreated clear coating shall be applied to the exterior surface.
 - 2. Antimicrobial compound shall be tested for efficacy by an NRTL and registered by the EPA for use in HVAC systems.
 - 3. Coating containing the antimicrobial compound shall have a hardness of 2H, minimum, when tested according to ASTM D 3363.
 - 4. Surface-Burning Characteristics: Maximum flame-spread index of 25 and maximum smokedeveloped index of 50 when tested according to UL 723; certified by an NRTL.
 - 5. Shop-Applied Coating Color: Black.
 - 6. Antimicrobial coating on sheet metal is not required for duct containing liner treated with antimicrobial coating.
- E. Reinforcement Shapes and Plates: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.
 - 1. Where black- and galvanized-steel shapes and plates are used to reinforce aluminum ducts, isolate the different metals with butyl rubber, neoprene, or EPDM gasket materials.
- F. Tie Rods: Galvanized steel, 1/4-inch (6-mm) minimum diameter for lengths 36 inches (900 mm) or less; 3/8-inch (10-mm) minimum diameter for lengths longer than 36 inches (900 mm).

GREENWICH PUBLIC SCHOOLS GREENWICH HIGH SCHOOL LOCKER ROOM RENOVATIONS PHASE II METAL DUCTS

G. Flush flat seam ductwork: Provide for all exposed uninsulated ducts and transverse joint detail shall be as indicated. Provide sheet metal 2 gauge numbers heavier than required for pressure classification with normal (standing) seam construction. Provide all joints and seams, smooth and aligned with no projections. For internal reinforcing, at transverse joints and on 2 ft centers, provide on ducts 31 inch to 60 inch wide, single vertical stay at duct midpoint, on ducts 61 inch to 90 inch wide provide 2 vertical stays on duct third (1/3) points and for ducts over 90 inch wide provide 3 vertical stays at ducts quarter (1/4) points. For vertical stays: provide 10 USSG galvanized steel, free of burrs and rough edges with both ends bent and fastened to top and bottom of duct.

2.3 DUCT LINER

- A. Comply with requirements specified in Division 23 Section "NOISE CONTROL AND ACOUSTICAL PERFORMANCE ".
- B. Shop Application of Duct Liner: Comply with SMACNA's "HVAC Duct Construction Standards Metal and Flexible,"Flexible Duct Liner Installation."
 - 1. Adhere a single layer of indicated thickness of duct liner with at least 90 percent adhesive coverage at liner contact surface area. Attaining indicated thickness with multiple layers of duct liner is prohibited.
 - 2. Apply adhesive to transverse edges of liner facing upstream.
 - 3. Butt transverse joints without gaps, and coat joint with adhesive.
 - 4. Fold and compress liner in corners of rectangular ducts or cut and fit to ensure butted-edge overlapping.
 - 5. Do not apply liner in rectangular ducts with longitudinal joints, except at corners of ducts, unless duct size and dimensions of standard liner make longitudinal joints necessary.
 - 6. Apply adhesive coating on longitudinal seams in ducts with air velocity of 2500 fpm (12.7 m/s).
 - 7. Secure liner with mechanical fasteners 4 inches (100 mm) from corners and at intervals not exceeding 12 inches (300 mm) transversely; at 3 inches (75 mm) from transverse joints and at intervals not exceeding 18 inches (450 mm) longitudinally.
 - 8. Secure transversely oriented liner edges facing the airstream with metal nosings that have either channel or "Z" profiles or are integrally formed from duct wall. Fabricate edge facings at the following locations:
 - a. Fan discharges.
 - b. Intervals of lined duct preceding unlined duct.
 - c. Upstream edges of transverse joints in ducts or where indicated.
 - 9. Secure insulation between perforated sheet metal inner duct of same thickness as specified for outer shell. Use mechanical fasteners that maintain inner duct at uniform distance from outer shell without compressing insulation.
 - a. Sheet Metal Inner Duct Perforations: 3/32-inch (2.4-mm) diameter, with an overall open area of 23 percent.
 - 10. Terminate inner ducts with buildouts attached to fire-damper sleeves, dampers, turning vane assemblies, or other devices. Fabricated buildouts (metal hat sections) or other buildout means are optional; when used, secure buildouts to duct walls with bolts, screws, rivets, or welds.

2.4 SEALANT AND GASKETS

- A. General Sealant and Gasket Requirements: Surface-burning characteristics for sealants and gaskets shall be a maximum flame-spread index of 25 and a maximum smoke-developed index of 50 when tested according to UL 723; certified by an NRTL.
- B. Indicate compliance with USGBC LEED rating criteria for Indoor environmental quality (IEQ)
- C. Two-Part Tape Sealing System:
 - 1. Tape: Woven cotton fiber impregnated with mineral gypsum and modified acrylic/silicone activator to react exothermically with tape to form hard, durable, airtight seal.
 - 2. Tape Width: 3 inches (76 mm)
 - 3. Sealant: Modified styrene acrylic.
 - 4. Water resistant.
 - 5. Mold and mildew resistant.
 - 6. Maximum Static-Pressure Class: 10-inch wg (2500 Pa), positive and negative.
 - 7. Service: Indoor and outdoor.
 - 8. Service Temperature: Minus 40 to plus 200 deg F (Minus 40 to plus 93 deg C).
 - 9. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum.
- D. Water-Based Joint and Seam Sealant:
 - 1. Application Method: Brush on.
 - 2. Solids Content: Minimum 65 percent.
 - 3. Shore A Hardness: Minimum 20.
 - 4. Water resistant.
 - 5. Mold and mildew resistant.
 - 6. VOC: Maximum 75 g/L (less water).
 - 7. Maximum Static-Pressure Class: 10-inch wg (2500 Pa), positive and negative.
 - 8. Service: Indoor or outdoor.
 - 9. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum sheets.
- E. Flanged Joint Sealant: Comply with ASTM C 920.
 - 1. General: Single-component, acid-curing, silicone, elastomeric.
 - 2. Type: S.
 - 3. Grade: NS.
 - 4. Class: 25.
 - 5. Use: O.
- F. Flange Gaskets: Butyl rubber, neoprene, or EPDM polymer with polyisobutylene plasticizer.

2.5 HANGERS AND SUPPORTS

- A. Hanger Rods for Noncorrosive Environments: Cadmium-plated steel rods and nuts.
- B. Strap and Rod Sizes: Comply with SMACNA's "HVAC Duct Construction Standards Metal and Flexible,"Rectangular Duct Hangers Minimum Size," and "Minimum Hanger Sizes for Round Duct."
- C. Steel Cables for Galvanized-Steel Ducts: Galvanized steel complying with ASTM A 603.

- D. Steel Cable End Connections: Cadmium-plated steel assemblies with brackets, swivel, and bolts designed for duct hanger service; with an automatic-locking and clamping device.
- E. Duct Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.
- F. Trapeze and Riser Supports:
 - 1. Supports for Galvanized-Steel Ducts: Galvanized-steel shapes and plates.
 - 2. Supports for Stainless-Steel Ducts: Stainless-steel shapes and plates.
 - 3. Supports for Aluminum Ducts: Aluminum or galvanized steel coated with zinc chromate.

PART 3 - EXECUTION

3.1 DUCT INSTALLATION

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of duct system. Indicated duct locations, configurations, and arrangements were used to size ducts and calculate friction loss for air-handling equipment sizing and for other design considerations. Install duct systems as indicated unless deviations to layout are approved on Shop Drawings and Coordination Drawings.
- B. Install ducts according to SMACNA's "HVAC Duct Construction Standards Metal and Flexible" unless otherwise indicated.
- C. Install ducts with fewest possible joints.
- D. Install factory- or shop-fabricated fittings for changes in direction, size, and shape and for branch connections.
- E. Unless otherwise indicated, install ducts vertically and horizontally, and parallel and perpendicular to building lines.
- F. Install ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building.
- G. Install ducts with a clearance of 1 inch (25 mm), plus allowance for insulation thickness.
- H. Protect duct interiors from moisture, construction debris and dust, and other foreign materials. Comply with SMACNA's "Duct Cleanliness for New Construction Guidelines."

3.2 SEAM AND JOINT SEALING

A. Seal duct seams and joints for duct static-pressure and leakage classes specified in "Performance Requirements" Article, according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Standard Duct Sealing Requirements," unless otherwise indicated..

3.3 HANGER AND SUPPORT INSTALLATION

A. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," "Hangers and Supports."

- B. Building Attachments: Concrete inserts, powder-actuated fasteners, or structural-steel fasteners appropriate for construction materials to which hangers are being attached.
 - 1. Install powder-actuated concrete fasteners after concrete is placed and completely cured.
 - 2. Use powder-actuated concrete fasteners for standard-weight aggregate concretes or for slabs more than 4 inches (100 mm) thick.
 - 3. Do not use powder-actuated concrete fasteners for lightweight-aggregate concretes or for slabs less than 4 inches (100 mm) thick.
 - 4. Do not use powder-actuated concrete fasteners for seismic restraints.
- C. Hanger Spacing: Comply with the requirements of this section, the BUILDING CODE and SMACNA's "HVAC Duct Construction Standards Metal and Flexible,"Rectangular Duct Hangers Minimum Size," and for maximum hanger spacing whichever is more stringent. Install hangers and supports within 24 inches (610 mm) of each elbow and within 48 inches (1200 mm) of each branch intersection.
- D. Hangers Exposed to View: Threaded rod and angle or channel supports.
- E. Support vertical ducts with steel angles or channel secured to the sides of the duct with welds, bolts, sheet metal screws, or blind rivets; support at each floor and at a maximum intervals of 16 feet (5 m).
- F. Install upper attachments to structures. Select and size upper attachments with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.
- G. Hangers, horizontal ducts:
 - 1. To 2 sq ft in area: Provide galvanized steel strap hangers, minimum 1 inch x 1/8 inch, maximum 8 ft 0 inch spacing.
 - 2. 2 to 4 sq ft in area: Galvanized steel strap hangers, minimum 1 inch x 1/8 inch, maximum 8 ft 0 inch spacing.
 - 3. Strap hangers shall be bent 2 inch under the bottom corner of rectangular ducts. One screw shall secure 2 inch portion of hanger to bottom of duct. Straps shall be secured to side of duct with a minimum of two screws and more, as necessary, to provide a maximum screw spacing of 12 inch. Side-of-duct screws shall be located not more than 2 inch from top and bottom of duct.
 - 4. 4 to 10 sq ft in area: Provide galvanized steel trapeze angles from steel threaded rods with a maximum 6 ft 0 inch spacing.
 - 5. Over 10 sq ft in area: Provide galvanized steel trapeze angles from steel threaded rods with a maximum 4 ft 0 inch spacing.
 - 6. Provide stronger support to match larger and heavier ducts; provide cross-bracing, angle iron hangers, as required for rigid and adequate supports.
 - 7. In mechanical rooms: Provide black steel painted or galvanized, vertical angles or rods and horizontal angles across ductwork.
- H. Hangers Vertical ducts: At each floor, provide minimum 2 supports per duct fastened to duct and spanning shaft opening. Fasten supports to floor or structural construction. Maximum screw spacing shall be 12 inch on center and maximum shall be four screw per riser.
 - 1. Angles and channels: Provide painted black steel or galvanized. Where angles are specified, channels of equivalent strength, material and protective coating will be permitted. Where more than one duct is supported by a common set of angles, support size shall be determined by sum of width dimensions.
 - 2. Supports: Provide as follows, except increase supports as required for load and span where span of angles exceed 6 ft or floor-to-floor height exceeds 14 ft.
 - a. Duct width to 30 inch: Provide angle size: 1-1/4 inch x 1-1/4 inch x 1/8 inch.

- b. Duct width, 31 inch to 54 inch: Angle size shall be 2 inch x 2 inch x 3/16 inch.
- c. Duct width, 55 inch to 90 inch: Angle size shall be 2 inch x 2 inch x 1/4 inch.

3.4 CONNECTIONS

- A. Make connections to equipment with flexible connectors complying with Division 23 Section "Air Duct Accessories."
- B. Comply with SMACNA's "HVAC Duct Construction Standards Metal and Flexible" for branch, outlet and inlet, and terminal unit connections.

3.5 PAINTING

A. Paint interior of metal ducts that are visible through registers and grilles and that do not have duct liner. Apply one coat of flat, black, latex paint over a compatible galvanized-steel primer. Paint materials and application requirements are specified in Division 09 painting Sections.

3.6 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
- B. Leakage Tests:
 - 1. Comply with SMACNA's "HVAC Air Duct Leakage Test Manual."
 - 2. All testing shall be done in the presence of the engineer or owner's representative. The contractor is responsible for providing all collars, caps, electric power, etc. necessary to perform the tests. The contractor is also responsible for scheduling the test no less than three (3) business days prior to its intended occurrence. Low pressure ductwork (2" class) shall be tested on an as needed basis at the engineer's direction. Leakage test procedure shall follow the outlines and classifications in the SMACNA HVAC duct leakage test manual. If specimen fails to meet allotted leakage level, the contractor shall modify to bring it into compliance and shall retest it until acceptable leakage is demonstrated. Tests and necessary repair shall be completed prior to concealment of ducts.
 - 3. Test the following systems:
 - a. All ductwork greater than 2" class as defined within is to be tested. .
 - 4. Disassemble, reassemble, and seal segments of systems to accommodate leakage testing and for compliance with test requirements.
 - 5. Test for leaks before insulation application.
 - 6. Conduct tests at static pressures equal to maximum design pressure of system or section being tested. If static-pressure classes are not indicated, test entire system at maximum system design pressure. Do not pressurize systems above maximum design operating pressure. Give seven days' advance notice for testing.
- C. Duct System Cleanliness Tests:
 - 1. Visually inspect duct system to ensure that no visible contaminants are present.
 - 2. Test sections of metal duct system, chosen randomly by Owner, for cleanliness according to "Vacuum Test" in NADCA ACR, "Assessment, Cleaning and Restoration of HVAC Systems."

- a. Acceptable Cleanliness Level: Net weight of debris collected on the filter media shall not exceed 0.75 mg/100 sq. cm.
- D. Duct system will be considered defective if it does not pass tests and inspections.
- E. Prepare test and inspection reports.

3.7 DUCT CLEANING

- A. Clean existing duct system(s) before testing, adjusting, and balancing.
- B. Use service openings for entry and inspection.
 - 1. Create new openings and install access panels appropriate for duct static-pressure class if required for cleaning access. Provide insulated panels for insulated or lined duct. Patch insulation and liner as recommended by duct liner manufacturer. Comply with Division 23 Section "Air Duct Accessories" for access panels and doors.
 - 2. Disconnect and reconnect flexible ducts as needed for cleaning and inspection.
 - 3. Remove and reinstall ceiling to gain access during the cleaning process.
- C. Particulate Collection and Odor Control:
 - 1. When venting vacuuming system inside the building, use HEPA filtration with 99.97 percent collection efficiency for 0.3-micron-size (or larger) particles.
 - 2. When venting vacuuming system to outdoors, use filter to collect debris removed from HVAC system, and locate exhaust downwind and away from air intakes and other points of entry into building.
- D. Clean the following components by removing surface contaminants and deposits:
 - 1. Air outlets and inlets (registers, grilles, and diffusers).
 - 2. Supply, return, and exhaust fans including fan housings, plenums (except ceiling supply and return plenums), scrolls, blades or vanes, shafts, baffles, dampers, and drive assemblies.
 - 3. Air-handling unit internal surfaces and components including mixing box, coil section, air wash systems, spray eliminators, condensate drain pans, humidifiers and dehumidifiers, filters and filter sections, and condensate collectors and drains.
 - 4. Coils and related components.
 - 5. Return-air ducts, dampers, actuators, and turning vanes except in ceiling plenums and mechanical equipment rooms.
 - 6. Supply-air ducts, dampers, actuators, and turning vanes.
 - 7. Dedicated exhaust and ventilation components and makeup air systems.
- E. Mechanical Cleaning Methodology:
 - 1. Clean metal duct systems using mechanical cleaning methods that extract contaminants from within duct systems and remove contaminants from building.
 - 2. Use vacuum-collection devices that are operated continuously during cleaning. Connect vacuum device to downstream end of duct sections so areas being cleaned are under negative pressure.
 - 3. Use mechanical agitation to dislodge debris adhered to interior duct surfaces without damaging integrity of metal ducts, duct liner, or duct accessories.
 - 4. Clean fibrous-glass duct liner with HEPA vacuuming equipment; do not permit duct liner to get wet. Replace fibrous-glass duct liner that is damaged, deteriorated, or delaminated or that has friable material, mold, or fungus growth.

- 5. Clean coils and coil drain pans according to NADCA 1992. Keep drain pan operational. Rinse coils with clean water to remove latent residues and cleaning materials; comb and straighten fins.
- 6. Provide drainage and cleanup for wash-down procedures.
- 7. Antimicrobial Agents and Coatings: Apply EPA-registered antimicrobial agents if fungus is present. Apply antimicrobial agents according to manufacturer's written instructions after removal of surface deposits and debris.

3.8 DUCT SCHEDULE

- A. Fabricate ducts with galvanized sheet steel:
- B. Liner:
 - 1. Comply with requirements specified in Division 23 Section "NOISE CONTROL AND ACOUSTICAL PERFORMANCE ".
- C. Elbow Configuration:
 - 1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards Metal and Flexible," Rectangular Elbows."
 - 1) Radius Type RE 1 with minimum 1.5 radius-to-diameter ratio.
 - 2) Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Vanes and Vane Runners," and "Vane Support in Elbows."
 - 3) Provide vanes on all short radius elbows.
 - 4) Provide double thickness turning vanes on all square elbows.

D. Branch Configuration:

- 1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards Metal and Flexible," "Branch Connections."
 - a. Rectangular Main to Rectangular Branch: 45-degree entry.
 - b. Rectangular Main to Round Branch: flanged spin in, conical.
 - c. Do not use "butt flange" straight taps.
 - d. Divided flow branches
 - 1) Provide long radius takeoff or square elbow as per SMACNA.
- E. Obstructions
 - 1. Conform to SMACNA
- F. Offsets and transitions
 - 1. Conform to SMACNA

END OF SECTION 233113

SECTION 233300 AIR DUCT 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. Backdraft and pressure relief dampers.
 - 2. Manual volume dampers.
 - 3. Control dampers.
 - 4. Flange connectors.
 - 5. Turning vanes.
 - 6. Duct-mounted access doors.
 - 7. Flexible connectors.
 - 8. Duct accessory hardware.
- B. Related Sections:
 - 1. Division 28 Section "Fire Detection and Alarm" for duct-mounted fire and smoke detectors.

1.3 SUBMITTALS

- A. Shop Drawings: For duct accessories. Include plans, elevations, sections, details and attachments to other work.
 - 1. Detail duct accessories fabrication and installation in ducts and other construction. Include dimensions, weights, loads, and required clearances; and method of field assembly into duct systems and other construction. Include the following:
 - a. Special fittings.
 - b. Manual volume damper installations.
 - c. Control damper installations.
- B. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which ceiling-mounted access panels and access doors required for access to duct accessories are shown and coordinated with each other, using input from Installers of the items involved.
- C. Source quality-control reports.
- D. Operation and Maintenance Data: For air duct accessories to include in operation and maintenance manuals.

1.4 QUALITY ASSURANCE

- A. Comply with NFPA 90A, "Installation of Air Conditioning and Ventilating Systems," and with NFPA 90B, "Installation of Warm Air Heating and Air Conditioning Systems."
- B. Comply with AMCA 500-D testing for damper rating.

1.5 EXTRA MATERIALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Fusible Links: Furnish quantity equal to 10 percent of amount installed.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Comply with SMACNA's "HVAC Duct Construction Standards Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.
- B. Galvanized Sheet Steel: Comply with ASTM A 653/A 653M.
 - 1. Galvanized Coating Designation: G60 (Z180).
 - 2. Exposed-Surface Finish: Mill phosphatized.
- C. Stainless-Steel Sheets: Comply with ASTM A 480/A 480M, Type 304, and having a No. 2D finish for concealed ducts and No 4 finish for exposed ducts.
- D. Reinforcement Shapes and Plates: Galvanized-steel reinforcement where installed on galvanized sheet metal ducts; compatible materials for aluminum and stainless-steel ducts.
- E. Tie Rods: Galvanized steel, 1/4-inch (6-mm) minimum diameter for lengths 36 inches (900 mm) or less; 3/8-inch (10-mm) minimum diameter for lengths longer than 36 inches (900 mm).

2.2 MANUAL VOLUME DAMPERS

- A. Dampers to be the same as duct construction.
- B. Standard, Steel, Manual Volume Dampers:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Pottorff; a division of PCI Industries, Inc.
 - b. Ruskin Company.
 - 2. Standard leakage rating, with linkage outside airstream.
 - 3. Suitable for horizontal or vertical applications.
 - 4. Frames:

- a. Hat-shaped, galvanized-steel channels, 0.064-inch (1.62-mm) minimum thickness.
- b. Mitered and welded corners.
- c. Flanges for attaching to walls and flangeless frames for installing in ducts.
- 5. Blades:
 - a. Multiple or single blade.
 - b. Provide single blade dampers up to 6 inch width and opposed multtiblade dampers above 6 inches in width.
 - c. Parallel- or opposed-blade design.
 - d. Stiffen damper blades for stability.
 - e. Galvanized-steel, 0.064 inch (1.62 mm) thick (16 ga.).
- 6. Blade Axles: Galvanized steel.
- 7. Bearings:
 - a. Molded synthetic.
 - b. Dampers in ducts with pressure classes of 3-inch wg (750 Pa) or less shall have axles full length of damper blades and bearings at both ends of operating shaft.
- 8. Tie Bars and Brackets: Galvanized steel.
- C. Low-Leakage, Steel, Manual Volume Dampers:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Pottorff; a division of PCI Industries, Inc.
 - b. Ruskin Company.
 - 2. Low-leakage rating, with linkage outside airstream, and bearing AMCA's Certified Ratings Seal for both air performance and air leakage.
 - 3. Suitable for horizontal or vertical applications.
 - 4. Frames:
 - a. Hat shaped.
 - b. Galvanized -steel channels, 0.064 inch (1.62 mm) thick.
 - c. Mitered and welded corners.
 - d. Flanges for attaching to walls and flangeless frames for installing in ducts.
 - 5. Blades:
 - a. Multiple or single blade.
 - b. Parallel- or opposed-blade design.
 - c. Stiffen damper blades for stability.
 - d. Galvanized, roll-formed steel, 0.064 inch (1.62 mm) thick. (16 ga.).
 - 6. Blade Axles: Galvanized steel.
 - 7. Bearings:
 - a. Molded synthetic.

- b. Dampers in ducts with pressure classes of 3-inch wg (750 Pa) or less shall have axles full length of damper blades and bearings at both ends of operating shaft.
- 8. Blade Seals: Neoprene.
- 9. Jamb Seals: Cambered aluminum.
- 10. Tie Bars and Brackets: Galvanized steel.
- 11. Accessories:
 - a. Include locking device to hold single-blade dampers in a fixed position without vibration.

2.3 CONTROL DAMPERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Greenheck Fan Corporation.
 - 2. Ruskin Company.
- B. Low-leakage rating, with linkage outside airstream, and bearing AMCA's Certified Ratings Seal for both air performance and air leakage.
- C. Dampers to be the same as duct construction.
- D. For internally lined ductwork: Provide 2 internal saddles to protect lining.
- E. Frames:
 - 1. Hat shaped.
 - 2. Galvanized -steel channels, 0.064 inch (1.62 mm) thick.
 - 3. Mitered and welded corners.
- F. Blades:
 - 1. Provide airfoil blades.
 - 2. Multiple blade with maximum blade width of 8 inches (200 mm).
 - 3. Provide dampers with parallel blades for 2 position control and opposed blades for modulating control.
 - 4. Parallel- and opposed blade design.
 - 5. Galvanized steel.
 - 6. 0.064 inch (1.62 mm) thick.
 - 7. Blade Edging: Closed-cell neoprene edging.
 - 8. Blade Edging: Inflatable seal blade edging, or replaceable rubber seals.
- G. Blade Axles: 1/2-inch- (13-mm-) diameter; [galvanized steel] [nonferrous metal]; blade-linkage hardware of zinc-plated steel and brass; ends sealed against blade bearings.
 - 1. Operating Temperature Range: From minus 40 to plus 200 deg F (minus 40 to plus 93 deg C).
- H. Bearings:
 - 1. Molded synthetic.
 - 2. Dampers in ducts with pressure classes of 3-inch wg (750 Pa) or less shall have axles full length of damper blades and bearings at both ends of operating shaft.

3. Thrust bearings at each end of every blade.

2.4 TURNING VANES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Ductmate Industries, Inc.
 - 2. Duro Dyne Inc.
 - 3. METALAIRE, Inc.
 - 4. SEMCO Incorporated.
- B. Turning Vanes for Metal Ducts: Curved blades of galvanized sheet steel; support with bars perpendicular to blades set; set into vane runners suitable for duct mounting.
 - 1. Acoustic Turning Vanes: Fabricate airfoil-shaped aluminum extrusions with perforated faces and fibrous-glass fill.
- C. General Requirements: Comply with SMACNA's "HVAC Duct Construction Standards Metal and Flexible"; "Vanes and Vane Runners," and "Vane Support in Elbows."
- D. Vane Construction: Double wall.
- E. The maximum unsupported vane length shall not exceed 48 inches.
- F. Single vane and short radius vanes are not acceptable.

2.5 REMOTE DAMPER OPERATORS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Pottorff; a division of PCI Industries, Inc.
 - 2. Ventfabrics, Inc.
 - 3. Young Regulator Company.
- B. Description: Cable system designed for remote manual damper adjustment.
- C. Tubing: Brass.
- D. Cable: Stainless steel.
- E. Wall-Box Mounting: Surface.
- F. Wall-Box Cover-Plate Material: Steel.

2.6 DUCT-MOUNTED ACCESS DOORS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Ductmate Industries, Inc.
 - 2. Greenheck Fan Corporation.
 - 3. McGill AirFlow LLC.
 - 4. Pottorff; a division of PCI Industries, Inc.

- 5. Ventfabrics, Inc.
- B. Duct-Mounted Access Doors: Fabricate access panels according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible"; Figures 2-10, "Duct Access Doors and Panels," and 2-11, "Access Panels - Round Duct."
 - 1. Door:
 - a. Double wall, rectangular.
 - b. Galvanized sheet metal with insulation fill and thickness as indicated for duct pressure class.
 - c. Vision panel.
 - d. Hinges and Latches: 1-by-1-inch (25-by-25-mm) butt or piano hinge and cam latches.
 - e. Fabricate doors airtight and suitable for duct pressure class.
 - 2. Frame: Galvanized sheet steel, with bend-over tabs and foam gaskets.
 - 3. Number of Hinges and Locks:
 - a. Access Doors Less Than 12 Inches (300 mm) Square: No hinges and two sash locks.
 - b. Access Doors up to 18 Inches (460 mm) Square: Two hinges and two sash locks.
 - c. Access Doors up to 24 by 48 Inches (600 by 1200 mm): Three hinges and two compression latches.
 - d. Access Doors Larger than 24 by 48 Inches (600 by 1200 mm): Four hinges and two compression latches with outside and inside handles.

2.7 FLEXIBLE CONNECTORS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Ductmate Industries, Inc.
 - 2. Duro Dyne Inc.
 - 3. Ventfabrics, Inc.
- B. Materials: Flame-retardant or noncombustible fabrics.
- C. Coatings and Adhesives: Comply with UL 181, Class 1.
- D. Metal-Edged Connectors: Factory fabricated with a fabric strip 3-1/2 inches (89 mm) wide attached to 2 strips of 2-3/4-inch- (70-mm-) wide, 0.028-inch- (0.7-mm-) thick, galvanized sheet steel or 0.032-inch- (0.8-mm-) thick aluminum sheets. Provide metal compatible with connected ducts.
- E. Indoor System, Flexible Connector Fabric: Glass fabric double coated with neoprene.
 - 1. Minimum Weight: 26 oz./sq. yd. (880 g/sq. m).
 - 2. Tensile Strength: 480 lbf/inch (84 N/mm) in the warp and 360 lbf/inch (63 N/mm) in the filling.
 - 3. Service Temperature: Minus 40 to plus 200 deg F (Minus 40 to plus 93 deg C).
- F. Outdoor System, Flexible Connector Fabric: Glass fabric double coated with weatherproof, synthetic rubber resistant to UV rays and ozone.
 - 1. Minimum Weight: 24 oz./sq. yd. (810 g/sq. m).
 - 2. Tensile Strength: 530 lbf/inch (93 N/mm) in the warp and 440 lbf/inch (77 N/mm) in the filling.

- 3. Service Temperature: Minus 50 to plus 250 deg F (Minus 45 to plus 121 deg C).
- G. 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 fan discharge and duct.
 - 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. Outdoor 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 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.

2.8 DUCT ACCESSORY HARDWARE

- A. Instrument Test Holes: Cast iron or cast aluminum to suit duct material, including screw cap and gasket. Size to allow insertion of pitot tube and other testing instruments and of length to suit duct-insulation thickness.
- B. Adhesives: High strength, quick setting, neoprene based, waterproof, and resistant to gasoline and grease.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install duct accessories according to applicable details in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for metal ducts and in NAIMA AH116, "Fibrous Glass Duct Construction Standards," for fibrous-glass ducts.
- B. Install duct accessories of materials suited to duct materials; use galvanized-steel accessories in galvanized-steel and fibrous-glass ducts, stainless-steel accessories in stainless-steel ducts, and aluminum accessories in aluminum ducts.
- C. Install volume dampers at points on supply, return, and exhaust systems where branches extend from larger ducts. Where dampers are installed in ducts having duct liner, install dampers with hat channels of same depth as liner, and terminate liner with nosing at hat channel.
 - 1. Coordinate subparagraphs below with Division 23 Section "Metal Ducts." Install steel volume dampers in steel ducts.
 - 2. Provide manual balancing volume dampers as required properly balance the air distribution system. If the location of balancing dampers are not defined on the drawings, the following minimum standards shall govern:
 - a. Low Pressure: All supply main air branches from trunk, each split, and all sub branches from main shall be provided with balancing dampers.
 - b. Low Pressure: All exhaust main air branches from trunk, each split, and all sub branches from main shall be provided with balancing dampers.

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- c. Ducts connecting to common plenums.
- d. Ducts serving single outlet.
- e. At open return duct in hung ceiling.
- f. As noted on plans.
- 3. For internally lined ductwork: Provide 2 internal saddles to protect lining.
- 4. Install levers to be accessible through the insulation
- D. Set dampers to fully open position before testing, adjusting, and balancing.
- E. Install test holes at fan inlets and outlets and elsewhere as indicated.
- F. Install duct access doors on sides of ducts to allow for inspecting, adjusting, and maintaining accessories and equipment at the following locations:
 - 1. On both sides of duct coils.
 - 2. Downstream from manual volume dampers, control dampers, and equipment.
 - 3. At each change in direction and at maximum 50-foot (15-m) spacing.
 - 4. Elsewhere as indicated.
- G. Install access doors with swing against duct static pressure.
- H. Access Door Sizes:
 - 1. One-Hand or Inspection Access: 8 by 5 inches (200 by 125 mm).
 - 2. Two-Hand Access: 12 by 6 inches (300 by 150 mm).
 - 3. Head and Hand Access: 18 by 10 inches (460 by 250 mm).
 - 4. Head and Shoulders Access: 21 by 14 inches (530 by 355 mm).
 - 5. Body Access: 25 by 14 inches (635 by 355 mm).
 - 6. Body plus Ladder Access: 25 by 17 inches (635 by 430 mm).
- I. Label access doors according to Division 23 Section "Identification for HVAC Piping and Equipment" to indicate the purpose of access door.
- J. Install flexible connectors to connect ducts to equipment.
- K. For fans developing static pressures of 5-inch wg (1250 Pa) and more, cover flexible connectors with loaded vinyl sheet held in place with metal straps.
- L. Connect terminal units to supply ducts directly. Do not use flexible ducts.
- M. Connect diffusers to low-pressure ducts directly.
- N. Install duct test holes where required for testing and balancing purposes.
- O. Install thrust limits at centerline of thrust, symmetrical on both sides of equipment. Attach thrust limits at centerline of thrust and adjust to a maximum of 1/4-inch (6-mm) movement during start and stop of fans.
- 3.2 FIELD QUALITY CONTROL
 - A. Tests and Inspections:

- 1. Operate dampers to verify full range of movement.
- 2. Inspect locations of access doors and verify that purpose of access door can be performed.
- 3. Inspect turning vanes for proper and secure installation.
- 4. Operate remote damper operators to verify full range of movement of operator and damper.

END OF SECTION 233300

SECTION 233713 DIFFUSERS, REGISTERS, AND GRILLES

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. Rectangular and square ceiling diffusers.
 - 2. Adjustable bar registers and grilles.
- B. Related Sections:
 - 1. Division 23 Section "Air Duct Accessories" for fire and smoke dampers and volume-control dampers not integral to diffusers, registers, and grilles.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated, include the following:
 - 1. Data Sheet: Indicate materials of construction, finish, and mounting details; and performance data including throw and drop, static-pressure drop, and noise ratings.
 - 2. Diffuser, Register, and Grille Schedule: Indicate drawing designation, room location, quantity, model number, size, and accessories furnished.
- B. Samples for Initial Selection: For diffusers, registers, and grilles with factory-applied color finishes.
- C. Samples for Verification: For diffusers, registers, and grilles, in manufacturer's standard sizes to verify color selected.
- D. 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. Ceiling suspension assembly members.
 - 2. Method of attaching hangers to building structure.
 - 3. Size and location of initial access modules for acoustical tile.
 - 4. Ceiling-mounted items including lighting fixtures, diffusers, grilles, speakers, sprinklers, access panels, and special moldings.
 - 5. Duct access panels.
- E. Source quality-control reports.

PART 2 - PRODUCTS

2.1 CEILING DIFFUSERS

- A. Rectangular and Square Ceiling Diffusers:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Price Industries.
 - b. Titus.
 - 2. Devices shall be specifically designed for variable-air-volume flows.
 - 3. Material: Steel.
 - 4. Finish: Baked enamel, color selected by Architect.
 - 5. Face Size: 24 by 24 inches (600 by 600 mm).
 - 6. Face Style: Plaque.
 - 7. Mounting: Surface or T-bar.
 - 8. Pattern: Fixed.
 - 9. Dampers: Combination damper and grid.
 - 10. Accessories:
 - a. Equalizing grid.
 - b. Sectorizing baffles.

2.2 CEILING LINEAR SLOT OUTLETS

- A. Linear Slot Diffuser:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Price Industries.
 - b. Titus.
 - 2. Devices shall be specifically designed for variable-air-volume flows.
 - 3. Material Shell: Aluminum, insulated.
 - 4. Material Pattern Controller and Tees: Aluminum.
 - 5. Finish Face and Shell: Baked enamel, black.
 - 6. Finish Pattern Controller: Baked enamel, black.
 - 7. Finish Tees: Baked enamel, white.
 - 8. Slot Width: Varies; refer to schedule.
 - 9. Number of Slots: Varies; refer to schedule.
 - 10. Length: Varies; refer to schedule.
 - 11. Accessories: Plaster frame, T-bar slot. Varies; refer to schedule.

2.3 REGISTERS AND GRILLES

- A. Adjustable Bar Register:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Price Industries.

b. Titus.

- 2. Material: Aluminum.
- 3. Finish: Baked enamel, white.
- 4. Face Blade Arrangement: Horizontal spaced 3/4 inch (19 mm) apart.
- 5. Core Construction: Integral.
- 6. Rear-Blade Arrangement: Vertical spaced 3/4 inch (19 mm) apart.
- 7. Frame: 1-1/4 inches (32 mm) wide.
- 8. Mounting: Countersunk screw.
- 9. Damper Type: Adjustable opposed blade.
- 10. Accessories:
 - a. Rear-blade gang operator.
 - b. Filter.
- B. Fixed Face Grille:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Price Industries.
 - b. Titus.
 - 2. Material: Aluminum.
 - 3. Finish: Baked enamel, white.
 - 4. Face Arrangement: Refer to schedule on drawings.
 - 5. Core Construction: Integral.
 - 6. Frame: 1 inch (25 mm) wide.
 - 7. Mounting: Countersunk screw or Lay in.
- 2.4 SOURCE QUALITY CONTROL
 - A. Verification of Performance: Rate diffusers, registers, and grilles according to ASHRAE 70, "Method of Testing for Rating the Performance of Air Outlets and Inlets."

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas where diffusers, registers, and grilles are to be installed for compliance with requirements for installation tolerances and other conditions affecting performance of equipment.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.
- 3.2 INSTALLATION
 - A. Install diffusers, registers, and grilles level and plumb.
 - B. Ceiling-Mounted Outlets and Inlets: Drawings indicate general arrangement of ducts, fittings, and accessories. Air outlet and inlet locations have been indicated to achieve design requirements for air volume, noise criteria, airflow pattern, throw, and pressure drop. Make final locations where indicated, as much as practical. For units installed in lay-in ceiling panels, locate units in the center of panel. Where

architectural features or other items conflict with installation, notify Architect for a determination of final location.

- C. Install diffusers, registers, and grilles with airtight connections to ducts and to allow service and maintenance of dampers, air extractors, and fire dampers.
- D. Only four (4) way diffusers shall be provided. Provide sheetmetal blank off as required for 1 way, 2 way or 3 way diffusers.
- E. Noise level at noted capacities shall not exceed criteria specified in Section NOISE CONTROL. Diffusers shall be suitable for operation at 5 percent excess and 25 percent less then noted capacity. Provide blanking for proper coverage and blow without producing objectionable noise or air motion at occupied level. Finish shall match color sample as approved:
- F. Linear diffusers: Frame types shall mate with ceilings. Provide means to neatly butt and align units to give continuous appearance without butting flanges. No screw holes or welded corners visible on diffusers or frames will be permitted. Air volume shall be adjustable through air supply face without requiring removal of face panel. Provide blanked sections for inactive lengths. Provide plaster frames and opposed blade volume dampers with remote cable operators where noted. Refer to Architectural Drawings for mounting details and overall lengths. Finish shall match color sample as approved:

3.3 ADJUSTING

A. After installation, adjust diffusers, registers, and grilles to air patterns indicated, or as directed, before starting air balancing.

END OF SECTION 233713

SECTION 238126

SPLIT-SYSTEM AIR-CONDITIONERS

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 split-system air-conditioning and heat-pump units consisting of separate evaporator-fan and compressor-condenser components.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated. Include rated capacities, operating characteristics, and furnished specialties and accessories. Include performance data in terms of capacities, outlet velocities, static pressures, sound power characteristics, motor requirements, and electrical characteristics.
- B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
 - 1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
 - 2. Wiring Diagrams: For power, signal, and control wiring.
- C. Samples for Initial Selection: For units with factory-applied color finishes.

1.4 INFORMATIONAL SUBMITTALS

- A. Field quality-control reports.
- B. Warranty: Sample of special warranty.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For split-system air-conditioning 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.

1.7 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. ASHRAE Compliance:
 - 1. Fabricate and label refrigeration system to comply with ASHRAE 15, "Safety Standard for Refrigeration Systems."
 - 2. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 4 "Outdoor Air Quality," Section 5 - "Systems and Equipment," Section 6 - " Procedures," and Section 7 - "Construction and System Start-up."

1.8 COORDINATION

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

1.9 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of split-system air-conditioning units that fail in materials or workmanship within specified warranty period.
 - 1. Warranty Period:
 - a. For Compressor: Five years from date of Substantial Completion.
 - b. For Parts: One year from date of Substantial Completion.
 - c. For Labor: One years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Carrier Corporation; a unit of United Technologies Corp
- B. The Coleman Company Inc
- C. First Operations LP
- D. Friedrich Air Conditioning Company

- E. Koldwave, Inc.
- F. Lennox Industries, Inc
- G. Mitsubishi Electric & Electronics USA, Inc.
- H. Mitsubishi Electric Sales Canada Inc.
- I. Mitsubishi Heavy Industries America, Inc
- J. Samsung HVAC
- K. SANYO North America Corporation
- L. Trane
- M. YORK; a Johnson Controls company

2.2 INDOOR UNITS (5 TONS OR LESS)

- A. Wall-Mounted, Evaporator-Fan Components:
 - 1. Cabinet: Enameled steel with removable panels on front and ends in color selected by Architect, and discharge drain pans with drain connection.
 - 2. Refrigerant Coil: Copper tube, with mechanically bonded aluminum fins and thermalexpansion valve. Comply with ARI 206/110.
 - 3. Fan: Direct drive, centrifugal.
 - 4. Fan Motors:
 - a. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements specified in Section 230513 "Common Motor Requirements for HVAC Equipment."
 - b. Multitapped, multispeed with internal thermal protection and permanent lubrication.
 - c. Enclosure Type: Totally enclosed, fan cooled.
 - d. Controllers, Electrical Devices, and Wiring: Comply with requirements for electrical devices and connections specified in electrical Sections.
 - 5. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.
 - 6. Condensate Drain Pans:
 - a. Fabricated with one percent slope in at least two planes to collect condensate from cooling coils (including coil piping connections, coil headers, and return bends) and humidifiers, and to direct water toward drain connection.
 - 1) Length: Extend drain pan downstream from leaving face to comply with ASHRAE 62.1.
 - 2) Depth: A minimum of 1 inch deep.

- b. Single-wall, galvanized-steel sheet.
- c. Drain Connection: Located at lowest point of pan and sized to prevent overflow. Terminate with threaded nipple on one end of pan.
 - 1) Minimum Connection Size: NPS 3/4.
- d. Pan-Top Surface Coating: Asphaltic waterproofing compound.
- 7. Air Filtration Section:
 - a. General Requirements for Air Filtration Section:
 - 1) Comply with NFPA 90A.
 - 2) Minimum Arrestance and MERV according to ASHRAE 52.2.
 - 3) Filter-Holding Frames: Arranged for flat or angular orientation, with access doors on both sides of unit. Filters shall be removable from one side or lifted out from access plenum.

2.3 OUTDOOR UNITS (5 TONS OR LESS)

- A. Air-Cooled, Compressor-Condenser Components:
 - 1. Casing: Steel, finished with baked enamel in color selected by Architect, with removable panels for access to controls, weep holes for water drainage, and mounting holes in base. Provide brass service valves, fittings, and gage ports on exterior of casing.
 - 2. Compressor: Hermetically sealed with crankcase heater and mounted on vibration isolation device. Compressor motor shall have thermal- and current-sensitive overload devices, start capacitor, relay, and contactor.
 - a. Compressor Type: Scroll.
 - b. Refrigerant Charge: R-410A.
 - c. Refrigerant Coil: Copper tube, with mechanically bonded aluminum fins and liquid subcooler. Comply with ARI 206/110.
 - 3. Heat-Pump Components: Reversing valve and low-temperature-air cutoff thermostat.
 - 4. Fan: Aluminum-propeller type, directly connected to motor.
 - 5. Motor: Permanently lubricated, with integral thermal-overload protection.
 - 6. Low Ambient Kit: Permits operation down to 0deg F.
 - 7. Mounting Base: Polyethylene.

2.4 ACCESSORIES

- A. Thermostat: Low voltage with subbase to control compressor and evaporator fan with the following features:
 - 1. Compressor time delay.
 - 2. 24-hour time control of system stop and start.
 - 3. Liquid-crystal display indicating temperature, set-point temperature, time setting, operating mode, and fan speed.

- 4. Fan-speed selection including auto setting.
- B. Automatic-reset timer to prevent rapid cycling of compressor.
- C. Refrigerant Line Kits: Soft-annealed copper suction and liquid lines factory cleaned, dried, pressurized, and sealed; factory-insulated suction line with flared fittings at both ends.
- D. Drain Hose: For condensate.

2.5 CAPACITIES AND CHARACTERISTICS

- A. Cooling and Heating Capacity:
 - 1. Refer to schedules on drawings.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install units level and plumb.
- B. Install evaporator-fan components using manufacturer's standard mounting devices securely fastened to building structure.
- C. Install roof-mounted, compressor-condenser components on engineered equipment support stands. Anchor units to supports with removable, cadmium-plated fasteners.

3.2 CONNECTIONS

- A. Piping installation requirements are specified in other Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Where piping is installed adjacent to unit, allow space for service and maintenance of unit.

3.3 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
- B. Tests and Inspections:
 - 1. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
 - 2. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
 - 3. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

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- C. Remove and replace malfunctioning units and retest as specified above.
- D. Prepare test and inspection reports.

3.4 STARTUP SERVICE

- A. Perform startup service.
 - 1. Complete installation and startup checks according to manufacturer's written instructions.

3.5 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain units.

END OF SECTION 238126

SECTION 238213

RADIANT HEATING 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. This Section includes the following:
 - 1. Hydronic heating panels.

1.3 SUBMITTALS

- A. Product Data: Include rated capacities, specialties, and accessories for each product indicated.
- B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work. Detail equipment assemblies and suspension and attachment. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
- C. Coordination Drawings: Reflected ceiling plan(s) and other details, drawn to scale, on which the following items are shown and coordinated with each other, based on input from installers of the items involved:
 - 1. Structural members to which heaters and suspension systems will be attached.
- D. Samples for Initial Selection: For units with factory-applied color finishes.
 - 1. Dimensioned Outline Drawings of Equipment Unit: Describe mounting and anchorage provisions.
 - 2. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
- E. Field quality-control test reports.
- F. Operation and Maintenance Data: For electric radiant heaters and panels to include in emergency, operation, and maintenance manuals.

1.4 COORDINATION

A. Coordinate layout and installation of radiant heaters and panels and suspension system components with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, fire-suppression system, and partition assemblies.

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PART 2 - PRODUCTS

2.1 HYDRONIC HEATING PANELS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Aerotech
 - 2. Airtex Products.
 - 3. Airtite.
- B. Description: Linear extruded aluminum panel with serpentine water piping, suitable for surface mounting.
 - 1. Panels: Continuous aluminum extrusions fitted together to achieve the specified widths.
 - 2. Backing Insulation: Minimum 1-inch- thick, mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 612, Type IA or Type IB with factory-applied jacket.
 - 3. Exposed-Side Panel Finish: Baked-enamel finish in manufacturer's standard paint color as selected by Architect.
 - 4. Factory Piping: ASTM B 88, Type M copper tube with ASME B16.22 wrought-copper fittings and brazed joints. Piping shall be mechanically bonded to panel. The copper tubing shall be held in place by an aluminum saddle integral with the panel extrusion that extends more than half around the copper tubing. A non-hardening thermal conductive paste shall be placed between the copper tubing and face plate prior to tubing insertion. The use of adhesive and/or clips to attach the copper tubing to the aluminum panel is not acceptable.
 - 5. Surface-Mounting Trim: Sheet metal with baked-enamel finish in manufacturer's standard paint color as selected by Architect.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas to receive radiant heating and cooling units for compliance with requirements for installation tolerances and other conditions affecting performance.
- B. Examine roughing-in for hydronic piping connections to verify actual locations before radiant heating and cooling unit installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install radiant heating and cooling units level and plumb.
- B. Support for Radiant Heating and Cooling Panels in or on Grid-Type Suspended Ceilings: Use grid as a support element.

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- 1. Install a minimum of four ceiling support-system rods or wires for each panel. Locate not more than 6 inches from panel corners.
- 2. Support Clips: Fasten to panel and to ceiling grid members at or near each panel corner with clips designed for the application.
- 3. Panels of Sizes Less Than Ceiling Grid: Install as indicated on reflected ceiling plans, or center in acoustical panel and support panels independently with at least two 3/4-inch metal channels spanning and secured to ceiling tees.
- C. Verify locations of thermostats with Drawings and room details before installation. Install devices 48 inches above finished floor.

3.3 CONNECTIONS

- A. Piping installation requirements are specified in Division 23 Section "Hydronic Piping." Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Unless otherwise indicated, install shutoff valve and union or flange at each connection.
- C. Install piping adjacent to unit to allow service and maintenance.

3.4 FIELD QUALITY CONTROL

A. After installing panels, inspect panel face for damage to finish. Remove paint splatters and other spots, dirt, and debris. Repair damaged finish to match original finish.

END OF SECTION

SECTION 260000 GENERAL PROVISIONS FOR ELECTRICAL WORK

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Work in this Section includes the providing of labor, materials, equipment and services necessary for a complete and safe installation in accordance with the contract documents and all applicable codes and authorities having jurisdiction for the following:
 - 1. Electrical work covered by all Sections within DIVISION 26 of the Specifications, including, but not limited to electrical systems and equipment.
 - 2. Raceway and Boxes
 - 3. Wires and Cables
 - 4. Low Voltage Distribution Equipment
 - 5. Power, Control and Alarm Wiring Systems
 - 6. Grounding and Bonding Systems
 - 7. Devices
 - 8. Lighting and Controls
 - 9. Fire Alarm System
 - 10. Testing

1.2 WORK NOT INCLUDED:

- A. Providing temporary light and power.
- B. Providing finished painting.
- C. Providing access doors and filler.
- D. Installing access doors and providing filler.
- E. Supplying and setting motors.
- F. Excavating and backfilling.

1.3 DESCRIPTION OF BID DOCUMENTS

- A. Specifications describe quality and character of materials and equipment.
- B. Drawings are diagrammatic and indicate general arrangement of systems and work. Follow drawings in laying out work and check drawings of other trades to verify space conditions. Maintain headroom and space conditions.
- C. Scaled and figured dimensions are approximate and are for estimate purposes only. Before proceeding with work, check and verify all dimensions.

- D. Make adjustments that may be necessary or requested in order to resolve space problems, preserve headroom, and avoid architectural openings, structural members and work of other trades.
- E. Typical details, where shown on the drawings, apply to each item of the project where such items are applicable. Typical details are not repeated on the plans.
- F. If Specifications or Drawings appear unclear or contradictory, consult the Architect and/or Engineer for interpretation as early as possible during bidding period. Do not proceed with work without Architect's and/or Engineer's decision.

1.4 DEFINITIONS

- A. "Provide": to supply, install, and make complete, safe, and operable, the particular work referred to unless specifically indicated otherwise.
- B. "Install": to erect, mount, and make complete with all related accessories.
- C. "Furnish" or "supply": to purchase, procure, acquire, and deliver complete with related accessories.
- D. "Work": labor, materials, equipment, services, and all related accessories necessary for the proper and complete installation of complete systems.
- E. "Piping": pipe, tube, fittings, flanges, valves, controls, strainers, hangers, supports, unions, traps, drains, insulation and all related accessories.
- F. "Wiring": raceway, fittings, wire, boxes and all related accessories.
- G. "Concealed": not in view, installed in masonry or other construction, within furred spaces, double partitions, hung ceilings, trenches, crawl spaces, or enclosures.
- H. "Exposed": in view, not installed underground or "concealed" as defined above.
- I. "Indicated," "shown," or "noted": as indicated, shown, or noted on drawings or specifications.
- J. "Similar" or "equal": of base bid manufacture, equal in quality materials, weight, size, performance, design, and efficiency of specified product, conforming with "Base Bid Manufacturers."
- K. "Reviewed" "satisfactory," "accepted," or "directed": as reviewed, satisfactory, accepted, or directed by Architect and/or Engineer.
- L. "Motor Controllers": manual or magnetic starters with or without switches, individual pushbuttons or hand-off-automatic (HOA) switches controlling the operation of motors.
- M. "Control or Actuating Devices": automatic sensing and switching devices such as thermostats, pressure, float, flow, operation of equipment.

1.5 QUALITY ASSURANCE

- A. All work shall combine with National Electrical Code and all applicable local codes.
- B. Furnish all materials and equipment new, free from defects and with listings or labels of Underwriter's Laboratories, Inc. or other nationally approved testing laboratory.

- C. All items of a given type shall be the product of the same manufacturer.
- D. All materials and equipment shall be the product of manufacturers regularly engaged in their manufacture.
- E. Equipment ampere ratings shall be for continuous operation in 104oF (40oC) ambient temperature unless otherwise indicated.
- F. Provide general heights of outlets as scheduled on drawings. Final heights including those not indicated on drawings to be determined by Architect prior to installation:

1.6 JOB CONDITIONS

- A. Inspection of Site Conditions.
 - 1. Before starting work, visit the site and examine the conditions under which the work has to be performed. Report in writing any conditions which might adversely affect the work.

1.7 REFERENCE STANDARDS

- A. Published specifications, standards, tests, or recommended methods of trade, industry or governmental organizations apply to work in all sections as noted below:
 - 1. NEMA National Electrical Manufacturers' Association.
 - 2. ANSI American National Standard Institute.
 - 3. IEEE Institute of Electrical & Electronics Engineers.
 - 4. NFPA National Fire Protection Association
 - 5. UL Underwriter's Laboratories, Inc.
 - 6. OSHA Occupational Safety and Health Administration Regulations.

1.8 SUBMITTAL

- A. Submit shop drawings and samples in accordance with all other sections of project specifications.
- B. Operating instructions, equipment maintenance manuals and parts lists.
 - 1. Before requesting acceptance of work, submit one set for review by the Architect and/or Engineer.
 - 2. Provide sets of manufacturers' equipment brochures and service manuals consisting of the following:
 - 01. Descriptive literature for equipment and components.
 - 02. Model number and performance data.
 - 03. Installation and operating instructions.
 - 04. Maintenance and repair instructions.
 - 05. Recommended spare parts lists.
 - 3. Assemble manufacturers' equipment manuals in chronological order following the specifications alpha-numerical system using heavy duty three ring binders.
 - 4. Submit three detailed and simplified one line, color coded wiring diagrams.
 - 5. Submit field test reports.

1.9 ELECTRONIC COPIES OF AKF DRAWINGS

- A. Upon award of contract, contractor shall submit list of drawings that they will require. AKF will provide drawings in (.PDF) format only.
- B. If the contractor requires (.dwg) format, they will be forwarded only upon receipt of signed acceptance of terms form. Permission from architect must first be obtained for AKF to include the architectural background as reference. The contractor is to obtain the architects latest drawings directly from architect.
- C. These files are being issued for the convenience of the contractor and the contractor remains responsible for all contract requirements related to the normal shop drawing preparation process.

1.10 SUBMISSIONS:

- A. Provide all coordination drawings and shop drawings in 'AutoCad' format, version compatible with owner. All catalog cuts and submittals to be provided in electronic "PDF" format the architect will forward all submissions to the engineer.
- B. If paper submissions are to be provided the following shall be adhered to.
 - 1. Submissions 11 in. X 17 in. or smaller: If the submission is a catalog cut, then the contractor shall submit one original and one copy. Otherwise, they shall submit two copies. The architect will forward the original and one copy (two copies when no original is received) to the engineer. All catalog cuts shall be complete.
 - 2. Submissions larger than 11 in. X 17 in.: submit two copies to the architect. The architect will forward to the engineer.
- C. Indicate on each submission: project name and location, architect and engineer, item identification and approval stamp of prime contractor, subcontractor names and phone numbers, reference to the applicable design drawing or specification article, date and scale.
- D. The work described in all shop drawing submission shall be carefully checked for all clearances (including those required for maintenance and servicing), field conditions, maintenance of architectural conditions and proper coordination with all trades on the job.
- E. Each submitted shop drawing is to include a certification that all related job conditions have been checked and verified and that there are no conflicts.
- F. All shop drawings are to be submitted to allow ample time for checking in advance of field requirements. All submittals to be complete and contain all required and detailed information. Shop drawings with multiple parts shall be submitted as a package.
- G. If submittals differ from the contract document requirements, make specific mention of such difference in a letter of transmittal, with request for substitution, together with reasons for same.

1.11 AS-BUILTS AND EQUIPMENT OPERATION INSTRUCTIONS

A. Provide all coordination drawings and shop drawings in AutoCad format, version compatible with owner. All catalog cuts and submittals to be provided in electronic "PDF" format the architect will forward all submissions to the engineer.

- B. On completion and acceptance of work, this contractor shall furnish written instructions, equipment manuals and demonstrate to the owner the proper operation and maintenance of all equipment and apparatus furnished under this contract.
- C. The contractor shall give one copy of the instructions to the owner and one copy to the engineer.
- D. Final "as-built" drawings indicating as installed conditions shall be provided to the architect and engineer after completion of the installation.

1.12 PRODUCT DELIVERY, HANDLING, AND STORAGE

- A. Ship materials and equipment in crated sections of sizes to permit passing through available space, where required.
- B. Receive and accept materials and equipment at the site, properly handle, house, and protect them from damage and the weather until installation. Replace equipment damaged in the course of handling without additional charge.
- C. Arrange for and provide storage space or area at the job site for all materials and equipment to be received and/or installed in this project.

1.13 ACCESSIBILITY

- A. Install all work so that parts requiring periodic inspection, operation, maintenance, and repair are readily accessible. Minor deviations from the drawings may be made to accomplish this, but changes of substantial magnitude shall not be made without written approval.
- B. Install equipment requiring access so as to be freely accessible through access doors.

1.14 PROTECTION OF MATERIALS

A. Protect from damage, water, dust, etc. all material, equipment and apparatus provided under this trade both in storage and installed.

1.15 GUARANTEE

A. The Contractor shall furnish a written guarantee to replace or repair promptly and assume responsibility for all expenses incurred for any workmanship and equipment in which defects develop within one year from the date of final certificate for payment and/or from date or actual use of equipment or occupancy of spaces by Owner included under the various parts of the work, whichever date is earlier. This work shall be done as directed by the Owner. This guarantee shall also provide that where defects occur, the Contractor will assume responsibility for all expenses incurred in repairing and replacing work of other trades affected by defects, repairs or replacements in equipment supplied by the Contractor.

1.16 PERMITS AND FEES

A. The Contractor shall give necessary notice, file drawings and specifications with the department having jurisdiction, obtain permits or licenses necessary to carry out this work and pay all fees therefor. The Contractor shall arrange for inspection and tests of any or all parts of the work if so required by

GREENWICH PUBLIC SCHOOLS GREENWICH HIGH SCHOOL LOCKER ROOM RENOVATIONS PHASE II GENERAL PROVISIONS FOR ELECTRICAL WORK authorities and pay all charges for same. The Contractor shall pay all costs for, and furnish to the Owner before final billing, all certificates necessary as evidence that the work installed conforms with all regulations where they apply to this work.

PART 2 - PRODUCTS

2.1 BASE BID MANUFACTURERS

- A. Base bid on materials or equipment are specified by name of manufacturer, brand or trade name and catalog reference.
- B. The choice will be optional with bidder where two or more manufacturers are named.
- C. Manufacturers, other than specified, will only be considered if at the time of bid, manufacturers' names and proposed substitutions are named and stated and the difference in base bid is indicated including changes in the cost of all affected work.

2.2 INSERTS AND SUPPORTS

- A. Support all electrical work from building construction by providing inserts, beam clamps, steel fishplates (in concrete fill only), and acceptable brackets. Submit all methods for review. Inserts shall be steel slotted type, factory painted.
 - 1. Single rod shall be similar to Grinnell Fig. 281.
 - 2. Multi-rod shall be similar to Fee Mason Series 9000 with end caps and closure strips.
 - 3. Clip form nails flush with inserts.
 - 4. Maximum loading including conduit, contents and covering shall not exceed 75% of rated insert capability.

2.3 SUPPLEMENTARY STEEL, CHANNELS AND SUPPORTS

- A. Furnish supplementary steel, channels, and supports required for proper installations, mounting, and support of electrical work.
- B. Connect supplementary steel and channels firmly to building construction in an accepted manner.
- C. Determine type and size of supporting channels and supplementary steel. Supplementary steel and channels shall be of sufficient strength and size to allow only a minimum deflection in conformance with manufacturers' requirements of loading.
- D. Install supplementary steel and channels in a neat and workmanlike manner parallel to walls, floors, and ceiling construction.
- E. All supplementary steel, channels and supports shall be submitted to the Structural Engineer for review.

2.4 ACCESS DOORS

A. Access doors will be provided under General Construction Work.

2.5 ACCESS TILE IDENTIFICATION:

A. Provide buttons, tabs or markers in removable ceiling tiles to identify location of concealed work. Submit for review.

2.6 GUARDS AND RAILINGS

A. Guards and railings will be provided under General Construction Work.

2.7 NAMEPLATES:

A. As indicated in Division 26 Section "Identification for Electrical Systems".

PART 3 - EXECUTION

3.1 FIRE ALARM SYSTEM

- A. Modify and extend existing fire alarm system to serve new and relocated devices as shown on drawings. Coordinate with the respective building Fire Alarm Service Company for single source products, modifications to existing equipment, installation, and the likes.
- B. Equipment and devices shall be installed under the supervision of the building Fire Alarm Service Company and shall be demonstrated to perform the required functions.
- C. Prior to commencement of any work, the contractor shall obtain written confirmation from the Fire Alarm Service Company that the existing system and associated equipment, devices, and wiring are fully operable and free of deficiencies.
- D. Upon completion of work and prior to any acceptance, the new and relocated devices shall be fully tested in the presence of the Building Owners' Representative, Engineer, and the local AHJ. The contractor shall certify in writing that these test functions have been completed successfully.

3.2 PAINTING

- A. Provide labor, materials and equipment necessary for field prime painting and apply in accordance with manufacturers' instructions.
- B. Apply zinc based primer with finish to match surroundings, to marred surfaces of steel equipment and raceways.
- C. Apply galvanized iron primer on panel and pull boxes, after fabrication.
- D. Apply hot dip galvanizing or dip in zinc based primer: outlet boxes, junction boxes, conduit hangers, rods, inserts, and supports.
- E. Field apply zinc based primer coat on non-galvanized steel and iron work.
- 3.3 FOUNDATIONS

- A. Provide foundations utilizing concrete as specified herein:
 - 1. Provide concrete of the same consistency as specified under General Construction Work.
 - 2. Provided concrete, pouted in place on roughened concrete floor, cleaned and flushed with coat of cement grout. Do not pour grout until concrete has set. Foundation shall be puddled and finished smooth with reinforcing as noted.
 - 3. Provide floor free foundation forms and special foundations as noted.
- B. Hold vibration isolation and anchor bolts in position during pour. Set anchor bolts in oversized sleeves with washers and nuts at bottom. Finish flush with nuts on top.
- C. Foundations shall extend 6 in beyond equipment, except as noted, with minimum height of 4 in.
- D. Forms shall be of the same standard as specified under General Construction Work.
- E. Provide foundations for any free-standing equipment.

3.4 FIELD QUALITY CONTROL

- A. Perform tests as noted, and in the presence of the Architect and/or Engineer in accordance with authorities having jurisdiction.
- B. Provide required labor, materials, equipment, and connections necessary for tests and submit for review.
- C. Repair or replace defective work, as directed and pay for restoring or replacing damaged work of others, due to tests, as directed.

3.5 CLEANING

- A. Brush and clean work prior to concealing, painting and acceptance. Perform in stages if directed.
- B. Clean and repair painted exposed work, soiled or damaged, to match adjoining work before final acceptance.
- C. Remove debris from inside and outside of materials and equipment.

END OF SECTION

SECTION 260500 COMMON WORK RESULTS FOR ELECTRICAL

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including and Division 01 General Requirements, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Electrical equipment coordination and installation.
 - 2. Sleeves for raceways and cables.
 - 3. Sleeve seals.
 - 4. Grout.
 - 5. Common electrical installation requirements.
- B. Related Sections include the following:
 - 1. Division 17 All Related Temperature Control Sections.
 - 2. Division 21 All Related Fire Protection Sections.
 - 3. Division 22 All Related Plumbing Sections.
 - 4. Division 23 All Related Mechanical Sections.
 - 5. Division 26 All Related Electrical Sections (includes fire alarm extensions).
 - 6. Division 27 All Related Communication, Sound, and Audio Visual Sections.
 - 7. Division 28 All Related Security Sections.
 - 8. Drawings are diagrammatic and are graphical representations of Contract requirements to best available standards at the scale indicated.

1.3 SUBMITTALS

A. Product Data: For sleeve seals.

1.4 COORDINATION

- A. Coordinate arrangement, mounting, and support of electrical equipment:
 - 1. To allow maximum possible headroom unless specific mounting heights that reduce headroom are indicated.
 - 2. To provide for ease of disconnecting the equipment with minimum interference to other installations.
 - 3. To allow right of way for piping and conduit installed at required slope.
 - 4. So connecting raceways, cables, wireways will be clear of obstructions and of working and access space of other equipment.
- B. Coordinate installation of required supporting devices and set sleeves in cast-in-place concrete, masonry walls, and other structural components as they are constructed.

- C. Coordinate location of access panels and doors for electrical items that are behind finished surfaces or otherwise concealed. Access doors and panels are specified in "Access Doors and Frames."
- D. Coordinate sleeve selection and application with selection and application of firestopping specified in "Penetration Firestopping."

PART 2 - PRODUCTS

2.1 SLEEVES FOR RACEWAYS AND CABLES

- A. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, galvanized steel, plain ends.
- B. Cast-Iron Pipe Sleeves: Cast or fabricated "wall pipe," equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.
- C. Sleeves for Rectangular Openings: Galvanized sheet steel.
 - 1. Minimum Metal Thickness:
 - a. For sleeve cross-section rectangle perimeter less than 50 inches and no side more than 16 inches, thickness shall be 0.052 inch.
 - b. For sleeve cross-section rectangle perimeter equal to, or more than, 50 inches and 1 or more sides equal to, or more than, 16 inches, thickness shall be 0.138 inch.

2.2 SLEEVE SEALS

- 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 Co.
 - d. Pipeline Seal and Insulator, Inc.
 - e. Link-Seal
 - 2. Sealing Elements: EPDM or NBR interlocking links shaped to fit surface of cable or conduit. Include type and number required for material and size of raceway or cable.
 - 3. Pressure Plates: Stainless steel. Include two for each sealing element.
 - 4. Connecting Bolts and Nuts: Stainless steel of length required to secure pressure plates to sealing elements. Include one for each sealing element.

2.3 GROUT

A. Nonmetallic, Shrinkage-Resistant Grout: ASTM C 1107, factory-packaged, nonmetallic aggregate grout, noncorrosive, non-staining, mixed with water to consistency suitable for application and a 30-minute working time.

PART 3 - EXECUTION

3.1 COMMON REQUIREMENTS FOR ELECTRICAL INSTALLATION

- A. Comply with NECA 1.
- B. Measure indicated mounting heights to bottom of unit for suspended items and to center of unit for wall-mounting items.
- C. Headroom Maintenance: If mounting heights or other location criteria are not indicated, arrange and install components and equipment to provide maximum possible headroom consistent with these requirements.
- D. Equipment: Install to facilitate service, maintenance, and repair or replacement of components of both electrical equipment and other nearby installations. Connect in such a way to facilitate future disconnects with minimum interference with other items in vicinity.
- E. Right of Way: Give to piping systems installed at a required slope.

3.2 SLEEVE INSTALLATION FOR ELECTRICAL PENETRATIONS

- A. Electrical penetrations occur when raceways, cables, wireways, cable trays, or busways penetrate concrete slabs, concrete or masonry walls, or fire-rated floor and wall assemblies.
- B. Concrete Slabs and Walls: Install sleeves for penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of slabs and walls.
- C. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.
- D. Fire-Rated Assemblies: Install sleeves for penetrations of fire-rated floor and wall assemblies unless openings compatible with firestop system used are fabricated during construction of floor or wall.
- E. Cut sleeves to length for mounting flush with both surfaces of walls.
- F. Extend sleeves installed in floors 2 inches above finished floor level.
- G. Size pipe sleeves to provide 1/4-inchannular clear space between sleeve and raceway or cable, unless indicated otherwise.
- H. Seal space outside of sleeves with grout for penetrations of concrete and masonry
 - 1. Promptly pack grout solidly between sleeve and wall so no voids remain. Tool exposed surfaces smooth; protect grout while curing.
- I. Interior Penetrations of Non-Fire-Rated Walls and Floors: Seal annular space between sleeve and raceway or cable, using joint sealant appropriate for size, depth, and location of joint. Comply with requirements in "Joint Sealants."
- J. Fire-Rated-Assembly Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at raceway and cable penetrations. Install sleeves and seal raceway and cable penetration sleeves with firestop materials in compliance with other sections of project specifications.

- K. Roof-Penetration Sleeves: Seal penetration of individual raceways and cables with flexible boottype flashing units applied in coordination with roofing work.
- L. Aboveground, Exterior-Wall Penetrations: Seal penetrations using steel pipe sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inchannular clear space between pipe and sleeve for installing mechanical sleeve seals.
- M. Underground, Exterior-Wall Penetrations: Install cast-iron pipe sleeves. Size sleeves to allow for 1-inch annular clear space between raceway or cable and sleeve for installing mechanical sleeve seals.

3.3 SLEEVE-SEAL INSTALLATION

- A. Install to seal exterior wall penetrations.
- B. Use 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.

3.4 FIRESTOPPING

A. Apply firestopping to penetrations of fire-rated floor and wall assemblies for electrical installations to restore original fire-resistance rating of assembly as specified in other sections of project specifications.

END OF SECTION

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. This Section includes the following:
 - 1. Building wires and cables rated 600 V and less.
 - 2. Connectors, splices, and terminations rated 600 V and less.
 - 3. Sleeves and sleeve seals for cables.
- B. Related Sections include the following:
 - 1. Division 17 All Related Temperature Control Sections.
 - 2. Division 21 All Related Fire Protection Sections.
 - 3. Division 22 All Related Plumbing Sections.
 - 4. Division 23 All Related Mechanical Sections.
 - 5. Division 26 All Related Electrical Sections (includes fire alarm extensions).
 - 6. Division 27 All Related Communication, Sound, and Audio Visual Sections.
 - 7. Division 28 All Related Security Sections.
 - 8. Drawings are diagrammatic and are graphical representations of Contract requirements to best available standards at the scale indicated.

1.3 DEFINITIONS

- A. EPDM: Ethylene-propylene-diene terpolymer rubber.
- B. NBR: Acrylonitrile-butadiene rubber.

1.4 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Field quality-control test reports.
- 1.5 QUALITY ASSURANCE
 - A. 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.
 - B. Comply with NFPA 70.
- 1.6 COORDINATION
 - A. Set sleeves in cast-in-place concrete, masonry walls, and other structural components as they are constructed.

PART 2 - PRODUCTS

2.1 CONDUCTORS AND CABLES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. American Insulated Wire Corp.; a Leviton Company.
 - 2. General Cable Corporation.
 - 3. Senator Wire & Cable Company.
 - 4. Southwire Company.
 - 5. Pirelli Cable.
 - 6. Okonite.
 - 7. Triangle.
- B. Copper Conductors: Comply with NEMA WC 70.
- C. Conductor Insulation: Comply with NEMA WC 70 for Type THHN-THWN and XHHW.
- D. Multiconductor Cable: Comply with NEMA WC 70 for Type MC (metal-clad) cable.
- 2.2 CONNECTORS AND SPLICES
 - A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. AFC Cable Systems, Inc.
 - 2. Hubbell Power Systems, Inc.
 - 3. O-Z/Gedney; EGS Electrical Group LLC.
 - 4. 3M; Electrical Products Division.
 - 5. Tyco Electronics Corp.
 - B. Description: Factory-fabricated connectors and splices of size, ampacity rating, material, type, and class for application and service indicated.

2.3 SLEEVES FOR CABLES

- A. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, galvanized steel, plain ends.
- B. Sleeves for Rectangular Openings: Galvanized sheet steel with minimum 0.052- or 0.138-inch thickness as indicated and of length to suit application.
- C. Coordinate sleeve selection and application with selection and application of firestopping specified in "Penetration Firestopping."

2.4 SLEEVE SEALS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Calpico, Inc.
 - 2. Metraflex Co.
 - 3. Pipeline Seal and Insulator, Inc.
 - 4. Link Seal
- B. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and cable.

- 1. Sealing Elements: EPDM or NBR interlocking links shaped to fit surface of cable or conduit. Include type and number required for material and size of raceway or cable.
- 2. Pressure Plates: Stainless steel. Include two for each sealing element.
- 3. Connecting Bolts and Nuts: Stainless steel of length required to secure pressure plates to sealing elements. Include one for each sealing element.

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. 10 AWG and smaller; stranded for No. 8 AWG and larger.
- 3.2 CONDUCTOR INSULATION AND MULTICONDUCTOR CABLE APPLICATIONS AND WIRING METHODS
 - A. Service Entrance: Type XHHW in raceway.
 - B. Exposed Feeders: Type THHN-THWN except 1/O AWG and larger shall be XHHW in raceway.
 - C. Feeders Concealed in Ceilings, Walls, Partitions, and Crawlspaces: Type THHN-THWN except 1/O AWG and larger shall be XHHW.
 - D. Feeders Concealed in Concrete below slabs-on-grade and underground: Type THHN-THWN in raceway except 1/O AWG and larger shall be XHHW.
 - E. Exposed Branch Circuits including crawl spaces: Type THHN-THWN in raceway.
 - F. Concealed Branch Circuits: Type THHN-THWN in raceway. MC-cable permitted in dry, accessible, hung ceilings and hollow partitions except for homeruns which shall be THHN-THWN in raceway.
 - G. Class 1 Control Circuits: Type THHN-THWN in raceway.
 - H. Class 2 Control Circuits: Type THHN-THWN in raceway

3.3 INSTALLATION OF CONDUCTORS AND CABLES

- A. Conceal cables in finished walls, ceilings, and floors, unless otherwise indicated.
- B. 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.
- C. Use pulling means; including fish tape, cable, rope, and basket-weave wire/cable grips that will not damage cables or raceway.
- D. Install exposed cables parallel and perpendicular to surfaces of exposed structural members, and follow surface contours where possible.
- E. Support cables according to Division 26 Section "Hangers and Supports for Electrical Systems."
- F. Identify and color-code conductors and cables according to Division 26 Section "Identification 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 and UL 486B.
- B. Make splices and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than unspliced conductors.
- C. Wiring at Outlets: Install conductor at each outlet, with at least 6 inches of slack.

3.5 SLEEVE INSTALLATION FOR ELECTRICAL PENETRATIONS

- A. Coordinate sleeve selection and application with selection and application of firestopping specified in "Penetration Firestopping."
- B. Concrete Slabs and Walls: Install sleeves for penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of slabs and walls.
- C. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.
- D. Rectangular Sleeve Minimum Metal Thickness:
 - 1. For sleeve rectangle perimeter less than 50 inches and no side greater than 16 inches, thickness shall be 0.052 inch.
 - 2. For sleeve rectangle perimeter equal to, or greater than, 50 inches and 1 or more sides equal to, or greater than, 16 inches, thickness shall be 0.138 inch.
- E. Fire-Rated Assemblies: Install sleeves for penetrations of fire-rated floor and wall assemblies unless openings compatible with firestop system used are fabricated during construction of floor or wall.
- F. Cut sleeves to length for mounting flush with both wall surfaces.
- G. Extend sleeves installed in floors 2 inches above finished floor level.
- H. Size pipe sleeves to provide 1/4-inch annular clear space between sleeve and cable unless sleeve seal is to be installed or unless seismic criteria require different clearance.
- I. Seal space outside of sleeves with grout for penetrations of concrete and masonry and with approved joint compound for gypsum board assemblies.
- J. Interior Penetrations of Non-Fire-Rated Walls and Floors: Seal annular space between sleeve and cable, using joint sealant appropriate for size, depth, and location of joint according to "Joint Sealants."
- K. Fire-Rated-Assembly Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at cable penetrations. Install sleeves and seal with firestop materials according to Section "Penetration Firestopping."
- L. Roof-Penetration Sleeves: Seal penetration of individual cables with flexible boot-type flashing units applied in coordination with roofing work.
- M. Aboveground Exterior-Wall Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Size sleeves to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.

N. Underground Exterior-Wall Penetrations: Install cast-iron "wall pipes" for sleeves. Size sleeves to allow for 1-inch annular clear space between cable and sleeve for installing mechanical sleeve seals.

3.6 SLEEVE-SEAL INSTALLATION

- A. Install to seal underground exterior-wall penetrations.
- B. Use type and number of sealing elements recommended by manufacturer for cable material and size. Position cable in center of sleeve. Assemble mechanical sleeve seals and install in annular space between cable and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

3.7 FIRESTOPPING

A. Apply firestopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fireresistance rating of assembly according to Section "Penetration Firestopping."

3.8 FIELD QUALITY CONTROL

- A. Perform tests and inspections and prepare test reports.
- B. Tests and Inspections:
 - 1. After installing conductors and cables and before electrical circuitry has been energized, test 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.
 - 3. Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each splice in cables and conductors No. 3 AWG and larger. Remove box and equipment covers so splices are accessible to portable scanner.
 - a. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each splice 11 months after date of Substantial Completion.
 - b. Instrument: Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.
 - c. Record of Infrared Scanning: Prepare a certified report that identifies splices checked and that describes scanning results. Include notation of deficiencies detected, remedial action taken and observations after remedial action.
- C. Remove and replace malfunctioning units and retest as specified above.

END OF SECTION

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. This Section includes methods and materials for grounding systems and equipment.
- B. Related Sections include the following:
 - 1. Division 17 All Related Temperature Control Sections.
 - 2. Division 21 All Related Fire Protection Sections.
 - 3. Division 22 All Related Plumbing Sections.
 - 4. Division 23 All Related Mechanical Sections.
 - 5. Division 26 All Related Electrical Sections (includes fire alarm extensions).
 - 6. Division 27 All Related Communication, Sound, and Audio Visual Sections.
 - 7. Division 28 All Related Security Sections.
 - 8. Drawings are diagrammatic and are graphical representations of Contract requirements to best available standards at the scale indicated.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Field quality-control test reports.
- C. Operation and Maintenance Data.

1.4 QUALITY ASSURANCE

- A. 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.
- B. Comply with UL 467 for grounding and bonding materials and equipment.

PART 2 - PRODUCTS

2.1 CONDUCTORS

A. Insulated Conductors: Copper wire or cable insulated for 600 V unless otherwise required by applicable Code or authorities having jurisdiction.

2.2 CONNECTORS

A. Listed and labeled by a nationally recognized testing laboratory acceptable to authorities having jurisdiction for applications in which used, and for specific types, sizes, and combinations of conductors and other items connected.

PART 3 - EXECUTION

3.1 APPLICATIONS

- A. Conductors: Install solid conductor for No. 10 AWG and smaller, and stranded conductors for No. 8 AWG and larger, unless otherwise indicated.
- B. Conductor Terminations and Connections:
 - 1. Equipment Grounding Conductor Terminations: Wirenut spring connectors.
 - 2. Pipe Grounding Conductor Terminations: Bolted connectors.
 - 3. Connections to Structural Steel: Welded connectors.

3.2 EQUIPMENT GROUNDING

- A. 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. Motor and appliance branch circuits.
 - 5. Three-phase motor and appliance branch circuits.
 - 6. Flexible raceway runs.
 - 7. Metal-clad cable runs.

3.3 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. 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 so vibration is not transmitted to rigidly mounted equipment.

3.4 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections and prepare test reports:
 - 1. After installing grounding system but before permanent electrical circuits have been energized, test for compliance with requirements.
 - a. Perform tests by fall-of-potential method according to IEEE 81.
- B. Report measured ground resistances that exceed the following values:
 - 1. Power and Lighting Equipment or System with Capacity 500 kVA and Less: 10 ohms.
 - 2. Power and Lighting Equipment or System with Capacity 500 to 1000 kVA: 5 ohms.
 - 3. Power and Lighting Equipment or System with Capacity More Than 1000 kVA: 3 ohms.
 - 4. Power Distribution Units or Panelboards Serving Electronic Equipment: 3 ohm(s).
- C. Excessive Ground Resistance: If resistance to ground exceeds specified values, notify Architect promptly and include recommendations to reduce ground resistance.

END OF SECTION

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. Division 17 All Related Temperature Control Sections.
 - 2. Division 21 All Related Fire Protection Sections.
 - 3. Division 22 All Related Plumbing Sections.
 - 4. Division 23 All Related Mechanical Sections.
 - 5. Division 26 All Related Electrical Sections (includes fire alarm extensions).
 - 6. Division 27 All Related Communication, Sound, and Audio Visual Sections.
 - 7. Division 28 All Related Security Sections.
 - 8. Drawings are diagrammatic and are graphical representations of Contract requirements to best available standards at the scale indicated.

1.3 DEFINITIONS

- A. EMT: Electrical metallic tubing.
- B. RMC: Rigid metal conduit.

1.4 PERFORMANCE REQUIREMENTS

- A. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.
- B. Design supports for multiple raceways capable of supporting combined weight of supported systems and its contents.

- C. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.
- D. Rated Strength: Adequate in tension, shear, and pullout force to resist maximum loads calculated or imposed for this Project.

1.5 SUBMITTALS

- A. Product Data: For the following:
 - 1. Steel slotted support systems.
- B. Shop Drawings: 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. Equipment supports.
- C. Welding certificates.

1.6 QUALITY ASSURANCE

- A. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code Steel."
- B. Comply with NFPA 70.

1.7 COORDINATION

- A. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in.
- B. Coordinate installation of roof curbs, equipment supports, and roof penetrations. These items are specified in Section "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. Manufacturers: Subject to compliance with requirements, provide products by one of 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: Manufacturers standard painted coating applied according to MFMA-4.
- 5. Channel Dimensions: Selected for applicable load criteria.
- B. Raceway and Cable Supports: As described in NECA 1 and NECA 101.
- C. Conduit and Cable Support Devices: Steel hangers, clamps, and associated fittings, designed for types and sizes of raceway or cable to be supported.
- D. 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. Plug shall have number, size, and shape of conductor gripping pieces as required to suit individual conductors or cables supported. Body shall be malleable iron.
- E. Structural Steel for Fabricated Supports and Restraints: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.
- F. 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, 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:

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- 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 Division 05 Section "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 diameter.
- C. Multiple Raceways or Cables: Install trapeze-type supports fabricated with steel slotted 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.
- D. Spring-steel clamps designed for supporting single conduits without bolts may be used for 1¹/₂-inch and smaller raceways serving branch circuits and communication systems above suspended ceilings and for fastening raceways to trapeze supports.

3.2 SUPPORT INSTALLATION

A. Comply with NECA 1 and NECA 101 for installation requirements except as specified in this Article.

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- 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 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. 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.
 - 5. To Steel: Beam clamps (MSS Type 19, 21, 23, 25, or 27) complying with MSS SP-69.
 - 6. To Light Steel: Sheet metal screws.
 - 7. 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 "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 PAINTING

- A. Touchup: Comply with requirements in painting Sections for cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal.
- B. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

END OF SECTION

GREENWICH PUBLIC SCHOOLS GREENWICH HIGH SCHOOL LOCKER ROOM RENOVATIONS PHASE II HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

GREENWICH PUBLIC SCHOOLS GREENWICH HIGH SCHOOL LOCKER ROOM RENOVATIONS PHASE II RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS

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. This Section includes raceways, fittings, boxes, enclosures, and cabinets for electrical wiring.
- B. Related Sections include the following:
 - 1. Division 17 All Related Temperature Control Sections.
 - 2. Division 21 All Related Fire Protection Sections.
 - 3. Division 22 All Related Plumbing Sections.
 - 4. Division 23 All Related Mechanical Sections.
 - 5. Division 26 All Related Electrical Sections (includes fire alarm extensions).
 - 6. Division 27 All Related Communication, Sound, and Audio Visual Sections.
 - 7. Division 28 All Related Security Sections.
 - 8. Drawings are diagrammatic and are graphical representations of Contract requirements to best available standards at the scale indicated.

1.3 DEFINITIONS

- A. EMT: Electrical metallic tubing.
- B. RMC: Rigid metal threaded galvanized conduit.
- C. FMC: Flexible metal conduit.
- D. LFMC: Liquidtight flexible metal conduit.

1.4 SUBMITTALS

- A. Product Data: For surface raceways, wireways and fittings, floor boxes, hinged-cover enclosures, and cabinets.
- B. Shop Drawings: For the following raceway components. Include plans, elevations, sections, details, and attachments to other work.
 - 1. Custom enclosures and cabinets.
- C. Samples for Initial Selection and Verification: For wireways and surface raceways with factory-applied texture and color finishes.

- D. Coordination Drawings: Conduit routing plans, drawn to scale, on which the following items are shown and coordinated with each other, based on input from installers of the items involved:
 - 1. Structural members in the paths of conduit groups with common supports.
 - 2. HVAC and plumbing items and architectural features in the paths of conduit groups with common supports.
- E. Qualification Data: For professional engineer and testing agency.
- F. Source quality-control test reports.

1.5 QUALITY ASSURANCE

- A. 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.
- B. Comply with NFPA 70.

PART 2 - PRODUCTS

2.1 METAL CONDUIT AND TUBING

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. AFC Cable Systems, Inc.
 - 2. Alflex Inc.
 - 3. Allied Tube & Conduit; a Tyco International Ltd. Co.
 - 4. Anamet Electrical, Inc.; Anaconda Metal Hose.
 - 5. Electri-Flex Co.
 - 6. Manhattan/CDT/Cole-Flex.
 - 7. Maverick Tube Corporation.
 - 8. O-Z Gedney; a unit of General Signal.
 - 9. Wheatland Tube Company.
- B. RMC: ANSI C80.1.
- C. EMT: ANSI C80.3.
- D. LFMC: Flexible steel conduit with PVC jacket.
- E. Fittings for Conduit (Including all Types and Flexible and Liquidtight), EMT, and Cable: NEMA FB 1; listed for type and size raceway with which used, and for application and environment in which installed.
- F. Joint Compound for Rigid Steel Conduit: Listed for use in cable connector assemblies, and compounded for use to lubricate and protect threaded raceway joints from corrosion and enhance their conductivity.
- 2.2 METAL WIREWAYS
 - A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- 1. Cooper B-Line, Inc.
- 2. Hoffman.
- 3. Square D; Schneider Electric.
- B. Description: Sheet metal sized and shaped as indicated, NEMA 250, Type 1 or 3R as required or unless otherwise indicated.
- C. Fittings and Accessories: Include 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: Flanged-and-gasketed type for wet locations.
- E. Finish: Manufacturer's standard enamel finish.

2.3 SURFACE RACEWAYS

- A. Surface Metal Raceways: Galvanized steel with snap-on covers. Manufacturer's standard enamel finishes in color selected by Architect.
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Thomas & Betts Corporation.
 - 2. Walker Systems, Inc.; Wiremold Company (The).
 - 3. Wiremold Company (The); Electrical Sales Division.

2.4 BOXES, ENCLOSURES, AND CABINETS

- C. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Cooper Crouse-Hinds; Div. of Cooper Industries, Inc.
 - 2. EGS/Appleton Electric.
 - 3. Erickson Electrical Equipment Company.
 - 4. Hoffman.
 - 5. Hubbell Incorporated; Killark Electric Manufacturing Co. Division.
 - 6. O-Z/Gedney; a unit of General Signal.
 - 7. RACO; a Hubbell Company.
 - 8. Robroy Industries, Inc.; Enclosure Division.
 - 9. Scott Fetzer Co.; Adalet Division.
 - 10. Spring City Electrical Manufacturing Company.
 - 11. Thomas & Betts Corporation.
 - 12. Walker Systems, Inc.; Wiremold Company (The).
 - 13. Woodhead, Daniel Company; Woodhead Industries, Inc. Subsidiary.
- D. Sheet Metal Outlet and Device Boxes: NEMA OS 1.
- E. Cast-Metal Outlet and Device Boxes: NEMA FB 1, aluminum, Type FD, with gasketed cover.
- F. Metal Floor Boxes: Cast metal, fully adjustable, rectangular, as specified on drawings.
- G. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.

- H. Cast-Metal Access, Pull, and Junction Boxes: NEMA FB 1, cast aluminum with gasketed cover.
- I. Hinged-Cover Enclosures: 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.
- J. 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.

2.5 SLEEVES FOR RACEWAYS

- K. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, galvanized steel, plain ends.
- L. Cast-Iron Pipe Sleeves: Cast or fabricated "wall pipe," equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.
- M. Sleeves for Rectangular Openings: Galvanized sheet steel with minimum 0.052- or 0.138-inch thickness as indicated and of length to suit application.
- N. Coordinate sleeve selection and application with selection and application of firestopping specified in Division 07 Section "Penetration Firestopping."

2.6 SLEEVE SEALS

- O. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Advance Products & Systems, Inc.
 - 2. Calpico, Inc.
 - 3. Metraflex Co.
 - 4. Pipeline Seal and Insulator, Inc.
- P. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and cable.
 - 1. Sealing Elements: EPDM or NBR interlocking links shaped to fit surface of cable or conduit. Include type and number required for material and size of raceway or cable.
 - 2. Pressure Plates: Stainless steel. Include two for each sealing element.
 - 3. Connecting Bolts and Nuts: Stainless steel of length required to secure pressure plates to sealing elements. Include one for each sealing element.

PART 3 - PRODUCTS

3.1 RACEWAY APPLICATION

- A. Outdoors: Apply raceway products as specified below, unless otherwise indicated:
 - 1. Exposed: RMC.
 - 2. Final Connection to Equipment: LFMC.
 - 3. Boxes and Enclosures, Aboveground: NEMA 250, Type 3R.
- B. Comply with the following indoor applications, unless otherwise indicated:
 - 1. Exposed, Not Subject to Physical Damage: EMT.
 - 2. Exposed and Subject to Severe Physical Damage: RMC.
 - 3. Concealed in Ceilings and Interior Walls and Partitions: EMT.
 - 4. Connection to Vibrating Equipment: FMC, except use LFMC in damp or wet locations.
 - 5. Raceways for Concealed General Purpose Distribution Communications Cable: EMT.
 - 6. Raceways for Communications Cable in Spaces Used for Environmental Air: EMT.
 - 7. Damp or Wet Locations Regardless of Type Systems: RMC.
 - 8. Boxes and Enclosures: NEMA 250, Type 1, except use NEMA 250, Type 3R in 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. EMT: Steel compression type.
 - 2. RMC: Threaded rigid steel type.
- 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.

3.2 INSTALLATION

- A. Comply with NECA 1 for installation requirements applicable to products specified in Part 2 except where requirements on Drawings or in this Article are stricter.
- 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. Support raceways as specified in Division 26; "Hangers and Supports for Electrical Systems."
- E. Arrange stub-ups so curved portions of bends are not visible above the finished slab.
- F. Install no more than the equivalent of three 90-degree bends in any conduit run except for communications conduits, for which fewer bends are allowed.
- G. Conceal conduit within finished walls, ceilings, floors, unless otherwise indicated.

- H. 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.
- I. Raceway Terminations at Locations Subject to Moisture or Vibration: Use insulating bushings to protect conductors, including conductors smaller than No. 4 AWG.
- J. 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.
- K. Raceways for Communications Cable: Install raceways as follows:
 - 1. 3/4-Inch Trade Size and Smaller: Install raceways in maximum lengths of 50 feet.
 - 2. 1-Inch Trade Size and Larger: Install raceways in maximum lengths of 75 feet.
 - 3. Install with a maximum of two 90-degree bends or equivalent for each length of raceway 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.
- L. Install raceway sealing fittings at suitable, approved, and accessible locations 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 at the following points:
 - 1. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.
 - 2. Where otherwise required by NFPA 70.
- M. Install expansion-joint fittings at suitable, approved, and accessible locations. Install fittings that provide expansion and contraction for at least 0.00041 inch per foot of length of straight run per deg F of temperature change. Install each expansion-joint fitting with position, mounting, and piston setting selected according to manufacturer's written instructions for conditions at specific location at the time of installation.
- N. Flexible Conduit Connections: Maximum of 72 inches of flexible conduit for recessed and semi recessed lighting fixtures, equipment subject to vibration, noise transmission, or movement; and for transformers and motors.
 - 1. Use LFMC in damp or wet locations not subject to severe physical damage.
- O. 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.

3.3 SLEEVE INSTALLATION FOR ELECTRICAL PENETRATIONS

- A. Coordinate sleeve selection and application with selection and application of firestopping specified in Section "Penetration Firestopping."
- B. Concrete Slabs and Walls: Install sleeves for penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of slabs and walls.
- C. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.

- D. Rectangular Sleeve Minimum Metal Thickness:
 - 1. For sleeve cross-section rectangle perimeter less than 50 inches and no side greater than 16 inches, thickness shall be 0.052 inch.
 - 2. For sleeve cross-section rectangle perimeter equal to, or greater than, 50 inches and 1 or more sides equal to, or greater than, 16 inches, thickness shall be 0.138 inch.
- E. Fire-Rated Assemblies: Install sleeves for penetrations of fire-rated floor and wall assemblies unless openings compatible with firestop system used are fabricated during construction of floor or wall.
- F. Cut sleeves to length for mounting flush with both surfaces of walls.
- G. Extend sleeves installed in floors 2 inches above finished floor level.
- H. Size pipe sleeves to provide 1/4-inch annular clear space between sleeve and raceway unless sleeve seal is to be installed or unless seismic criteria require different clearance.
- I. Seal space outside of sleeves with grout for penetrations of concrete and masonry and with approved joint compound for gypsum board assemblies.
- J. Interior Penetrations of Non-Fire-Rated Walls and Floors: Seal annular space between sleeve and raceway, using joint sealant appropriate for size, depth, and location of joint. Refer to Section "Joint Sealants" for materials and installation.
- K. Fire-Rated-Assembly Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at raceway penetrations. Install sleeves and seal with firestop materials. Comply with Section "Penetration Firestopping."
- L. Roof-Penetration Sleeves: Seal penetration of individual raceways with flexible, boot-type flashing units applied in coordination with roofing work.

3.4 SLEEVE-SEAL INSTALLATION

- A. Install to seal underground, exterior wall penetrations.
- B. Use type and number of sealing elements recommended by manufacturer for raceway material and size. Position raceway in center of sleeve. Assemble mechanical sleeve seals and install in annular space between raceway and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

3.5 FIRESTOPPING

A. Apply firestopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly. Firestopping materials and installation requirements are specified in Division 07 Section "Penetration Firestopping."

3.6 **PROTECTION**

- A. Provide final protection and maintain conditions that ensure coatings, finishes, and cabinets are without damage or deterioration at time of Substantial Completion.
 - 1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
 - 2. Repair damage to PVC or paint finishes with matching touchup coating recommended by manufacturer.

END OF SECTION

SECTION 260548 VIBRATION 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. Division 17 All Related Temperature Control Sections.
 - 2. Division 21 All Related Fire Protection Sections.
 - 3. Division 22 All Related Plumbing Sections.
 - 4. Division 23 All Related Mechanical Sections.
 - 5. Division 26 All Related Electrical Sections (includes fire alarm extensions).
 - 6. Division 27 All Related Communication, Sound, and Audio Visual Sections.
 - 7. Division 28 All Related Security Sections.
 - 8. Drawings are diagrammatic and are graphical representations of Contract requirements to best available standards at the scale indicated.

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 SUBMITTALS

- A. Product Data: For the following:
 - 1. Include rated load, rated deflection, and overload capacity for each vibration isolation device.

- 2. Restrained-Isolation Devices: Include ratings for horizontal, vertical, and combined loads.
- B. Delegated-Design Submittal: For vibration isolation 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. Indicate materials and dimensions and identify hardware, including attachment and anchorage devices.
 - 2. Field-fabricated supports.
- C. Coordination Drawings: Show coordination of bracing for electrical components with other systems and equipment in the vicinity, including other supports.
- D. Welding certificates.
- E. Qualification Data: For professional engineer and testing agency.
- F. Field quality-control test reports.

1.5 QUALITY ASSURANCE

- A. Testing Agency Qualifications: An independent agency, with the experience and capability to conduct the testing indicated, that is a nationally recognized testing laboratory (NRTL) as defined by OSHA in 29 CFR 1910.7, and that is acceptable to authorities having jurisdiction.
- B. 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.
- D. Restrained Spring Isolators: Freestanding, steel, open-spring isolators with vibration or limit-stop restraint.
 - 1. Housing: Steel with resilient vertical-limit stops to prevent spring extension due to weight being removed; factory-drilled baseplate bonded to 1/4-inch-thick, neoprene or rubber isolator pad attached to baseplate underside; and adjustable equipment mounting and leveling bolt that acts as blocking during installation.
 - 2. Restraint: Vibration or limit-stop as required for equipment and authorities having jurisdiction.
 - 3. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
 - 4. Minimum Additional Travel: 50 percent of the required deflection at rated load.
 - 5. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
 - 6. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.

2.2 FACTORY FINISHES

A. Finish: Manufacturer's standard prime-coat finish ready for field painting.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and equipment to receive vibration isolation 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 or OSHPD or an agency acceptable to authorities having jurisdiction in accordance with structural specification.
- B. Hanger Rod Stiffeners: Install hanger rod stiffeners as needed or scheduled on Drawings to receive them and where required to prevent buckling of hanger rods.
- 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.

3.3 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 post connection 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.

3.4 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

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. This Section includes the following:
 - 1. Identification for raceway and metal-clad cable.
 - 2. Identification for conductors and communication and control cable.
 - 3. Warning labels and signs.
 - 4. Instruction signs.
 - 5. Equipment identification labels.
 - 6. Miscellaneous identification products.
- B. Related Sections include the following:
 - 1. Division 17 All Related Temperature Control Sections.
 - 2. Division 21 All Related Fire Protection Sections.
 - 3. Division 22 All Related Plumbing Sections.
 - 4. Division 23 All Related Mechanical Sections.
 - 5. Division 26 All Related Electrical Sections (includes fire alarm extensions).
 - 6. Division 27 All Related Communication, Sound, and Audio Visual Sections.
 - 7. Division 28 All Related Security Sections.
 - 8. Drawings are diagrammatic and are graphical representations of Contract requirements to best available standards at the scale indicated.

1.3 SUBMITTALS

- A. Product Data: For each electrical identification product indicated.
- B. Identification Schedule: An index of nomenclature of electrical equipment and system components used in identification signs and labels.
- C. Samples: For each type of label and sign to illustrate size, colors, lettering style, mounting provisions, and graphic features of identification products.

1.4 QUALITY ASSURANCE

A. Comply with ANSI A13.1 and ANSI C2.

- B. Comply with NFPA 70.
- C. Comply with 29 CFR 1910.145.

1.5 COORDINATION

- A. Coordinate identification names, abbreviations, colors, and other features with requirements in the Contract Documents, 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 RACEWAY 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 raceway and cable size.
- B. Color for Printed Legend:
 - 1. Power Circuits: Black letters on an orange field. Other circuits: submit colors proposed.
 - 2. Legend: Indicate system or service and voltage, if applicable.
- C. Self-Adhesive Vinyl Tape: Colored, heavy duty, waterproof, fade resistant; 2 inches wide; compounded for outdoor use.

2.2 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. Marker Tapes: Vinyl or vinyl-cloth, self-adhesive wraparound type, with circuit identification legend machine printed by thermal transfer or equivalent process.
- C. Write-On Tags: Polyester tag, 0.015 inch thick, with corrosion-resistant grommet and polyester or nylon tie for attachment to conductor or cable.
 - 1. Marker for Tags: Permanent, waterproof, black ink marker recommended by tag manufacturer.

2.3 WARNING LABELS AND SIGNS

A. Comply with NFPA 70 and 29 CFR 1910.145.

- B. Baked-Enamel Warning Signs: Preprinted aluminum signs, punched or drilled for fasteners, with colors, legend, and size required for application. 1/4-inch grommets in corners for mounting. Nominal size, 7 by 10 inches.
- C. Metal-Backed, Butyrate Warning Signs: Weather-resistant, non-fading, preprinted, cellulose-acetate butyrate signs with 0.0396-inch galvanized-steel backing; and with colors, legend, and size required for application. 1/4-inch grommets in corners for mounting. Nominal size, 10 by 14 inches.
- D. 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."

2.4 INSTRUCTION SIGNS

- A. Engraved, laminated acrylic or melamine plastic, minimum 1/16 inch thick for signs up to 20 sq. in. 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.

2.5 EQUIPMENT IDENTIFICATION LABELS

A. 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.

2.6 MISCELLANEOUS IDENTIFICATION PRODUCTS

- A. Cable Ties: Fungus-inert, self-extinguishing, 1-piece, self-locking, Type 6/6 nylon cable ties.
 - 1. Minimum Width: 3/16 inch.
 - 2. Tensile Strength: 50 lb, minimum.
 - 3. Temperature Range: Minus 40 to plus 185 deg F.
 - 4. Color: Black, except where used for color-coding.
- 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 APPLICATION

A. Accessible Raceways and Metal-Clad Cables, 600 V or Less, for Service, Feeder, and Branch Circuits More Than 30 A: Identify with orange snap-around label.

- B. Accessible Raceways and Cables of Auxiliary Systems: the following systems with color-coded, snaparound, color-coding bands shall be used for this project:
 - 1. Fire Alarm System: Red.
 - 2. Fire-Suppression Supervisory and Control System: Red and yellow.
 - 3. Security System: Blue and yellow.
 - 4. Mechanical and Electrical Supervisory System: Green and blue.
 - 5. Telecommunication System: Green and yellow.
 - 6. Control Wiring: Green and red.
- C. Power-Circuit Conductor Identification: For primary and secondary conductors No. 1/0 AWG and larger in vaults, pull and junction boxes, manholes, and handholes use write-on tags. Identify source and circuit number of each set of conductors. For single conductor cables, identify phase in addition to the above.
- D. Branch-Circuit Conductor Identification: Where there are conductors for more than three branch circuits in same junction or pull box, use color-coding conductor tape. Identify each ungrounded conductor according to source and circuit number.
- E. Conductors to Be Extended in the Future: Attach write-on tags to conductors and list source and circuit number.
- F. Auxiliary Electrical Systems Conductor Identification: Identify field-installed alarm, control, signal, sound, intercommunications, voice, and data 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 Operation and Maintenance Manual.
- G. Warning Labels for Indoor Cabinets, Boxes, and Enclosures for Power and Lighting: Comply with 29 CFR 1910.145 and apply metal-backed, butyrate warning signs. Identify system voltage with black letters on an orange background. Apply to exterior of door, cover, or other access.
 - 1. 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.
 - 2. Equipment Requiring Workspace Clearance According to NFPA 70: Unless otherwise indicated, apply to door or cover of equipment but not on flush panelboards and similar equipment in finished spaces.
- H. Instruction Signs:
 - 1. Operating Instructions: 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.
 - 2. Emergency Operating Instructions: 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.

- I. Equipment Identification Labels: On each unit of equipment, install unique designation label that is consistent with wiring diagrams, schedules, and 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: Adhesive film label with clear protective overlay. Unless otherwise indicated, provide a single line of text with 1/2-inch-high letters on 1½ high label; where 2 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.
 - 2. Equipment to Be Labeled: All equipment requires a label 94D shall include but not limited to:
 - a. Switchboards
 - b. Panelboards
 - c. Electrical cabinets and enclosures.
 - d. Lighting relay panels.
 - e. Disconnect switches
 - f. Enclosed circuit breakers.
 - g. Contactors and relays.
 - h. Remote switching devices.
 - i. Remote indicator devices and lights.
 - j. Fire-alarm control panel and annunciation equipment.
 - k. Monitoring and control equipment.
 - 1. Access doors and panels for concealed electrical items.

3.2 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 non-adhesive signs and plastic labels with screws and auxiliary hardware appropriate to the location and substrate.
- F. System Identification Color Banding for Raceways and Cables: Each color 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.

- G. Color-Coding for Phase Identification, 600 V and Less: Use the colors listed below for ungrounded service, feeder, and branch-circuit conductors.
 - 1. Color shall be factory applied or, for sizes larger than No. 10 AWG if authorities having jurisdiction permit, field applied.
 - 2. Colors for 208/120-V Circuits:
 - a. Phase A: Black.
 - b. Phase B: Red.
 - c. Phase C: Blue.
 - 3. Colors for 480/277-V Circuits:
 - a. Phase A: Brown.
 - b. Phase B: Orange.
 - c. Phase C: Yellow.
 - 4. 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.
- H. Painted Identification: Prepare surface and apply paint according to Division 09 Painting Section.

END OF SECTION

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. TVSS: Transient voltage surge suppressor.

1.4 PERFORMANCE REQUIREMENTS

1.5 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. Include evidence of NRTL listing for series rating of installed devices.
 - 6. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.
 - 7. Include wiring diagrams for power, signal, and control wiring.
 - 8. Include time-current coordination curves for each type and rating of overcurrent protective device included in panelboards. Submit on translucent log-log graft paper; include selectable ranges for each type of overcurrent protective device.
- C. Qualification Data: For qualified testing agency.
- D. 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.
- E. Panelboard Schedules: For installation in panelboards submit final versions after load balancing.
- F. Operation and Maintenance Data: For panelboards and components to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 01 Section "Operation and Maintenance Data," include the following:
 - 1. Manufacturer's written instructions for testing and adjusting overcurrent protective devices.
 - 2. Time-current curves, including selectable ranges for each type of overcurrent protective device that allows adjustments.

1.6 QUALITY ASSURANCE

- A. 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.
- B. Source Limitations: Obtain panelboards, overcurrent protective devices, components, and accessories from single source from single manufacturer.
- 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.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Remove loose packing and flammable materials from inside panelboards; install temporary electric heating (250 W per panelboard) to prevent condensation as required.
- B. Handle and prepare panelboards for installation according to NEMA PB 1.

1.8 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.

- 2. Rate equipment for continuous operation under the following conditions unless otherwise indicated:
 - a. Ambient Temperature: Not exceeding minus 22 deg F to plus 104 deg F.
 - b. Altitude: Not exceeding 6600 feet.
- B. Service Conditions: NEMA PB 1, usual service conditions, as follows:
 - 1. Ambient temperatures within limits specified.
 - 2. Altitude not exceeding 6600 feet.

1.9 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.

1.10 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: One year from date of Substantial Completion.

1.11 EXTRA MATERIALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Keys: Two spares for each type of panelboard cabinet lock.
 - 2. Circuit Breakers Including GFCI and Ground Fault Equipment Protection (GFEP) Types: Three spares of each size, type and poles.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR PANELBOARDS

- A. Enclosures: Flush and surface mounted cabinets as indicated on drawings.
 - 1. Rated for environmental conditions at installed location.
 - a. Indoor Dry and Clean Locations: NEMA 250, Type 1.
 - b. Outdoor Locations: NEMA 250, Type 3R.
 - c. Wash-Down Areas: NEMA 250, Type 4X, stainless steel..
 - d. Other Wet or Damp Indoor Locations: NEMA 250, Type 4.

- 2. Front Cover: Entire front trim hinged to box and with standard lockable latch door within hinged trim cover. For doors more than 48 inches (1218 mm) high, provide two latches, keyed alike.
- 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.
- B. Incoming Mains Location: Top and bottom as required.
- C. Phase, Neutral, and Ground Buses:
 - 1. Material: Hard-drawn copper, 98 percent conductivity.
 - 2. Neutral: 100% full capacity.
 - 3. Equipment Ground Bus: Adequate for feeder and branch-circuit equipment grounding conductors; bonded to box.
- D. Conductor Connectors: Suitable for use with conductor material and sizes.
 - 1. Material: Hard-drawn copper, 98 percent conductivity.
 - 2. Main and Neutral Lugs: Mechanical type.
 - 3. Ground Lugs and Bus-Configured Terminators: Mechanical type.
 - 4. Feed-Through Lugs: Mechanical type, suitable for use with conductor material. Locate at opposite end of bus from incoming lugs or main device.
 - 5. Subfeed (Double) Lugs: Mechanical type suitable for use with conductor material. Locate at same end of bus as incoming lugs or main device.
- E. Panelboard Short-Circuit Current Rating: Panelboards shall be fully rated for the short circuit current available at the main terminals. Minimum rating shall be 22 KAIC including breakers.
- F. Panel Separation: All panelboards associated with emergency electrical systems shall be separated from other by 2 hour fire rated construction.

2.2 DISTRIBUTION PANELBOARDS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
 - 2. General Electric Company; GE Consumer & Industrial Electrical Distribution.
 - 3. Square D; a brand of Schneider Electric (types NQOD, NEHB, QMB only).
- B. Panelboards: NEMA PB 1, power and feeder distribution type.
- C. Mains: Circuit breaker or main lugs only as indicated on drawings.
- D. Branch Overcurrent Protective Devices for Circuit-Breaker Frame Sizes 125 A and Smaller: Bolt-on circuit breakers, replaceable without disturbing adjacent units.

E. 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 available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
 - 2. General Electric Company; GE Consumer & Industrial Electrical Distribution.
 - 3. Square D; a brand of Schneider Electric.
- B. Panelboards: NEMA PB 1, lighting and appliance branch-circuit type.
- C. Mains: Circuit breaker main lugs only as indicated on drawings.
- D. Branch Overcurrent Protective Devices: Bolt-on circuit breakers, replaceable without disturbing adjacent units.
- E. Not Permitted: Column type panelboards and load centers.

2.4 DISCONNECTING AND OVERCURRENT PROTECTIVE DEVICES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
 - 2. General Electric Company; GE Consumer & Industrial Electrical Distribution.
 - 3. 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: Frame sizes 225A or less, fully rated for short circuit current available at the main terminals, inverse time-current element for low-level overloads, instantaneous magnetic trip element for short circuits, adjustable magnetic trip for frame sizes above 100A.
 - 2. Electronic Trip Circuit Breakers: Frame sizes 250A and larger, fully rated for short circuit current available at the main terminals, RMS sensing; adjustable magnetic trip, interchangeable electronic trip unit, and having the following field-adjustable settings:
 - a. Instantaneous trip.
 - b. Long- and short-time pickup levels.
 - c. Long- and short-time time adjustments.
 - d. Ground-fault pickup level, time delay, and I²t response.
 - 3. GFCI Circuit Breakers: Single- and two-pole configurations with Class A ground-fault protection (6-mA trip).
 - 4. Molded-Case Circuit-Breaker (MCCB) Features and Accessories:

- a. Standard frame sizes, trip ratings, and number of poles.
- b. Mechanical style lugs, suitable for number, size, trip ratings, and conductor materials.
- c. Application Listing: Appropriate for application.
- 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 or 24V as required trip coil energized from separate circuit, set to trip at 55 percent of rated voltage.
- f. Undervoltage Trip: Set to operate at 35 to 75 percent of rated voltage with field-adjustable 0.1- to 0.6-second time delay.
- g. Auxiliary Contacts: One SPDT switch or Two SPDT switches as indicated with "a" and "b" contacts; "a" contacts mimic circuit-breaker contacts and "b" contacts operate in reverse of circuit-breaker contacts.
- h. Alarm Switch: Single-pole, normally open contact that actuates only when circuit breaker trips.
- i. Multipole units enclosed in a single housing or factory assembled to operate as a single unit.
- j. Handle Padlocking Device: Fixed attachment, for locking circuit-breaker handle in on or off position as indicated.
- k. Handle Clamp: Loose attachment, for holding circuit-breaker handle in on position.

2.5 ACCESSORY COMPONENTS AND FEATURES

- A. Panelboard Keys: Provide one (1) spare key turned over to Owner for each panel in project.
- B. Circuit Breakers Including GFCI and Ground Fault Equipment Protection (GFEP) Types: Provide thre (3) spares of each size, type and pole turned over to Owner for each panel in project.
- C. Accessory Set: Include tools and miscellaneous items required for overcurrent protective device test, inspection, maintenance, and operation.
- D. 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 NECA 407.
- 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. Comply with NECA 1.

- B. Install panelboards and accessories according to NECA 407.
- C. Comply with mounting and anchoring requirements specified in Division 26 Section "Vibration Controls for Electrical Systems."
- D. 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.
- E. Install overcurrent protective devices and controllers not already factory installed.
 - 1. Set field-adjustable, circuit-breaker trip ranges in accord with "Overcurrent protection Study" furnished to Contractor by Yale..
- F. Arrange conductors in gutters into groups and bundle and wrap with wire ties after completing load balancing.
- G. Install filler plates in unused spaces.

3.3 IDENTIFICATION

- A. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs complying with Division 26 Section "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 Division 26 Section "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 Division 26 Section "Identification for Electrical Systems."

3.4 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust field-assembled components and equipment installation, including connections, and to assist in field testing. Report results in writing.
- B. Testing: Contractor will engage a qualified independent testing agency in accord with Part 1 of these specifications to direct and supervise the specific acceptance testing as described herein.
- C. Acceptance Testing Preparation:
 - 1. Test insulation resistance for each panelboard bus, component, connecting supply, feeder, and control circuit.
 - 2. Test continuity of each circuit.
- D. 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 panelboard. 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 panelboard 11 months after date of Substantial Completion.
 - c. Instruments and Equipment:
 - 1) Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.
- E. Panelboards will be considered defective if they do not pass tests and inspections.
- F. 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. Set field-adjustable circuit-breaker trip ranges as recommended by panelboard manufacturer's power analysis group or by third party as required. Circuit changes made during load balancing may negate color-coding of phases and circuits. If load balancing proves undesirable or is to be performed by others, delete paragraph below.
- C. 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.

3.6 PROTECTION

A. Temporary Heating: Apply temporary heat to maintain temperature according to manufacturer's written instructions.

END OF SECTION

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. This Section includes the following:
 - 1. Receptacles.
 - 2. Switches.
 - 3. Motion Sensors.
 - 4. Multi-outlet surface raceway assemblies.
- B. Related Sections include the following:
 - 1. Division 26 Section "Lighting Control Devices".
 - 2. Division 26 Section "Network Lighting Controls".
 - 3. Division 26 Section "Interior Lighting".
 - 4. Drawings are diagrammatic and are graphical representations of Contract requirements to best available standards at the scale indicated.

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 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: List of legends and description of materials and process used for premarking wall plates.
- C. Samples: One for each type of device and wall plate specified, in each color.
- D. Field quality-control test reports.

E. Operation and Maintenance Data: For wiring devices to include in all manufacturers' packing label warnings and instruction manuals that include labeling conditions.

1.5 QUALITY ASSURANCE

- A. Source Limitations: Obtain each type of wiring device and associated wall plate through one source from a single manufacturer. Insofar as they are available, obtain all wiring devices and associated wall plates from a single manufacturer and one source.
- B. 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.
- C. Comply with NFPA 70.

1.6 COORDINATION

A. Receptacles for Owner-Furnished Equipment: Match plugs configurations.

1.7 EXTRA MATERIALS

- A. Furnish extra materials described in subparagraphs below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
- B. One for every twenty installed, but no fewer than two.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. The catalog numbers used are those of Pass & Seymour. Subject to compliance with requirements, manufacturer's offering products that may be incorporated into the work include, but are not limited to Hubbell and Leviton.
- B. If equipment of another manufacturer is to be submitted for approval as equal, the contractor shall, at the time of bid, list all exceptions taken to these Specifications, all variances from these Specifications and all substitutions of operating capabilities or equipment called for in these Specifications and forward said list to the Engineer. Any such exceptions, variances or substitutions that were not listed at the time of bid and are identified in the submittal, shall be grounds for immediate disapproval without comment. Final determination of compliance with these Specifications shall rest with the Engineer, who, at his discretion, may require proof of performance.
- C. Alternate product submissions based upon use of a product line considered proprietary in its distribution, design, application software, or ongoing maintenance and repair shall not acceptable. Proof of a product's non-proprietary nature shall be the burden of the contractor at the time of Bid, and shall be in the form of written documentation. The determination of a product's compliance to this requirement shall be exclusively that of the Consulting Engineer.

2.2 DEVICES

A. All devices shall be commercial spec-grade hard-use in color as selected by Architect. Catalogue numbers listed herein are to establish features, ratings, and quality.

2.3 RECEPTACLES

- A. Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 configuration 5-20R, and UL 498. Pass & Seymour 5850"X" (duplex).
- B. GFCI Receptacles: 125 V, 20 A, straight blade, feed-through type. Comply with NEMA WD 1, NEMA WD 6, UL 498, and UL 943, Class A, and include indicator light that is lighted when device is tripped. Pass &Seymour 2097TRWR"X" (duplex).
- C. Twistlock Receptacles: Single locking type, comply with NEMA WD 1, NEMA WD 6, UL 498, with voltage, ampere, and configuration as indicated on drawings. The following are examples to establish reference standards:
 - 1. 125V, 20A: Pass & Seymour L520R
 - 2. 125V, 30A Pass & Seymour L530R
 - 3. 250V, 30A Pass & Seymour L630R

2.4 SWITCHES

- A. Snap Switches: 120/277 V, 20 A, Comply with NEMA WD 1 and UL 20. Pass &Seymour CSB20AC1"X" (single pole), 2"X" (two pole), 3"X" (three way), 4"X" (four way).
- B. Pilot Light Switches: as above except with neon-lighted handle "Light-On when Load-off" or "Light-on when Load-On" as required by design.
- C. Key-Operated, Single-Pole Switches: as above except with factory-supplied key in lieu of switch handle to match building standards.
- D. Key-Operated, Single-Pole, Double-Throw, Momentary Contact, Center-Off Switches: as above except with factory-supplied key in lieu of switch handle to match building standards.
- E. Wet-Location Switch: as above except comply with NEMA WD-1 and WD-6.

2.5 MOTION SENSORS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Watt Stopper.
 - 2. Hubbell Lighting.
 - 3. Sensor Switch, Inc.
- B. General Description: Wall or ceiling mounted, solid-state, low-voltage devices with a with a separate power-pack relay unit as indicated on drawings.

- 1. Operation: Unless otherwise indicated, turn lights on when covered area is occupied and off when unoccupied; with a time delay for turning lights off.
- 2. Sensor Output: Contacts rated to operate the connected power-pack relay, complying with UL 773A. Sensor shall be powered from the relay unit.
- 3. Relay Unit: 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. Power supply to sensor shall be 24-V dc, 150-mA, Class 2 power source as defined by NFPA 70.
- 4. Mounting: As indicated on drawings.
- C. Dual-Technology (DT) Type
 - 1. The Dual Technology sensor shall be capable of detecting presence in the control area by detecting doppler shifts in transmitted ultrasound and passive infrared heat changes.
 - 2. Sensor shall utilize Dual Sensing Verification Principle for coordination between ultrasonic and PIR technologies. Detection verification of both technologies must occur in order to activate lighting systems. Upon verification, detection by either shall hold lighting on.
 - 3. Sensor shall have a retrigger feature in which detection by either technology shall retrigger the lighting system on within 5 seconds of being switched off.
 - 4. Ultrasonic sensing shall be volumetric in coverage with a frequency of 40 KHz. It shall utilize Advanced Signal Processing which automatically adjusts the detection threshold dynamically to compensate for constantly changing levels of activity and air flow throughout controlled space.
 - 5. Sensor mounting/aiming shall be done in order to eliminate detection through open doorways and outside of the controlled area. To provide superior small motion detection and immediate activation upon entry, coverage of both technologies must be complete and overlapping throughout the controlled area.
 - 6. To avoid false ON activations and to provide immunity to RFI and EMI, Detection Signature Analysis shall be used to examine the frequency, duration, and amplitude of a signal, to respond only to those signals caused by human motion.
 - 7. Sensor shall operate at 24 VDC/VAC and halfwave rectified and utilize a power pack.
 - 8. The PIR technology shall utilize a temperature compensated, dual element sensor and a multielement Fresnel lens. The lens shall be Poly IR4 material to offer superior performance in the infrared wavelengths and filter short wavelength IR, such as those emitted by the sun and other visible light sources. The lens shall have grooves facing in to avoid dust and residue build up which affects IR reception.
 - 9. Coverage and distribution of lens shall be based on the specific sensor model specified on drawings.
 - 10. DT-200 sensors shall have an additional single-pole, double throw isolated relay with normally open, normally closed and common outputs. The isolated relay is for use with HVAC control, data logging, and other control options.
 - 11. Sensors shall utilize SmartSet[™] technology to optimize time delay and sensitivity settings to fit occupant usage patterns. The use of SmartSet shall be selectable with a DIP switch.
 - 12. Sensors shall have a time delay that is adjusted automatically (with the SmartSet setting) or shall have a fixed time delay of 5 to 30 minutes, set by DIP switch.
 - 13. Sensors shall feature a walk-through mode, where lights turn off 3 minutes after the area is initially occupied if no motion is detected after the first 30 seconds.
 - 14. Sensor shall have an override ON function for use in the event of a failure.
 - 15. Sensor shall have a built-in light level sensor that works from 10 to 300 footcandles.
 - 16. Sensor shall have 8 occupancy logic options for customized control to meet application needs.
 - 17. Sensor shall have a manual on function that is facilitated by installing a momentary switch.
 - 18. Each sensing technology shall have an LED indicator that remains active at all times in order to verify detection within the area to be controlled. The LED can be disabled.
 - 19. To ensure quality and reliability, sensor shall be manufactured by an ISO 9002 certified manufacturing facility and shall have a defect rate of less than 1/3 of 1%.
 - 20. Sensor shall have standard 5 year warranty and shall be UL and CUL listed.

2.6 COMBINATION OCCUPANCY SENSOR/SWITCHES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Watt Stopper.
 - 2. Hubbell Lighting.
 - 3. Sensor Switch, Inc.
- B. General Description: Wall mounted line-voltage, sensor/switch devices as indicated on drawings.
 - 1. Sensor shall be capable of detecting presence in the control area by detecting Doppler shifts in transmitted ultrasound and passive infrared heat changes.
 - 2. Sensor shall utilize Dual Sensing Verification Principle for coordination between ultrasonic and PIR technologies to reduce likelihood of false operations
 - 3. For best results, sensor shall feature a trigger mode where the end-user can choose which technology will activate the sensor from Off mode (initial), the type of detection that will reset the time delay (maintain), and the type of detection that will cause the sensor to be turned back On immediately after lights turned Off due to lack of motion (re-trigger). Selection of technologies for initial, maintain, and re-trigger shall be done with DIP switches.
 - 4. Sensor shall have its trigger mode factory preset to allow for quick installation in most applications. In this default setting, both technologies must occur in order to initially activate lighting systems. Detection by either technology shall maintain lighting on, and detection by either technology shall turn lights back on after lights were turned off for 5 seconds or less in automatic mode and 30 seconds or less in manual mode.
 - 5. Sensor shall have 4 occupancy logic options for customized control to meet application needs.
 - 6. Robotic test method as referred in the NEMA WD 7 guide shall be utilized for minor motion coverage verification.
 - 7. Ultrasonic sensing shall be volumetric in coverage with a frequency of 40 KHz. It shall utilize Advanced Signal Processing which automatically adjusts the detection threshold dynamically to compensate for constantly changing levels of activity and air flow throughout controlled space.
 - 8. The PIR technology shall utilize a temperature compensated, dual element sensor and a multielement Fresnel lens. The lens shall be Poly IR4 material to offer superior performance in the infrared wavelengths and filter short wavelength IR, such as those emitted by the sun and other visible light sources. The lens shall have grooves facing in to avoid dust and residue build up which affects IR reception.
 - 9. Sensor shall utilize SmartSet[™] technology to optimize automatic time delay to fit occupant usage patterns. The use of SmartSet shall be selectable with a DIP switch.
 - 10. Sensor shall utilize Zero Crossing circuitry on both relays to reduce stress on relays and therefore increase sensor life.
 - 11. Sensor shall have one or two relays as required per drawings. Dual relay devices shall be capable of simultaneously control of independent lighting loads or circuits. The secondary relay is isolated, allowing for two-circuit control.
 - 12. Sensor shall have no minimum load requirement and shall be capable of switching from 0 to 800 Watt incandescent; 0 to 800 Watt fluorescent or 1/6 hp @ 120 VAC, 50/60Hz; and 0 to 1200 Watt fluorescent @ 230/277 VAC, 50/60Hz.
 - 13. To blend in aesthetically, sensor shall not protrude more than 3/8" from the wall and utilize color-matched lens.
 - 14. To assure detection at desktop level uniformly across the space, sensor shall have a 28 segment, 2 level, Fresnel injection molded lens.
 - 15. Sensor shall feature a walk-through mode, where lights turn off 3 minutes after the area is initially occupied if no motion is detected after the first 30 seconds, set by a DIP switch.
 - 16. To avoid false ON activations and to provide immunity to RFI and EMI, Detection Signature Analysis shall be used to examine the frequency, duration, and amplitude of a signal, to respond only to those signals caused by human motion.
 - 17. Sensor shall cover up to 1,000 sq. ft. for walking motion, with a field view of 180 degree
 - 18. Sensor shall have automatic-ON or manual-ON operation on both relays adjustable with DIP switch.

- 19. Sensor shall have the option for an audible warning that shall beep to warn the end-user before lights turn Off automatically.
- 20. Each sensing technology shall have a LED indicator that remains active at all times in order to verify detection within the area to be controlled.
- 21. Sensor shall have a service switch to allow end-users to operate the sensor in the unlikely event of a failure; set by a trim pot.
- 22. Sensor shall be able to control incandescent, magnetic low voltage, electronic low voltage, and fluorescent loads.
- 23. Sensor shall have a built-in light level featuring simple, one-step daylighting setup that works from 8 to 180 footcandles.
- 24. Switching mechanism shall be a relay(s). Triac and other harmonic generating devices shall not be allowed. Sensor shall have ground wire and grounded strap for safety.
- 25. The Dual Technology wall switch sensor shall be a completely self-contained control system that replaces a standard toggle switch
- 26. To ensure quality and reliability, sensor shall be manufactured by an ISO 9002 certified manufacturing facility and shall have a defect rate of less than 1/3 of 1%.
- 27. Sensor shall have standard 5 year warranty and shall be UL and CUL listed.

2.7 WALL PLATES

- A. Single and combination types as required to match corresponding wiring devices.
 - 1. Plate-Securing Screws: Metal with head color to match plate finish.
 - 2. Material for Finished Spaces: Metal with baked enamel finish to match devices.
 - 3. Material for Unfinished Spaces: Galvanized steel.
 - 4. Material for Damp Locations: Cast aluminum with spring-loaded lift cover, and listed and labeled for use in "wet locations."
 - 5. Material for Wet Locations: Weatherproof, NEMA 250, complying with type 3R weatherresistant, die-cast aluminum, with "while-in-use" pad lockable cover.

2.8 MULTI-OUTLET SURFACE RACEWAY ASSEMBLIES

A. Type: Legrand/Wiremold #4000 series raceway or approved equal designed for use as a complete matching assembly of raceways and receptacles, aluminum material unless noted otherwise, devices: types and quantity as indicated on drawings, with all required fittings and accessories to suit layout shown on drawings.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Comply with NECA 1, including the mounting heights listed in that standard, unless otherwise noted.
- B. Coordination with Other Trades:
 - 1. Take steps to insure that devices and their boxes are protected. 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 the 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 just 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.
- D. Device Installation:
 - 1. Replace all devices that have been in temporary use during construction or that show signs that they 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, 2/3 to 3/4 of the way around terminal screw.
 - 6. Use a torque screwdriver when a torque is recommended or required by the 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 up, 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. 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, multi-gang wall plates.
- H. Adjust locations of floor outlets and to suit arrangement of partitions and furnishings.

3.2 IDENTIFICATION

- A. Comply with Division 26 Section "Identification for Electrical Systems."
 - 1. Receptacles: Identify panel board and circuit number from which served. Use hot, stamped or engraved machine printing with black -filled lettering on face of plate, and durable wire markers or tags inside outlet boxes.

3.3 FIELD QUALITY CONTROL

- A. Perform tests and inspections and prepare test reports.
 - 1. Test Instruments: Use instruments that comply with UL 1436.

- 2. Test Instrument for Convenience Receptacles: Digital wiring analyzer with digital readout or illuminated LED 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 not acceptable.
 - 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. The 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.

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 control circuits, enclosed switches, enclosed controllers, and main service switch.
 - 2. Spare-fuse cabinets.

1.3 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. Current-limitation curves for fuses with current-limiting characteristics.
 - 4. Time-current coordination curves (average melt) and current-limitation curves (instantaneous peak let-through current) for each type and rating of fuse
 - 5. Coordination charts and tables and related data.
 - 6. Fuse sizes for elevator feeders and elevator disconnect switches.
- B. Operation and Maintenance Data: For fuses to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 01 Section "Operation and Maintenance Data," include the following:
 - 1. Ambient temperature adjustment information.
 - 2. Current-limitation curves for fuses with current-limiting characteristics.
 - 3. Time-current coordination curves (average melt) and current-limitation curves (instantaneous peak let-through current) for each type and rating of fuse]
 - 4. Coordination charts and tables and related data.

1.4 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.
- E. Comply with UL 248-11 for plug fuses.

1.5 PROJECT CONDITIONS

- A. Where ambient temperature to which fuses are directly exposed is less than 40 deg F or more than 100 deg F, apply manufacturer's ambient temperature adjustment factors to fuse ratings.
- 1.6 COORDINATION
 - A. Coordinate fuse ratings with utilization equipment nameplate limitations of maximum fuse size and with system short-circuit current levels.

1.7 EXTRA MATERIALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Fuses: Equal to 3 for each size and type.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Cooper Bussmann, Inc.
 - 2. Ferraz Shawmut, 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 are applied to fuse ratings.
- E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 FUSE APPLICATIONS

- A. Cartridge Fuses:
 - 1. Service and feeder switches:
 - a. 0-600amperes; Class RK1, Bussmann Low-Peak, dual element, time-delay, 300kA, Type LPN-RK(amp)SP (250 volt), LPS-RK(amp)SP (600 volt)
 - b. 601-6000amperes; Class L, Bussmann Low-Peak, time-delay, 300kA, KRP-CL, (600 volt).
 - 2. Motor and Transformer Branch Circuits:
 - a. 0-600 amperes; Class RK1, Bussmann Low-Peak, dual element, time-delay, 300kA, Type LPN-RK(amp)SP (250 volt), LPS-RK(amp)SP (600 volt)
 - b. 601-6000 amperes; Class L, Bussmann Low-Peak, time-delay, 300kA, Type KRP-CL, (600 volt).
 - 3. Other (Non-Motor) Branch Circuits:
 - a. 0-600 amperes; Class RK1, Bussmann Low-Peak, dual element, time-delay, 300kA, Type LPN-RK(amp)SP (250 volt), LPS-RK(amp)SP (600 volt)
 - 4. Control Circuits: Class CC fast acting or as recommended by control equipment manufacturer.

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 Division 26 Section "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

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.
- B. Related Sections include the following:
 - 1. Division 26 Section "Fuses".
 - 2. Drawings are diagrammatic and are graphical representations of Contract requirements to best available standards at the scale indicated.

1.3 DEFINITIONS

- A. NC: Normally closed.
- B. NO: Normally open.
- C. SPDT: Single pole, double throw.

1.4 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. Include evidence of NRTL listing for series rating of installed devices.
 - 5. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices, accessories, and auxiliary components.
 - 6. Include time-current coordination curves (average melt) for each type and rating of overcurrent protective device; include selectable ranges for each type of overcurrent protective device. Submit on translucent log-log graph paper.
- 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.

- C. Qualification Data: For qualified testing agency.
- D. 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.
- E. Manufacturer's field service report.
- F. Operation and Maintenance Data: For enclosed switches and circuit breakers to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 01 Section "Operation and Maintenance Data," include the following:
 - 1. Manufacturer's written instructions for testing and adjusting enclosed switches and circuit breakers.
 - 2. Time-current coordination curves (average melt) for each type and rating of overcurrent protective device; include selectable ranges for each type of overcurrent protective device. Submit on translucent log-log graph paper.

1.5 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.

1.6 PROJECT CONDITIONS

- A. Environmental Limitations: Rate equipment for continuous operation under the following conditions unless otherwise indicated:
 - 1. Ambient Temperature: Not less than minus 22 deg F and not exceeding 104 deg F.
 - 2. Altitude: Not exceeding 6600 feet.
 - 3. Emission
 - 4. Comply with NFPA 70E.

1.7 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.

1.8 EXTRA MATERIALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Fuses: Equal to 10 percent of quantity installed for each size and type, but no fewer than three of each size and type.
 - 2. Fuse Pullers: Two for each size and type.

PART 2 - PRODUCTS

2.1 FUSIBLE SWITCHES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. General Electric Company.
 - 2. Square D; Schneider Electric.
 - 3. Eaton Electrical Inc.; Cutler-Hammer Products.
 - 4. Siemens Energy & Automation, Inc.
- B. Type HD, Heavy Duty, Single Throw, 240-V ac, 800 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. Type HD, Heavy Duty, Double Throw, 240-V ac, 800 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.
- D. 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. Class R Fuse Kit: Provides rejection of other fuse types when Class R fuses are specified.
 - 4. Auxiliary Contact Kit: Two 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.
 - 6. Accessory Control Power Voltage: Remote mounted and powered of voltage as required.

2.2 NONFUSIBLE SWITCHES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. General Electric Company.
 - 2. Square D; Schneider Electric.
 - 3. Eaton Electrical Inc.; Cutler-Hammer Products.
 - 4. Siemens Energy & Automation, Inc.
- B. Type HD, Heavy Duty, Single Throw, 240-V ac, 800 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. Type HD, Heavy Duty, Double 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.
- D. 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. Auxiliary Contact Kit: Two NO/NC (Form "C") auxiliary contact(s), arranged to activate before switch blades open.
 - 4. Lugs: Mechanical type, suitable for number, size, and conductor material.
 - 5. Accessory Control Power Voltage: Remote mounted and powered of voltage as required.

2.3 MOLDED-CASE CIRCUIT BREAKERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. General Electric Company.
 - 2. Square D; Schneider Electric.
 - 3. Eaton Electrical Inc.; Cutler-Hammer Products.
 - 4. Siemens Energy & Automation, Inc.
- 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: For breakers with frame sizes 225A and less, inverse time-current element for low-level overloads and instantaneous magnetic trip element for short circuits. Provide with field-replaceable rating plug for breaker frame sizes 225A.
- D. Electronic Trip Circuit Breakers: For breakers with frame sizes 250A and larger unless smaller indicated on drawings, rms sensing, field-replaceable rating plug, with the following field-adjustable settings:
 - 1. Instantaneous trip.
 - 2. Long- and short-time pickup levels.
 - 3. Long- and short-time time adjustments.
- E. Features and Accessories:
 - 1. Standard frame sizes, trip ratings, and number of poles.
 - 2. Lugs: Mechanical 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. Ground-Fault Protection where Required: Comply with UL 1053; integrally mounted, selfpowered or remote-mounted and powered type as required with mechanical ground-fault indicator; relay with adjustable pickup and time-delay settings, push-to-test feature, internal memory, and shunt trip unit; and three-phase, zero-sequence current transformer/sensor.
 - 5. Shunt Trip where Required: Trip coil energized from separate circuit, with coil-clearing contact.
 - 6. Auxiliary Contacts where Required: Two SPDT switches with "a" and "b" contacts; "a" contacts mimic circuit-breaker contacts, "b" contacts operate in reverse of circuit-breaker contacts.

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. Corrosive and/or 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 Division 26 Section "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 Division 26 Section "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 and prepare test reports.
 - 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. 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. 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.
- B. Set field-adjustable circuit-breaker trip ranges as specified in Division 26 Section "Overcurrent Protective Device Coordination Study" or as recommended by manufacturer where short circuit study not required under this contract.

END OF SECTION

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 solid-state luminaires and exit light units that use LED technology.
 - 2. Fixture supports.

1.3 DEFINITIONS

- A. CCT: Correlated color temperature.
- B. CRI: Color Rendering Index.
- C. Fixture: See "Luminaire."
- D. IP: International Protection or Ingress Protection Rating.
- E. LED: Light-emitting diode.
- F. Lumen: Measured output of lamp and luminaire, or both.
- G. Luminaire: Complete lighting unit, including lamp, reflector, and housing.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Arrange in order of luminaire designation.
 - 2. Include data on features, accessories, and finishes.
 - 3. Include physical description and dimensions of luminaires.
 - 4. Include emergency lighting units, including batteries and chargers.
 - 5. Include life, output (lumens, CCT, and CRI), and energy efficiency data.
 - 6. Photometric data and adjustment factors based on laboratory tests complying with IESNA Lighting Measurements Testing and Calculation Guides, of each lighting fixture type. The adjustment factors shall be for lamps and accessories identical to those indicated for the lighting fixture as applied in this Project IES LM-79 and IES LM-80.

- a. Manufacturers' Certified Data: Photometric data certified by manufacturer's laboratory with a current accreditation under the National Voluntary Laboratory Accreditation Program for Energy Efficient Lighting Products.
- b. Testing Agency Certified Data: For indicated luminaires, photometric data certified by a qualified independent testing agency. Photometric data for remaining luminaires shall be certified by manufacturer.
- B. Shop Drawings: For nonstandard or custom luminaires.
 - 1. Include plans, elevations, sections, and mounting and attachment details.
 - 2. Include details of luminaire assemblies. Indicate dimensions, weights, loads, and required clearances, method of field assembly, components, and location and size of each field connection.
 - 3. Include diagrams for power, signal, and control wiring.
- C. Samples: For each luminaire and for each color and texture with standard factory-applied finish.
- D. Samples for Initial Selection: For each type of luminaire with custom factory-applied finishes.
 - 1. Include Samples of luminaires and accessories involving color and finish selection.
- E. Samples for Verification: For each type of luminaire.
 - 1. Include Samples of luminaires and accessories to verify finish selection.
- F. Product Schedule: For luminaires and lamps.

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 luminaires.
 - 2. Suspended ceiling components.
 - 3. Partitions and millwork that penetrate the ceiling or extend to within 12 inches (300 mm) of the plane of the luminaires.
 - 4. Structural members to which equipment and or luminaires will be attached.
 - 5. Initial access modules for acoustical tile, including size and locations.
 - 6. Items penetrating finished ceiling, including the following:
 - a. Other luminaires.
 - b. Air outlets and inlets.
 - c. Speakers and security devices.
 - d. Sprinklers and fire alarm devices.
 - e. Access panels.
 - f. Ceiling-mounted projectors and screens.
 - 7. Moldings.
- B. Qualification Data: For testing laboratory providing photometric data for luminaires.
- C. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

- D. Product Certificates: For each type of luminaire.
- E. Product Test Reports: For each luminaire, for tests performed by manufacturer and witnessed by a qualified testing agency.
- F. Sample warranty.

1.6 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For luminaires and lighting systems to include in operation and maintenance manuals.
 - 1. Provide a list of all lamp types used on Project; use ANSI and manufacturers' codes.

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. Diffusers and Lenses: One for every 10 of each type and rating installed. Furnish at least one of each type.

1.8 QUALITY ASSURANCE

- A. Luminaire Photometric Data Testing Laboratory Qualifications: Luminaire manufacturer's laboratory that is accredited under the NVLAP for Energy Efficient Lighting Products.
- B. Luminaire Photometric Data Testing Laboratory Qualifications: Provided by an independent agency, with the experience and capability to conduct the testing indicated, that is an NRTL as defined by OSHA in 29 CFR 1910.7, accredited under the NVLAP for Energy Efficient Lighting Products, and complying with the applicable IES testing standards.
- C. Provide luminaires from a single manufacturer for each luminaire type.
- D. Mockups: as requested by Architect, lighting luminaire in space complete with power and control connections.
 - 1. Obtain Architect's approval of luminaires in mockups before starting installations.
 - 2. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
 - 3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
 - 4. 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. Protect finishes of exposed surfaces by applying a strippable, temporary protective covering before shipping.

1.10 WARRANTY

- A. Warranty: Manufacturer and Installer agree to repair or replace components of luminaires that fail in materials or workmanship within specified warranty period.
- B. Warranty Period: Five year(s) from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 LUMINAIRE REQUIREMENTS

- 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. NRTL Compliance: Luminaires for hazardous locations shall be listed and labeled for indicated class and division of hazard by an NRTL.
- C. FM Global Compliance: Luminaires for hazardous locations shall be listed and labeled for indicated class and division of hazard by FM Global.
- D. Recessed Fixtures: Comply with NEMA LE 4.
- E. Bulb shape complying with ANSI C79.1.
- F. Lamp base complying with ANSI C81.61 or IEC 60061-1.
- G. CRI of as indicated in fixture schedule.
- H. Rated lamp life indicated in fixture schedule.
- I. Lamps dimmable from 100 percent to 0 percent of maximum light output.
- J. Internal driver.

2.2 MATERIALS

- A. General:
 - 1. Free of burrs and sharp corners and edges.
 - 2. Sheet metal components shall be steel unless otherwise indicated.
 - 3. Form and support to prevent warping and sagging.
- B. 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.
- C. Factory-Applied Labels: Comply with UL 1598. Include recommended lamps. Locate labels 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 characteristics:
 - a. "USE ONLY" and include specific lamp type.
 - b. Lamp diameter, shape, size, wattage, and coating.
 - c. CCT and CRI for all luminaires.

2.3 FINISHES

A. Variations in finishes are unacceptable in the same piece. Variations in finishes of adjoining components are acceptable if they are within the range of approved Samples and if they can be and are assembled or installed to minimize contrast.

2.4 LUMINAIRE FIXTURE SUPPORT COMPONENTS

- A. Comply with requirements in Section 260529 "Hangers and Supports for Electrical Systems" for channel and angle iron supports and nonmetallic channel and angle supports.
- B. Wires: ASTM A 641/A 641 M, Class 3, soft temper, zinc-coated steel, 12 gage (2.68 mm)].

2.5 EXIT SIGNS

A. Comply with UL 924; for sign colors, visibility, luminance, and lettering size, comply with authorities having jurisdiction.

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 luminaire to verify actual locations of luminaire and electrical connections before fixture installation. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 TEMPORARY LIGHTING

A. If approved by the Architect, use selected permanent luminaires for temporary lighting. When construction is sufficiently complete, luminaires shall be restored to pre-construction condition.

3.3 INSTALLATION

- A. Comply with NECA 1.
- B. Install luminaires level, plumb, and square with ceilings and walls unless otherwise indicated.
- C. Install lamps in each luminaire.

- D. Supports:
 - 1. Sized and rated for luminaire weight.
 - 2. Able to maintain luminaire position after cleaning and relamping.
 - 3. Provide support for luminaire without causing deflection of ceiling or wall.
 - 4. Luminaire mounting devices shall be capable of supporting a horizontal force of 100 percent of luminaire weight and vertical force of 400 percent of luminaire weight.
- E. Flush-Mounted Luminaire Support:
 - 1. Secured to outlet box.
 - 2. Attached to ceiling structural members at four points equally spaced around circumference of luminaire.
 - 3. Trim ring flush with finished surface.
- F. Wall-Mounted Luminaire Support:
 - 1. Attached to structural members in walls using through bolts and backing plates on either side of wall as required.
 - 2. Do not attach luminaires directly to gypsum board.
- G. Ceiling-Mounted Luminaire Support:
 - 1. Ceiling mount with 5/32-inch- (4-mm-) diameter aircraft cable supports as detailed on drawngs adjustable to required length.
- H. Suspended Luminaire Support:
 - 1. Pendants and Rods: Where longer than 48 inches (1200 mm), brace to limit swinging.
 - 2. Stem-Mounted, Single-Unit Luminaires: Suspend with twin-stem hangers. Support with approved outlet box and accessories that hold stem and provide damping of luminaire oscillations. Support outlet box vertically to building structure using approved devices.
 - 3. Continuous Rows of Luminaires: Use tubing or stem for wiring at one point and same for other ends and intermediaries for support.
 - 4. Do not use ceiling grid as support for pendant luminaires. Connect support wires or rods to building structure.
- I. Ceiling-Grid-Mounted Luminaires:
 - 1. Secure to any required outlet box.
 - 2. Secure luminaire to the luminaire opening using approved fasteners in a minimum of four locations, spaced near corners of luminaire.
 - 3. Use approved devices and support components to connect luminaire to ceiling grid and building structure in a minimum of four locations, spaced near corners of luminaire.
- J. Comply with requirements in Section 260519 "Low-Voltage Electrical Power Conductors and Cables" for wiring connections.

3.4 IDENTIFICATION

A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

3.5 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections:
 - 1. Operational Test: After installing luminaires, switches, and accessories, and after electrical circuitry has been energized, test units to confirm proper operation.
 - 2. Test for Emergency Lighting: Interrupt power supply to demonstrate proper operation. Verify transfer from normal power to battery power and retransfer to normal.
- B. Luminaire will be considered defective if it does not pass operation tests and inspections.
- C. Prepare test and inspection reports.

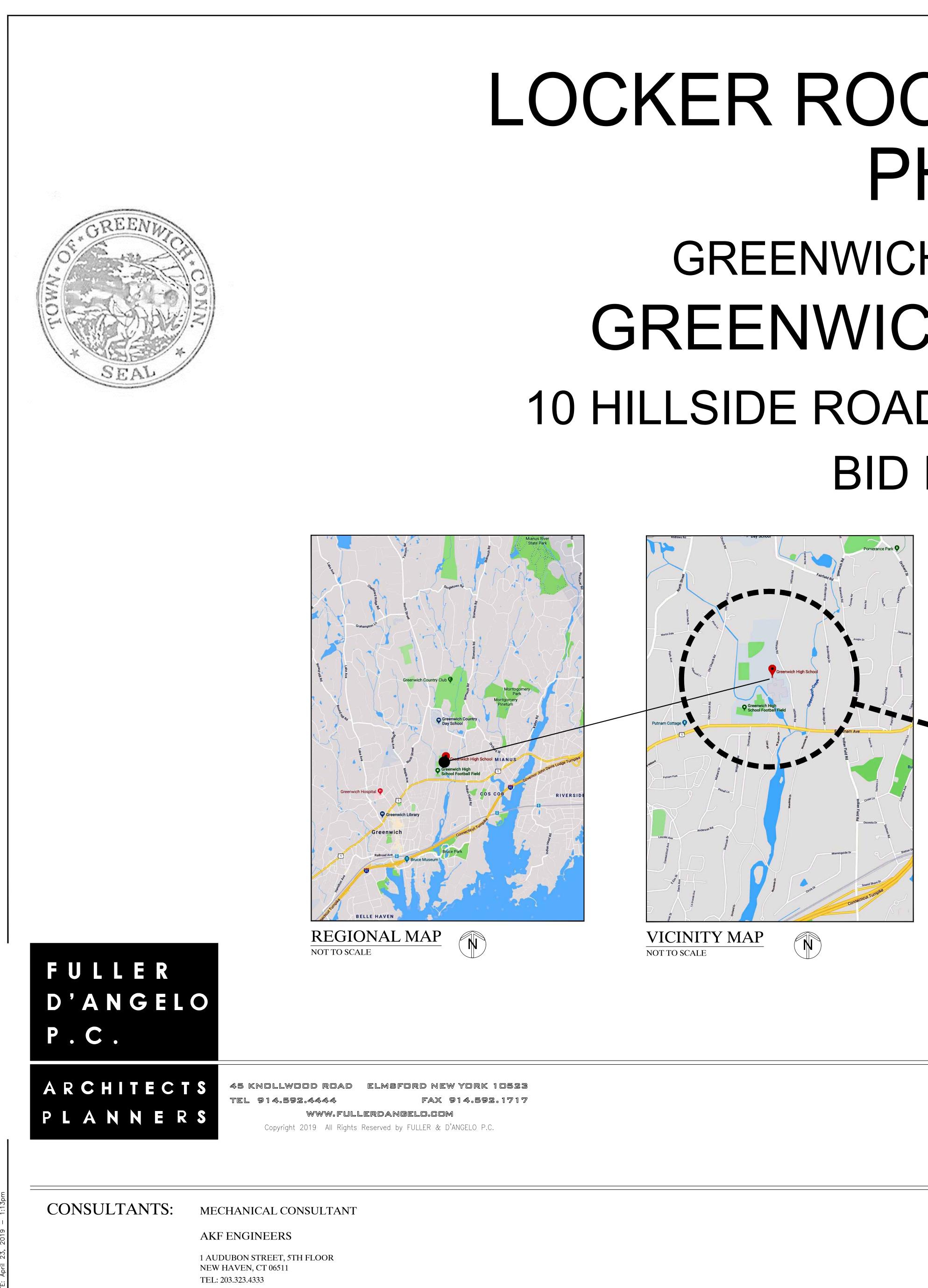
3.6 STARTUP SERVICE

- A. Comply with requirements for startup specified in Section 260943.16 "Addressable-Fixture Lighting Controls."
- B. Comply with requirements for startup specified in Section 260943.23 "Relay-Based Lighting Controls."

3.7 ADJUSTING

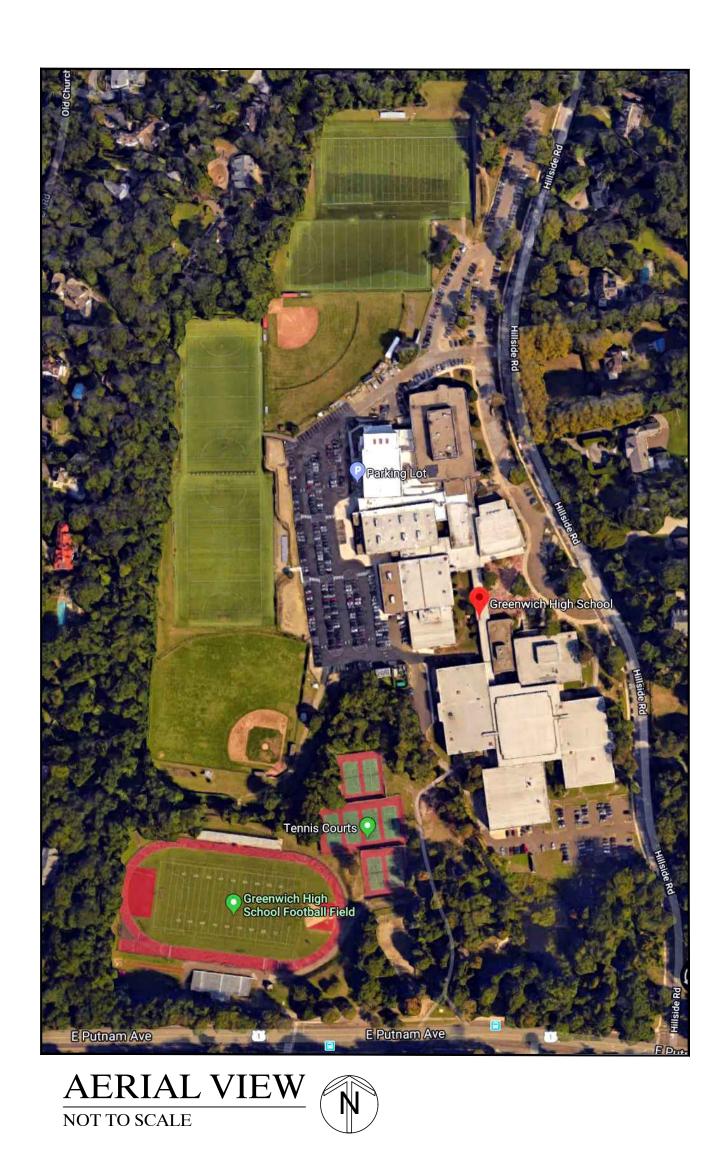
- A. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting the direction of aim of luminaires to suit occupied conditions. Make up to two visits to Project during other-than-normal hours for this purpose. Some of this work may be required during hours of darkness.
 - 1. During adjustment visits, inspect all luminaires. Replace lamps or luminaires that are defective.
 - 2. Parts and supplies shall be manufacturer's authorized replacement parts and supplies.
- B. Adjust the aim of luminaires in the presence of the Architect.

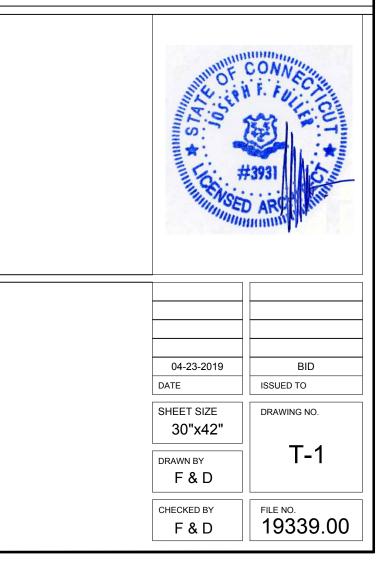
END OF SECTION



LOCKER ROOM RENOVATIONS PHASE II **GREENWICH PUBLIC SCHOOLS GREENWICH HIGH SCHOOL** 10 HILLSIDE ROAD, GREENWICH, CT 06830 BID NO. 2243-19





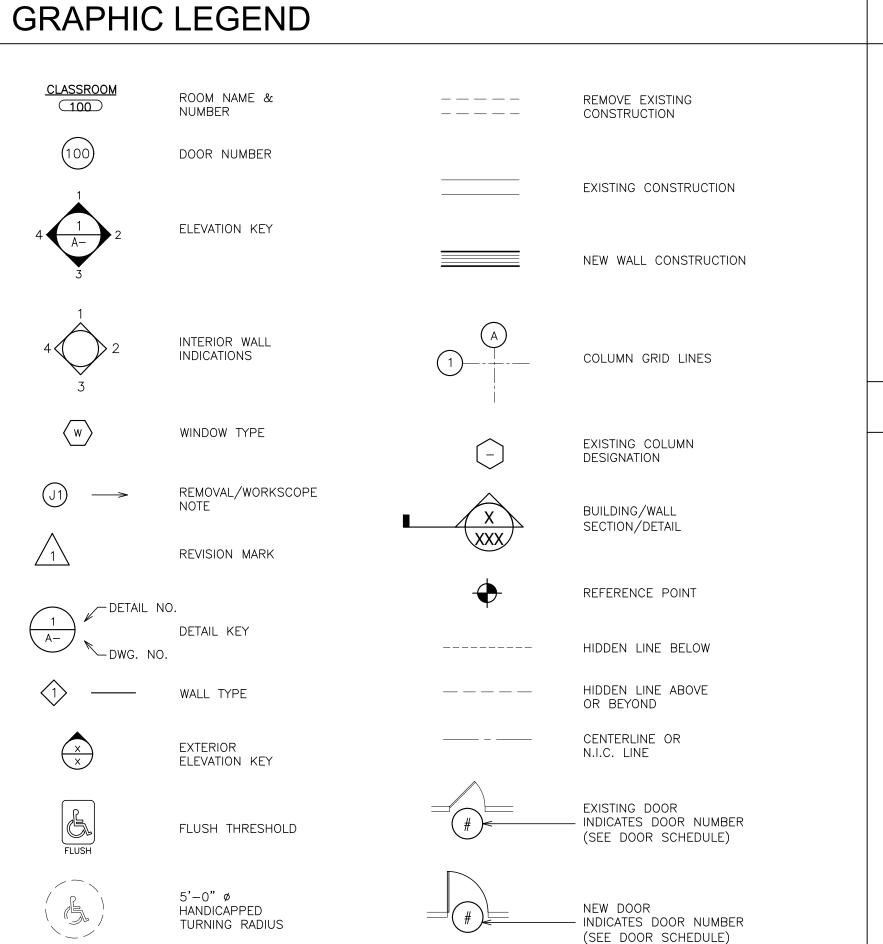


| AE | BE | BREVIATION | S | | | | | |
|---------------------------|----|--|--------------------------|--------|--|------------------------------|--------|---|
| & ACU ACM | — | AND AIR CONDITIONING UNIT ASBESTOS CONTAINING MATERIAL | FD F.DAMP FE FG | - | FLOOR DRAIN FIRE DAMPER FIRE EXTINGUISHER FIBER GLASS | PART P–CONTR PB PCC | - | PARTIAL PLUMBING CONTRACTOR PANEL BOX POWER CHARGING |
| ACT ACW | | ACOUSTICAL CEILING TILE ASBESTOS CONTAINING | FIN FIXT FHC | _ | FINISH FIXTURE FIRE HOSE CABINET | PD PH | — | CABINET PRESSURE DROP PENTHOUSE |
| AD ADJ | _ | WASTE ACCESS DOOR ADJACENT | FL or FLR FTG | — | FLOOR FOOTING | PLT PLUMB PWD | - | PLATE PLUMBING PLYWOOD |
| AFF AHU ALUM | _ | ABOVE FINISH FLOOR AIR HANDLER UNIT ALUMINUM | FOB FOG FOR | - | FLAT ON BOTTOM FUEL OIL GAUGE FUEL OIL RETURN | PNL PNT PREFAB | - | PANEL PAINT PREFABRICATED |
| ALT AMB AMP | _ | ALTERNATE AMBIENT AMPERE | FOS FOT FP | _ | FUEL OIL SUPPLY FLAT ON TOP FIRE PROOF | PRESS PRSC PSI | _ | PRESSURE PROJECTION SCREEN POUNDS PER SQUARE |
| APD APPROX A.R. | — | AIR PRESSURE DROP APPROXIMATE AREA OF REFUGE | FPM FPS FRP | _ | FEET PER MINUTE FEET PER SECOND FIBER REINFORCED | PT | _ | INCH PRESSURE TREATED |
| ARCH AVG | | ARCHITECTURAL AVERAGE | FT | _ | POLYSTYRENE FOOT or FEET | QT QTY | | QUARRY TILE QUANTITY |
| BDD BFW BHP | — | BACK DRAFT DAMPER BOILER FEED WATER BRAKE HORSE POWER | GA GAL GALV | _ | GAUGE GALLONS GALVANIZED | R RA RAD | — | RISER or RADIUS RETURN AIR RADIATION |
| BITUM BLDG BLK | _ | BITUMINOUS BUILDING BLOCK | GC GEN GL | _ | GENERAL CONSTRUCTION GENERAL GLASS | RD REF REINF | - | ROOF DRAIN ROOF EXHAUST FAN REINFORCED |
| BTUH | _ | BRITISH THERMAL UNITS PER HOUR | GPH GPM | _ | GALLONS PER HOUR GALLONS PER MINUTE | REQ'D RH | _ _ | REQUIRED RELATIVE HUMIDITY |
| BU BUR | _ | BUILT UP BUILT UP ROOFING | | _ | GRAINS GAS VALVE GYPSUM WALL BOARD | RO RM RPM | — | ROUGH OPENING ROOM REVOLUTIONS PER |
| C CB CC | — | COMMON CATCH BASIN COOLING COIL | | _ | GYPSUM BOARD GYPSUM FIBERBOARD | RTU S | | MINUTE ROOF TOP UNIT SINK |
| CEIL or CLG CER/CEG | | CEILING CEILING EXHAUST | | _ | HEIGHT HOSE BIB HEATING, VENTING & | SA SAN SCHED | — | SUPPLY AIR SANITARY SCHEDULE |
| CFM | | REGISTER/GRILLE CUBIC FEET PER | | _ | AIR CONDITIONING CONTRACTOR HOLLOW CORE | SD | _ | SMOKE DETECTOR SMOKE DAMPER SECTION |
| CHWR | — | MINUTE CEILING HEIGHT CHILLED WATER RETURN | H/C HD | _ _ | HEATING/COOLING HEAD HEATING COIL | SF | - | SQUARE FOOT or SQUARE FEET SHEET |
| CJ CL or € | _ | CHILLED WATER SUPPLY CONTROL JOINT CENTER LINE | HG HM | _ | REFRIGERANT HOT GAS HOLLOW METAL | SIM SP | _ _ | SIMILAR STATIC PRESSURE |
| CLOS or CL | _ | COOLING WATER | HPS | _ | HORIZONTAL HIGH POINT HIGH PRESSURE STEAM | SQ SQ FT | _ | SPECIFICATION(S) SQUARE SQUARE FEET |
| CMP CO | | CORRUGATED METAL PIPE CLEAN OUT | H.PWR HR HT | — | HORSE POWER HOUR(S) HEAT | STD STL | — | STAINLESS STEEL STANDARD STEEL |
| COL COMPR CONC | _ | COLUMN COMPRESSOR CONCRETE | | | HIGH TEMPERATURE HOT WATER HEATER | STOR | — | STEAM STORAGE STRUCTURAL |
| COND CONST CONTR | _ | CONDENSER CONSTRUCTION CONTRACTOR | UNIT | | HEATING/VENTILATION | SUCT SUSP | | SUCTION SUSPENDED |
| CONV CP | _ | CONVECTOR CONDENSATE PUMP CEILING RETURN | HWR HWS | _ | COVERING HOT WATER RETURN HOT WATER SUPPLY | T TCP | | TREAD or TOILET TEMPERATURE CONTRO PANEL |
| CRU | _ | REGISTER/GRILLE COMPUTER ROOM UNIT | HX | _ | HEAT EXCHANGER FREQUENCY (CYCLES | T.D. T.DIFF | | TRENCH DRAIN TEMPERATURE DIFFERENCE |
| CSD CT | | CEILING SUPPLY DIFFUSER CERAMIC TILE | ID | _ | PER MINUTE) INSIDE DIAMETER | TEL TEMP | _ | TELEPHONE TEMPERATURE |
| C.TWR CU CU FT | _ | COOLING TOWER CONDENSER UNIT CUBIC FEET | IEF INT INSUL | _ | IN-LINE EXHAUST FAN INTERIOR INSULATION | ТНК Т.О. Т.О.С. | - | THICK TRIMMED OPENING TOP OF CURB |
| CUH CV | | CABINET UNIT HEATER COEFFICIENT, VALVE FLOW | INV IN | | INVERT INCH | T.O.P. T.O.S. TSP | — | TOP OF PARAPET TOP OF STEEL TOTAL STATIC PRESSUR |
| CWR CWS | | CONDENSER WATER RETURN CONDENSER WATER | JC JT JB | _ | JANITOR'S CLOSET JOINT JUNCTION BOX | T'STAT TYP | | THERMOSTAT TYPICAL |
| D or DIA | _ | SUPPLY DIAMETER | KIT KW | _ | KITCHEN KILOWATT | U UH UL | _ | URINAL UNIT HEATER UNDERWRITERS |
| DB dB | | DRY BULB TEMPERATURE DECIBEL | К.М.Н. | | KINDERGARTEN MOUNTING HEIGHT | UNFIN UV | _ | LABORATORY UNFINISHED UNIT VENTILATOR |
| DC DEG DEMO | — | DUST COLLECTOR DEGREE DEMOLITION | L LAT | _ | LENGTH LEAVING AIR TEMPERATURE | V VAV | | VOLT VARIABLE AIR VOLUME |
| DF DH DIM | — | DRINKING FOUNTAIN DOUBLE HUNG DIMENSION | LAM LAV LBS | _ | LAMINATE LAVATORY | VCT VD VEL | — | VINYL COMPOSITION TI VOLUME DAMPER VELOCITY |
| DN DO | | DOWN REPEAT or DOOR OPENING | or # LCC | _ | POUNDS LEAD COATED COPPER | VEST VIF VLV | — | VESTIBULE VERIFY IN FIELD VALVE |
| DP DR DWG | — | DEEP DOOR DRAWING | LDR LF LIQ | _ | LEADER LINEAR FEET LIQUID | VOL V.P. V.W.C. | — | VOLUME VISION PANEL VINYL WALL COVERING |
| DX E | _ | DIRECT EXPANSION | LL LP LPS | _ | LIVE LOAD LOW POINT LOW PRESSURE STEAM | W WASHER | _ | WOMEN or WIDTH or |
| EA EAT | _ | EACH ENTERING AIR TEMPERATURE | LRG LSD | _ | LINEAR RETURN GRILLE LINEAR SUPPLY DIFFUSER | w/ WB W.C. | _ | WITH WET BULB WATER CLOSET |
| | | ELECTRICAL CONTRACTOR EXISTING CUSPIDOR | LWT | | LEAVING WATER TEMPERATURE | WD WEF | _ | WOOD WALL EXHAUST FAN WALL EXHAUST |
| EDB | _ | EXISTING COSI IDOR ENTERING DRY BULB EXISTING DRINKING FOUNTAIN | M MAX MAT | _ | MIRROR MAXIMUM MATERIAL | WG | | REGISTER/GRILLE INCHES OF WATER, |
| EDR | | EQUIVALENT DIRECT RADIATION | MBH MD | | BTU PER HOUR IN THOUSANDS MOTORIZED DAMPER | W.G. WK | | GAGE (PRESSURE) WIRE GLASS WORK |
| E.E.W. | _ | EMERGENCY EGRESS WINDOW EXHAUST FAN | MECH MFR MIN | — | MECHANICAL MANUFACTURE MINIMUM | W.I. W.P. WPD | _ | WROUGHT IRON WATER PROOF WATER PRESSURE DRO |
| EFE | _ | EXISTING FIRE EXTINGUISHER EXHAUST HOOD | MISC MO MPS | _ | MISCELLANEOUS MASONRY OPENING MEDIUM PRESSURE | W.R. WRR/WRG | | WATER RESISTANT WALL SUPPLY REGISTER/GRILLE |
| EJ EQ ELEC | _ | EXPANSION JOINT EQUAL ELECTRIC/ELECTRICAL | MS MH | _ | STEAM MARBLE SADDLE MAN HOLE | WTG WTR W.W.F. | _ | WALL TRANSFER GRILL WATER WELDED WIRE FABRIC |
| EL or ELEV E.M.H. | | ELEVATION ELEMENTARY SCHOOL | MTD MTL | — | MOUNTED METAL | W.W.F. W.W.M. YD | _ | WELDED WIRE FABRIC WELDED WIRE MESH YARD DRAIN |
| ENCL ENTR | _ | MOUNTING HEIGHT ENCLOSURE ENTRANCE | N N/A NC | _ | NORTH NOT APPLICABLE NORMALLY CLOSED | U I | - | |
| EQUIP ESP | | EQUIPMENT EXTERNAL STATIC PRESSURE | NIC or N.I.C. | _ | NOT IN CONTRACT | | | |
| ETC | _ | ETCETERA – AND OTHER THINGS or AND SO FORTH | N.OPEN NTS | _ | NUMBER(S) NORMALLY OPEN | | | |
| EVAP EWB EWT | _ | EVAPORATOR ENTERING WET BULB ENTERING WATER | OA OC | _ | NOT TO SCALE OUTSIDE AIR ON CENTER | | | |
| EXH EXH.A | _ | EXHAUST AIR | OD ODR OF | _ | OUTSIDE DIAMETER OPEN DUCT RETURN OUTSIDE FACE | | | |
| EXIST EXP | _ | EXISTING EXPANSION | OH OPNG OPP | - | OVERHEAD OPENING OPPOSITE | | | |
| EXT F | _ | EXTERIOR FAHRENHEIT | OZ | - | OUNCE PUMP (IN-LINE or | | | |
| FAI FCU | | FRESH AIR INTAKE FAN COIL UNIT | | | BASE MOUNTED) | | | |

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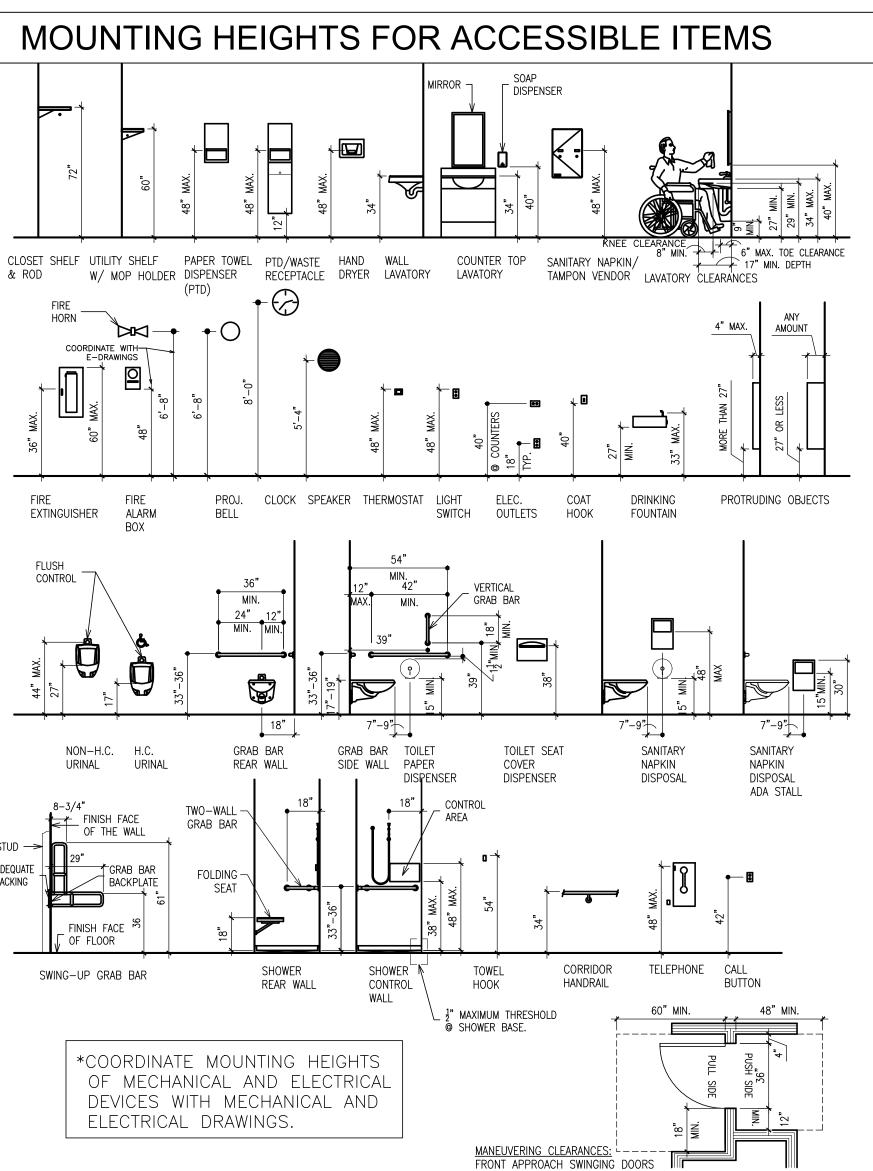
(100)

(100) $4 \left(\begin{array}{c} 1 \\ A - \end{array} \right)$ $\langle w \rangle$ J1 \longrightarrow A-_____ $\begin{pmatrix} x \\ x \end{pmatrix}$ L FLUSH 4 HORN COORDINATE WITH E-DRAWINGS FIRF FIRE EXTINGUISHER ALARM BOX FLUSH CONTROL NON-H.C. H.C. URINAL URINAL FINISH FACE OF THE WALL GRAB BAR BACKPLATE ADEQUATE BACKING FINISH FACE OF FLOOR SWING-UP GRAB BAR



MATERIALS LEGEND

| | CONCRETE | PARTICLE BOARD |
|--|---------------------------|--|
| >> | CONCRETE MASONRY UNITS | PLYWOOD |
| | BRICK | ACOUSTICAL TILE |
| <u>_ </u> | STONE | CONTINUOUS WOOD FRAMING THROUGH MEMBER |
| | METALS | WOOD FRAMING THROUGH INTERRUPTED MEMBER |
| | COMPACTED GRAVEL | FINISHED WOOD |
| | EARTH/UNDISTURBED SOIL | BATT INSULATION |
| XX | DRAINAGE BOARD | RIGID INSULATION |



| | CODE INFORMATION | |
|-----|--|--|
| | | |
| | 1. <u>APPLICABLE STATE BUILDING CODE</u> | 2015 INTERNATIONA 2015 LIFE SAFETY C |
| | 2018 CONNECTICUT STATE BUILDING CODE (SBC) The 2018 SBC adopts the following model codes: | Tentative Interim Ame |
| | 2015 INTERNATIONAL BUILDING CODE | National Fire Protection |
| | 2015 INTERNATIONAL EXISTING BUILDING CODE ICC/ANSI A117.1-2009 ACCESSIBLE AND USABLE | 2018 CONNECTICUT STATE FIRE |
| | BUILDINGS AND FACILITIES | The 2018 SFPC adopts the for 2015 FIRE CODE (NF |
| | 2015 INTERNATIONAL ENERGY CONSERVATION CODE 2015 INTERNATIONAL MECHANICAL CODE | 2. CONDITION: EX |
| | 2015 INTERNATIONAL PLUMBING CODE | CLASSIFICATION: AL |
| | 2017 NATIONAL ELECTRICAL CODE (NFPA 70) | 3. <u>USE GROUP CLASSIFICAT</u> |
| | 2018 CONNECTICUT STATE FIRE SAFETY CODE (SFSC) | E - EDUCATIONA |
| | The 2018 SFSC adopts the following model codes: GENERAL REMOVAL NO | A-4 - ASSEMBLY (S |
| 4 | | |
| 1 | . DRAWINGS INDICATE ONLY MAJOR SCOPE OF REMOVALS. ITEMS NOT SHOWN AS REQUIRED TO SUIT ALL NEW WO AND STORE ANY AND ALL ITEMS SHOWN AS REQUIRED STORING LOCATIONS. | RK. CONTRACTOR IS REQUIRED |
| 2 | 2. EXISTING MECHANICAL AND ELECTRICAL EQUIPMENT, ETC CONTRACTOR IS TO DETERMINE EXACT LOCATIONS OF A | |
| 3 | 3. CONTRACTOR SHALL BE ADVISED THAT EXISTING ABOVE TAKEN WHEN REMOVING CEILINGS IN ORDER TO NOT D. SPECIFICATIONS FOR CABLE BUNDLING AND SUPPORT. | |
| 4 | CONTRACTOR IS TO VERIFY ANY MAJOR DIMENSIONAL DE OBSTRUCTIONS. THESE SHALL BE BROUGHT TO THE OW DRAWINGS INDICATE APPROXIMATE DIMENSIONS AND EXIS DRAWINGS FURNISHED BY THE OWNER. VARIATIONS MAY SUCH VARIATIONS SHALL BE INCLUDED WITHIN THE COM | NER'S REPRESENTATIVE'S ATTE STING CONDITIONS BASED ON EXIST AS TO FIELD CONDITION |
| 5 | 5. ALL SURFACES DISTURBED BY REMOVALS SHALL BE PA FINISHES, COORDINATE AND PREPARE SURFACES TO AC AND MANUFACTURER'S RECOMMENDATIONS. | TCHED/REPAIRED TO MATCH E |
| 6 | 5. CONTRACTOR SHALL FIRE STOP ALL TRADE RELATED PE PARTITIONS AND WALLS AT ALL LOCATIONS WITH APPRO | |
| 7 | 7. ALWAYS WORK IN A MANNER WHICH PROVIDES CONTINU APPROPRIATE LINTEL FOR ALL OPENINGS UNLESS SPEC REQUIRED. | IOUS SUPPORT TO STRUCTURE |
| 8 | 3. COORDINATE REMOVALS WITH NEW WORK. | |
| 9 | 9. ABATEMENT OF HAZARDOUS MATERIAL SHALL BE COORE | DINATED WITH REMOVAL WORK. |
| 1 | 0. IF AT ANY TIME DURING SELECTIVE REMOVAL PROCEDUP MATERIALS, WORK SHALL STOP IMMEDIATELY AND THE O TAKE STEPS TO HAVE AFFECTED WORK AREAS DECONTA ABATEMENT CONTRACTOR. OBTAIN APPROVALS FROM GO ABATEMENT. WORK IN AFFECTED AREAS SHALL RESUME BEEN RENDERED HARMLESS BY LABORATORY ANALYSIS | OWNER SHALL BE NOTIFIED IN MINATED BY A STATE OF CON VERNING AGENCIES PRIOR TO IN THE ABSENCE OF CONTAM |
| 1 | 1. THE OWNER SHALL HAVE FIRST REFUSAL RIGHT TO ALL BE SALVAGED, THE CONTRACTOR SHALL DELIVER TO TH OF ITEMS, THEY BECOME THE PROPERTY OF THE CONT | E OWNER. WHERE THE OWNER |
| 1 | 2. FOR ALL LEAD AND ASBESTOS REMOVAL AND DISPOSAL | REFER TO ABATEMENT DOCUM |
| | GENERAL NOTES | |
| | | |
| IHE | FOLLOWING NOTES SHALL APPLY THROUGHOUT. EXCEPTION | S ARE SPECIFICALLY NOTED O |
| 1. | ALL ELEVATIONS AND DETAILS SHOWN ON THESE DRAWINGS ARE APPROXIMATE AND IS FOR INFORMATION ONLY. DO NOT SCALE | |
| 2. | ANY FIELD CONDITION THAT VARIES FROM A CONDITION SHOWN OF THE ARCHITECT (I.E. DISCREPANCIES, OMISSIONS OR AMBIGU APPROPRIATE CLARIFICATION CAN BE ISSUED DURING THE BID I AMBIGUITIES IN THE CONTRACT DOCUMENTS ARE NOT CLARIFIED WORK SCOPE, USING THE NECESSARY OR BETTER QUALITY MAT PROPOSAL, ALL COSTS FOR SAME. | IITIES) BY THE PROSPECTIVE BIDI PERIOD. IN THE EVENT DISCREPA , THE CONTRACTOR(S) SHALL CC |
| 3. | IT IS CONTRACTOR'S RESPONSIBILITY TO BE FULLY INFORMED C VERIFY ALL EXISTING CONDITIONS; DIMENSIONS ETC. OF THE EX SUIT SUCH CONDITIONS UNLESS OTHERWISE SHOWN. | |
| 4. | THE CONTRACTOR SHALL COORDINATE THE WORK OF ALL OTHER BUT NOT LIMITED TO, PENETRATIONS, FABRICATIONS AND INSTAL PROVISIONS OF THE CONTRACT DOCUMENTS AND APPLICABLE R | LATIONS. THE CONTRACTOR MUST |
| 5. | INDICATED DIMENSIONS ARE TO FACE OF MASONRY, CONCRETE, | FACE OF FINISH OR CENTERLINE |
| 6. | WRITTEN DIMENSIONS SHALL TAKE PRECEDENCE OVER SCALED I | DIMENSIONS. |
| 7. | WHERE REQUIRED, SHOP DRAWINGS SHALL BE SUBMITTED AND FABRICATION OR FIELD WORK IS PERFORMED. | APPROVED BY THE ARCHITECT B |
| 8. | EACH CONTRACTOR SHALL BE FULLY INFORMED OF ALL CODES APPLICABLE STATE DAS - CONNECTICUT SCHOOL CONSTRUCTION CONFLICTS, THE MORE STRINGENT CODE OF STANDARD SHALL | N STANDARDS AND GUIDELINES. I |
| 9. | USE ONLY NEW AND BEST QUALITY MATERIALS AND EQUIPMENT WORKMANSHIP TO CONSTRUCT THE NEW WORK WITHOUT DEFEC | |
| 10. | IN THE EVENT OF A CONFLICT, LARGE SCALE DRAWINGS SHALL OMITTING OTHER PORTIONS OF THE SMALL SCALE DRAWING IN OVER SCHEDULES, PIPING AND WIRING DIAGRAMS WITHOUT OMIT QUESTION. | QUESTION. SIMILARITY, NOTES SH |
| 11. | PERFORM ALL NECESSARY DEMOLITION REQUIRED TO INSTALL N | |

- EXISTING CONDITIONS DISTURBED BY ALL THE WORK, ALL TO MATCH THE EXISTING UNLESS INDICATED OTHERWISE.
- 12. ALL WORK SHALL BE SET STRAIGHT, PLUMP AND LEVEL OR WITH INDICATED SLOPE.
- 13. EACH CONTRACTOR SHALL COLLECT HIS OWN RUBBISH AND CONSTRUCTION DEBRIS EACH DAY, PLACE IT IN APPROPRIATE CONTAINERS AND DISPOSE OF IT IN A LEGAL MANNER.
- 14. ALL OCCUPIED PORTIONS OF SCHOOL BUILDINGS MUST CONTINUE TO OPERATE DURING NORMAL BUSINESS HOURS, AS WELL AS COMPLY WITH THE MINIMUM REQUIREMENTS NECESSARY TO MAINTAIN A CERTIFICATE OF OCCUPANCY. IF ANY CONSTRUCTION OPERATION IS DEEMED TO BE DISRUPTIVE BY THE SCHOOL DISTRICT TO THE NORMAL OPERATION OF THE SCHOOL BUILDING, THEN THE CONTRACTOR SHALL PERFORM THE WORK ON A PREMIUM TIME BASIS DURING OTHER THAN NORMAL BUSINESS HOURS. ALL COSTS ASSOCIATED WITH PREMIUM TIME WORK SHALL BE INCLUDED IN THE CONTRACTOR'S BID PROPOSAL. REFER TO MILESTONE SCHEDULE FOR SECOND SHIFT HOURS.

| | LIST OF DRAWINGS | |
|---|---|--|
| 2015 INTERNATIONAL FIRE CODE 2015 LIFE SAFETY CODE (NFPA 101) with annexes and Tentative Interim Amendment (TIA) 12-2, promulgated by the | T-1 TITLE SHEET G-1 ABBREVIATIONS, LEGENDS, GENERAL NOTES, CODE INFORMATION, MOUNTING HEIGHTS & LIST OF DRAWINGS | ELECTRICAL: |
| National Fire Protection Association. | G-2 PROPOSED SITE LOGISTICS PLAN | E-000 ELECTRICAL COVER SHEET |
| 2018 CONNECTICUT STATE FIRE PREVENTION CODE (SFPC) | <u>ARCHITECTURAL:</u> | E-100 ELECTRICAL FLOOR PLAN - DEMOLITIC |
| The 2018 SFPC adopts the following model codes: 2015 FIRE CODE (NFPA 1) | A10 FIRST FLOOR LOCKER ROOM OVERALL PLAN | E-200 ELECTRICAL FLOOR PLAN - NEW WOR |
| 2. CONDITION: EXISTING BUILDING CLASSIFICATION: ALTERATION LEVEL 2 | AR100 BASE BID – LOCKER ROOM REMOVALS – PARTIAL FIRST FLOOR PLAN | E-300 ELECTRICAL FLOOR PLAN - POWER |
| 3. USE GROUP CLASSIFICATION (303) | A100 BASE BID – LOCKER ROOM MODIFICATIONS – PARTIAL FIRST FLOOR PLAN | E-400 ELECTRICAL FLOOR PLAN - ALTERNATI E-401 ELECTRICAL FLOOR PLAN - ALTERNATI |
| E - EDUCATIONAL GROUP A-4 - ASSEMBLY (SWIMMING POOL) | A101A ALTERNATE 1 – TRAINING ROOM MODIFICATIONS – PARTIAL PLANS A102A ALTERNATE 2 – TEAM ROOM MODIFICATIONS – PARTIAL PLAN A103A ALTERNATE 3 – CORRIDOR MODIFICATIONS – PARTIAL PLANS | E—402 ELECTRICAL FLOOR PLAN — ALTERNATI E—403 ELECTRICAL FLOOR PLAN — ALTERNATI |
| DTES: | A104A ALTERNATE 4 – INSTRUCTORS OFFICE MODIFICATIONS – PARTIAL PLANS | E-500 ELECTRICAL DETAILS |
| | A150 BASE BID – INTERIOR ELEVATIONS | |
| . CONTRACTOR IS REQUIRED TO REMOVE ANY AND ALL | A151A ALTERNATES 1 & 3 - INTERIOR ELEVATIONS | <u>Plumbing:</u> |
| RK. CONTRACTOR IS REQUIRED TO REMOVE, PROTECT | A154 ALTERNATE 4 – INTERIOR ELEVATIONS | |
| TO SUIT ALL NEW WORK, COORDINATE W/ OWNER FOR | A203A ALTERNATE 3 & BASE BID – CORRIDOR MODIFICATIONS – PARTIAL REFLECTED CEILING PLANS | P-000 PLUMBING COVER SHEET |
| | A204A ALTERNATE 4 – INSTRUCTORS OFFICE MODIFICATIONS – PARTIAL REFLECTED CEILING PLANS | P-100 PLUMBING FLOOR PLAN - DEMOLITION |
| C. SHOWN ON DRAWINGS ARE APPROXIMATELY LOCATED. | Reflected ceiling Flans | P-200 PLUMBING FLOOR PLAN |
| | A500 PARTITION TYPES & MISCELLANEOUS DETAILS | |
| CEILING CABLING MAY BE PRESENT. CARE SHALL BE | A502 DETAILS – EPOXY FLOOR JOINTS, TILE AND TRIM A503 DETAILS – CEILINGS, LOCKERS, BASES, BENCHES, ROLLER SHADE | P-300 PLUMBING FLOOR PLAN - ALTERNATE P-301 PLUMBING FLOOR PLAN - ALTERNATE |
| AMAGE EXISTING CABLING TO REMAIN. REFER TO | A504 CASEWORK DETAILS | P-302 PLUMBING FLOOR PLAN - ALTERNATE |
| | | P–303 PLUMBING FLOOR PLAN – ALTERNATE |
| EVIATIONS FROM DRAWINGS OR STRUCTURAL | A700 DOOR SCHEDULE, DOOR FRAME TYPE AND NOTES A725 WINDOW SCHEDULE, WINDOW FRAME TYPE, WINDOW DETAILS, LINTEL SCHEDULE, SIGNAGE | P-400 PLUMBING SCHEDULES |
| NER'S REPRESENTATIVE'S ATTENTION. ALL CONTRACT | A800 PROPOSED – PARTIAL FIRST FLOOR FINISH PLANS, FINISH | P-500 PLUMBING DETAILS |
| STING CONDITIONS BASED ON FIELD SURVEY AND | SCHEDULE, DETAIL & NOTES | |
| EXIST AS TO FIELD CONDITIONS. THE COST FOR ANY | MECHANICAL: | FIRE PROTECTION COVE |
| TCHED/REPAIRED TO MATCH EXISTING ADJACENT | M-000 MECHANICAL COVER SHEET | F-000 FIRE PROTECTION COVER SHEET |
| COMMODATE WITH NEW FINISH ACCORDING TO SPECS | M-100 MECHANICAL FLOOR PLAN - DEMOLITION | F-100 FIRE PROTECTION FLOOR PLAN |
| | M-200 MECHANICAL FLOOR PLAN - DUCTWORK | F—200 FIRE PROTECTION FLOOR PLAN — ALT |
| NETRATIONS - EXISTING OR NEW - THROUGH FLOORS, | | F—201 FIRE PROTECTION FLOOR PLAN — ALT |
| VED MATERIALS AND SYSTEMS. | M—300 MECHANICAL PARTIAL FLOOR PLAN — ALTERNATE 1 M—301 MECHANICAL PARTIAL FLOOR PLAN — ALTERNATE 2 | F-202 FIRE PROTECTION FLOOR PLAN - ALT F-203 FIRE PROTECTION FLOOR PLAN - ALT |
| | M=302 MECHANICAL PARTIAL FLOOR PLAN – ALTERNATE 2 M=302 MECHANICAL PARTIAL FLOOR PLAN – ALTERNATE 3 | . 200 FILE FROTEORION FLOOR FLAIN - ALT |
| JOUS SUPPORT TO STRUCTURE ABOVE. PROVIDE | M-303 MECHANICAL PARTIAL FLOOR PLAN - ALTERNATE 4 | F-300 FIRE PROTECTION DETAILS |
| | M-400 MECHANICAL SCHEDULES | |
| | M-500 MECHANICAL DETAILS | |
| | | |

SHOULD THE CONTRACTOR SUSPECT HAZARDOUS IER SHALL BE NOTIFIED IN WRITING. OWNER SHALL ATED BY A STATE OF CONNECTICUT LICENSED NING AGENCIES PRIOR TO COMMENCEMENT OF THE ABSENCE OF CONTAMINANTS AND WHEN IT HAS WRITTEN AGREEMENT BY OWNER AND CONTRACTOR.

MS TO BE REMOVED. WHERE ITEMS ARE CHOSEN TO WNER. WHERE THE OWNER REFUSES POSSESSION TOR AND SHALL BE DISPOSED OF LEGALLY.

FER TO ABATEMENT DOCUMENTS.

E SPECIFICALLY NOTED ON EACH DRAWING:

PICAL. MASONRY REPAIR WORK AS DEPICTED IS SHOWN CONTRACT DRAWINGS.

THE DRAWINGS SHALL BE BROUGHT TO THE ATTENTION) BY THE PROSPECTIVE BIDDER SO THAT THE DD. IN THE EVENT DISCREPANCIES, OMISSIONS OR E CONTRACTOR(S) SHALL COMPENSATE SAME IN THE . OR METHOD OF WORK AND WILL INCLUDE IN HIS BID

E SCOPE OF THE PROJECT. THE CONTRACTOR SHALL G BUILDING(S) AND SHALL ADAPT THE NEW WORK TO

BCONTRACTORS ENGAGED ON THE PROJECT INCLUDING NS. THE CONTRACTOR MUST COMPLY WITH ALL ENCED STANDARDS.

ROVED BY THE ARCHITECT BEFORE ANY SHOP

ING JURISDICTION OVER ALL THE WORK INCLUDING ALL ANDARDS AND GUIDELINES. IN THE EVENT OF ANY PRECEDENCE.

THE INTENDED PURPOSE, AND THE BEST

PRECEDENCE OVER SMALL SCALE DRAWINGS WITHOUT TION. SIMILARITY, NOTES SHALL TAKE PRECEDENCE OTHER WORK SHOWN OR DESCRIBED THAT ARE NOT IN

NORK PER THE CONTRACT DOCUMENTS AND PROVIDE PROTECTION FOR EXISTING CONSTRUCTION ADJACENT TO THE NEW WORK. THE CONTRACTOR(S) SHALL RESTORE ALL

THE EXISTING CONDITIONS REPRESENTED HEREON ARE BASED ON THE EXISTING DRAWINGS. THEY INCLUDED FOR CONTRACTORS REFERENCE ONLY. ACTUAL LOCATION OF PIPING AND UTILITIES MAY VARY

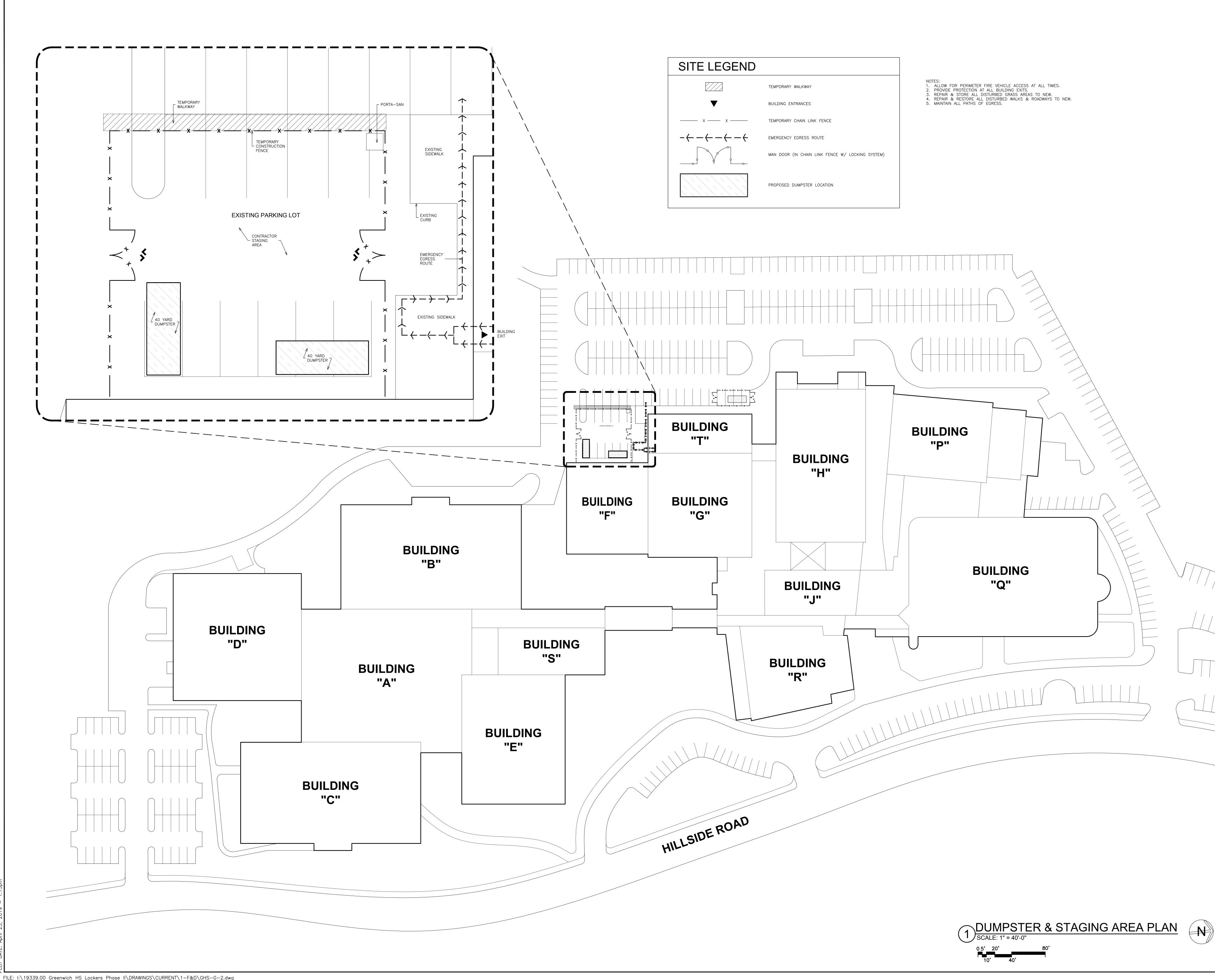
IMPORTANT NOTICE:

CONTRACTOR(S) SHALL VERIFY LOCATIONS IN FIELD AND MAKE ALLOWANCE IN BID FOR LOCATIONS AND ARRANGEMENTS OTHER THAN SHOWN.

F&D CANNOT GUARANTEE THE CORRECTNESS OF THE EXISTING CONDITIONS SHOWN AND ASSUMES RESPONSIBILITY THEREFORE. INCLUSION OF THESE EXISTING CONDITIONS HEREON SHALL IN NO WAY ALL CONTRACTOR(S) OF THEIR RESPONSIBILITY TO VISIT THE SITE TO VERIFY ALL EXISTING CONDITIONS.

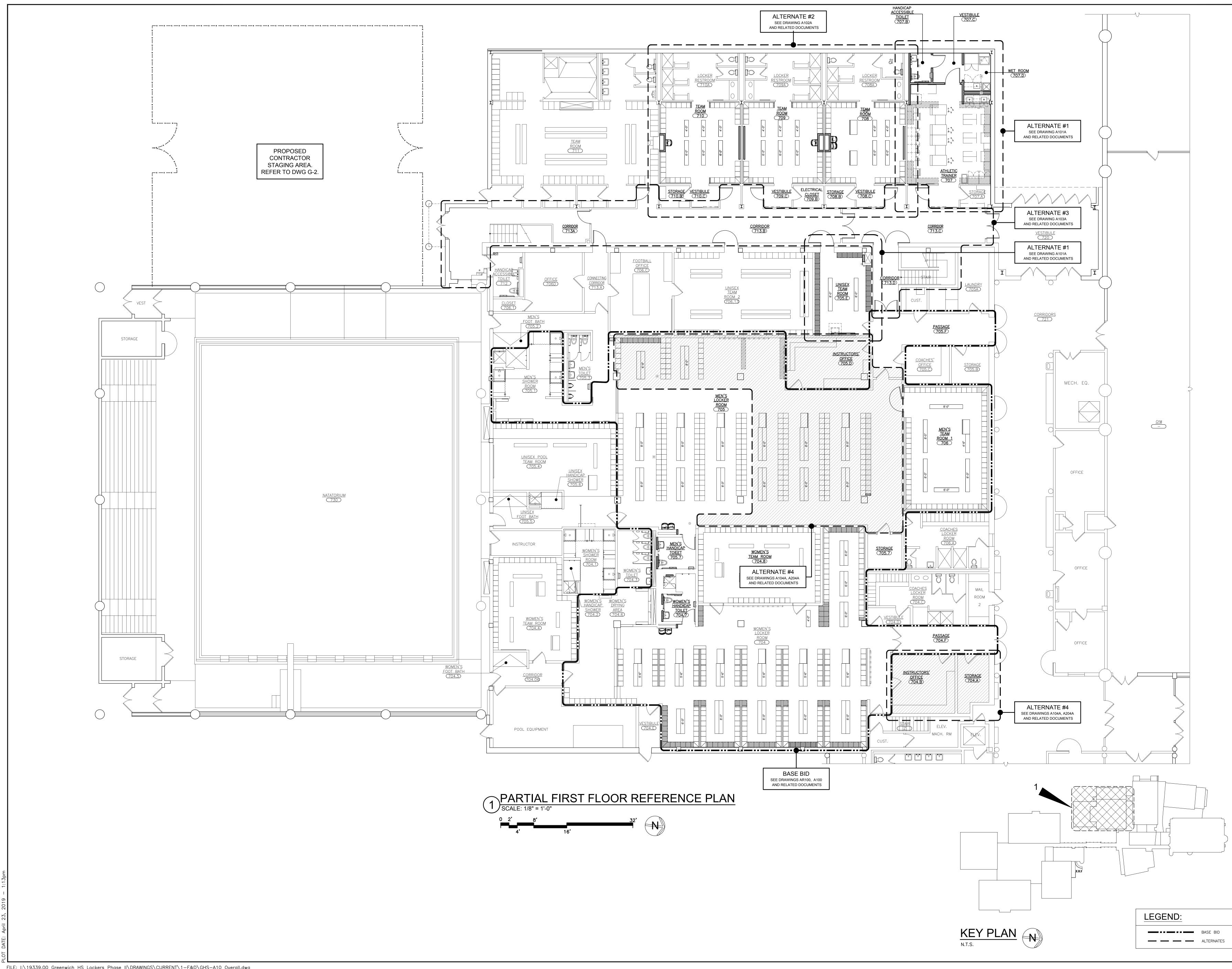
- 15. ALL CONTRACTORS SHALL COMPLY WITH THE FOLLOWING MINIMUM SAFETY AND SECURITY REQUIREMENTS FOR PROJECT; A) ALL MATERIALS SHALL BE STORED IN A SAFE, SECURE AND WEATHER TIGHT ENVIRONMENT; B) SECURITY FENCES AROUND DEBRIS AND CONSTRUCTION WHERE DISPLAYED IN A VISIBLE PLACE ON THEIR
- 16. CONSTRUCTION AREAS WHICH UNDER THE CONTROL OF THE CONTRACTOR AND THEREFORE NOT OCC DISTRICT STAFF OR STUDENTS SHALL BE SEPARATED FROM OCCUPIED AREAS. PROVISIONS SHALL B PREVENT THE PASSAGE OF DUST AND CONTAMINANTS INTO OCCUPIED PARTS OF THE BUILDING. PER INSPECTIONS AND REPAIRS OF THE CONTAINMENT BARRIERS MUST BE MADE TO PREVENT EXPOSUR AND CONTAMINANTS.
- a) A SPECIFIC STAIRWELL AND ENTRANCE SHALL BE PROVIDED FOR CONTRACTORS USE DURING WORK WORKERS MAY NOT USE CORRIDORS, STAIRS OR ELEVATORS DESIGNATED FOR STUDENTS OR SCHOO
- b) REMOVAL OF ALL DEBRIS SHALL BE THROUGH DESIGNATED, SEPARATED AND PROTECTED AREAS OF THERE SHALL BE NO MOVEMENT OF DEBRIS OR EQUIPMENT THROUGH OCCUPIED SPACES OF THE c) ALL OCCUPIED PARTS OF A BUILDING AFFECTED BY CONSTRUCTION ACTIVITY SHALL BE CLEANED AT
- OF EACH WORK DAY.
- 17. CONSTRUCTION AREAS WHICH UNDER THE CONTROL OF THE CONTRACTOR AND THEREFORE NOT OCC DISTRICT STAFF OR STUDENTS SHALL BE SEPARATED FROM OCCUPIED AREAS. PROVISIONS SHALL BE PREVENT THE PASSAGE OF DUST AND CONTAMINANTS INTO OCCUPIED PARTS OF THE BUILDING. PER INSPECTIONS AND REPAIRS OF THE CONTAINMENT BARRIERS MUST BE MADE TO PREVENT EXPOSURE AND CONTAMINANTS.
- a) A SPECIFIC STAIRWELL AND ENTRANCE SHALL BE PROVIDED FOR CONTRACTORS USE DURING WORK WORKERS MAY NOT USE CORRIDORS, STAIRS OR ELEVATORS DESIGNATED FOR STUDENTS OR SCHOO
- b) REMOVAL OF ALL DEBRIS SHALL BE THROUGH DESIGNATED, SEPARATED AND PROTECTED AREAS OF THERE SHALL BE NO MOVEMENT OF DEBRIS OR EQUIPMENT THROUGH OCCUPIED SPACES OF THE
- c) ALL OCCUPIED PARTS OF A BUILDING AFFECTED BY CONSTRUCTION ACTIVITY SHALL BE CLEANED AT OF EACH WORK DAY.
- 2. CONSTRUCTION OPERATIONS SHALL NOT PRODUCE NOISE IN EXCESS OF 60DBA IN OCCUPIED SPACE BE SCHEDULED FOR TIMES WHEN THE AFFECTED BUILDING SPACES ARE NOT OCCUPIED OR ACOUST ABATEMENT MEASURES SHALL BE TAKEN.
- 3. THE CONTRACTOR SHALL BE RESPONSIBLE TO ENSURE THAT ITS ACTIVITIES AND MATERIALS WHICH F "OFF-GASSING" OF VOLATILE ORGANIC COMPOUNDS SUCH AS GLUES, PAINTS, FURNITURE, CARPETING COVERING, DRAPERY, CURED OR VENTILATED IN ACCORDANCE WITH MANUFACTURERS RECOMMENDATION SPACE CAN BE OCCUPIED. PRIOR APPROVAL OF PROTECTIVE MEASURES PLAN BY SCHOOL DISTRICT IS REC PROCEEDING
- 4. ALL NEW WALLS, AND PARTITIONS AS NOTED SHALL BE CARRIED UP AN SECURED TIGHTLY TO ROOF DECK SLAB UNLESS OTHERWISE SPECIFIED. (SEE PARTITION TYPE DRAWING FOR MORE INFO.)
- 5. THE CONTRACTOR SHALL PROVIDE THE NECESSARY LEVELING COMPOUNDS TO EXISTING AND NEW SUBSTRATE SLABS SO THAT NEW FLOOR FINISHES ARE INSTALLED PER THE MANUFACTURER'S REQUIREMENTS.
- 6. ALL PIPING IN FINISHED SPACES TO BE FURRED-OUT WITH METAL STUDS @ 12" O.C. AND 5%" GYPS TYPE 'X' AND FINISHED TO MATCH ADJACENT SURFACES.

| | |] |
|--|---|--|
| EMOLITION EW WORK DWER LTERNATE 1 LTERNATE 2 LTERNATE 3 LTERNATE 4 | AS PER USA CONGRESS ARCHITECTURAL WORKS COPYRIGHT PROTECTION ACT OF 1990 ALL IDEAS AND DESIGNS INCLUDING DERIVATIVES THEREOF, ALL DRAWINGS AND SPECIFICATIONS CONSTITUTE THE ORIGINAL COPYRIGHT WORK BY FULLER AND | D'ANGELO, P.C. (F&D). THE DRAWINGS AND SPECIFICATIONS AS INSTRUMENTS OF SERVICE BY F&D ARE CREATED BY F&D FOR THIS PROJECT ONLY AND REMAIN THE PRODUCT AND PROPERTY OF F&D. ANY REPRODUCTION WITHOUT THE PRIOR CONSENT OF F&D IS PROHIBITED. |
| MOLITION | | |
| ERNATE 1 ERNATE 2 ERNATE 3 ERNATE 4 | | |
| COVER SHEET: T - ALTERNATE 1 - ALTERNATE 2 - ALTERNATE 3 - ALTERNATE 4 | CH PUBLIC SCHOOLS Haveneyer Building 90 Greenwich Avenue | Greenwich, Connecticut 06830-6521 (203) 625-7400 ROAD ELMBFORD NEW YORK 10523 144 FAX 914.592.1717 WW.FULLERDANGELO.GOM II Rights Reserved by FULLER & D'ANGELD P.C. |
| IEY ARE 'ARY IN FIELD. AND | GREENWICH PUL | Greenwich, Connec (203) 65 45 KNOLLWOOD ROAD ELP TEL 914.592.4444 WWW.FULLLERD Copyright 2019 All Rights Reserv |
| MES NO ′ ALLEVIATE THE | U L L E R A N G E L O | P.C. A R C H I T E C T S P L A N N E R S |
| | | |
| S FOR THIS ; B) MAINTAIN EIR PERSON. - OCCUPIED BY -L BE MADE TO - PERIODIC - SURE TO DUST | | |
| ORK HOURS. CHOOL STAFF. OF THE BUILDING. THE BUILDING. D AT THE CLOSE | | |
| OCCUPIED BY LL BE MADE TO PERIODIC SURE TO DUST | TO STATE | CONNEC 1. FULL C |
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| SPACES OR SHALL OUSTICAL | PROJECT TITLE LOCKER ROOM RENOVATIONS - PHASE II GREENWICH HIGH SCHOOL GREENWICH, CT | DRAWING TITLE ABBREVIATIONS, LEGENDS, GENERAL NOTES, CODE INFORMATION, MOUNTING HEIGHTS & LIST OF DRAWINGS |
| ICH RESULT IN PETING, WALL IDATIONS BEFORE S REQUIRED BEFORE | PROJECT TITLE LOCKER ROOM GREENWICH HI GREENWICH, CT | DRAWING TITLE ABBREVIL GENERAL INFORMA HEIGHTS |
| ROOF DECK/FLOOR TRATE CONCRETE | 04-23-2019 DATE SCALE | BID ISSUED TO DRAWING NO. |
| GYPSUM BOARD | AS NOTED DRAWN BY F & D CHECKED BY | G-1 |
| | F & D | 19339.00 |

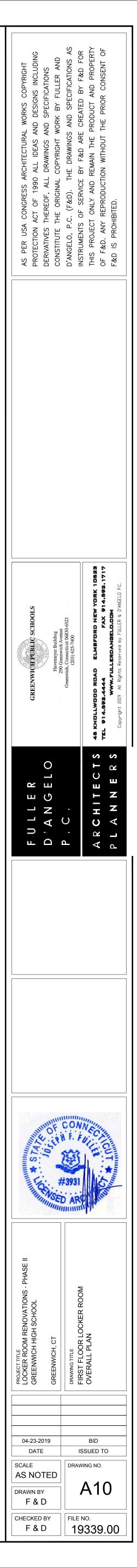


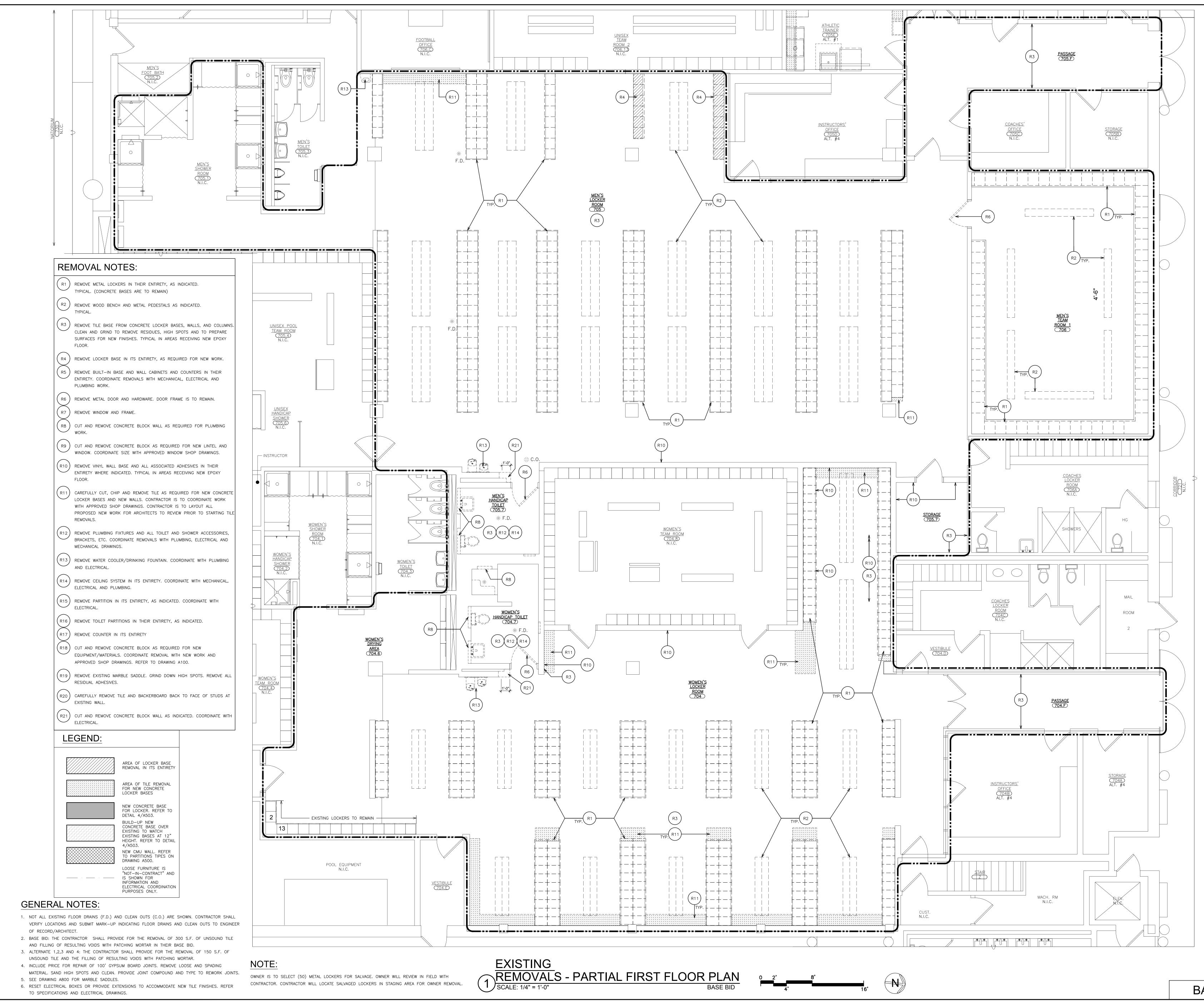
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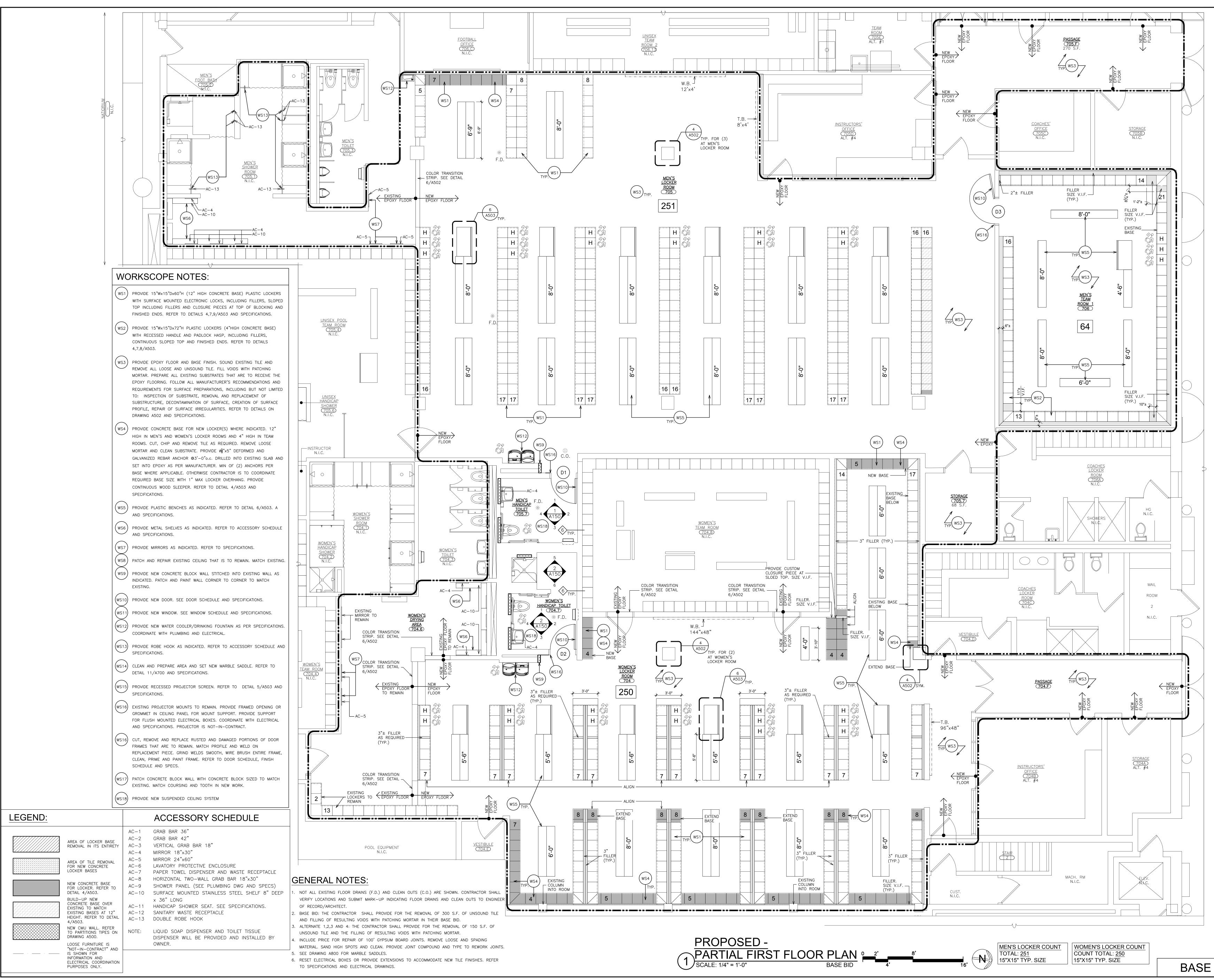




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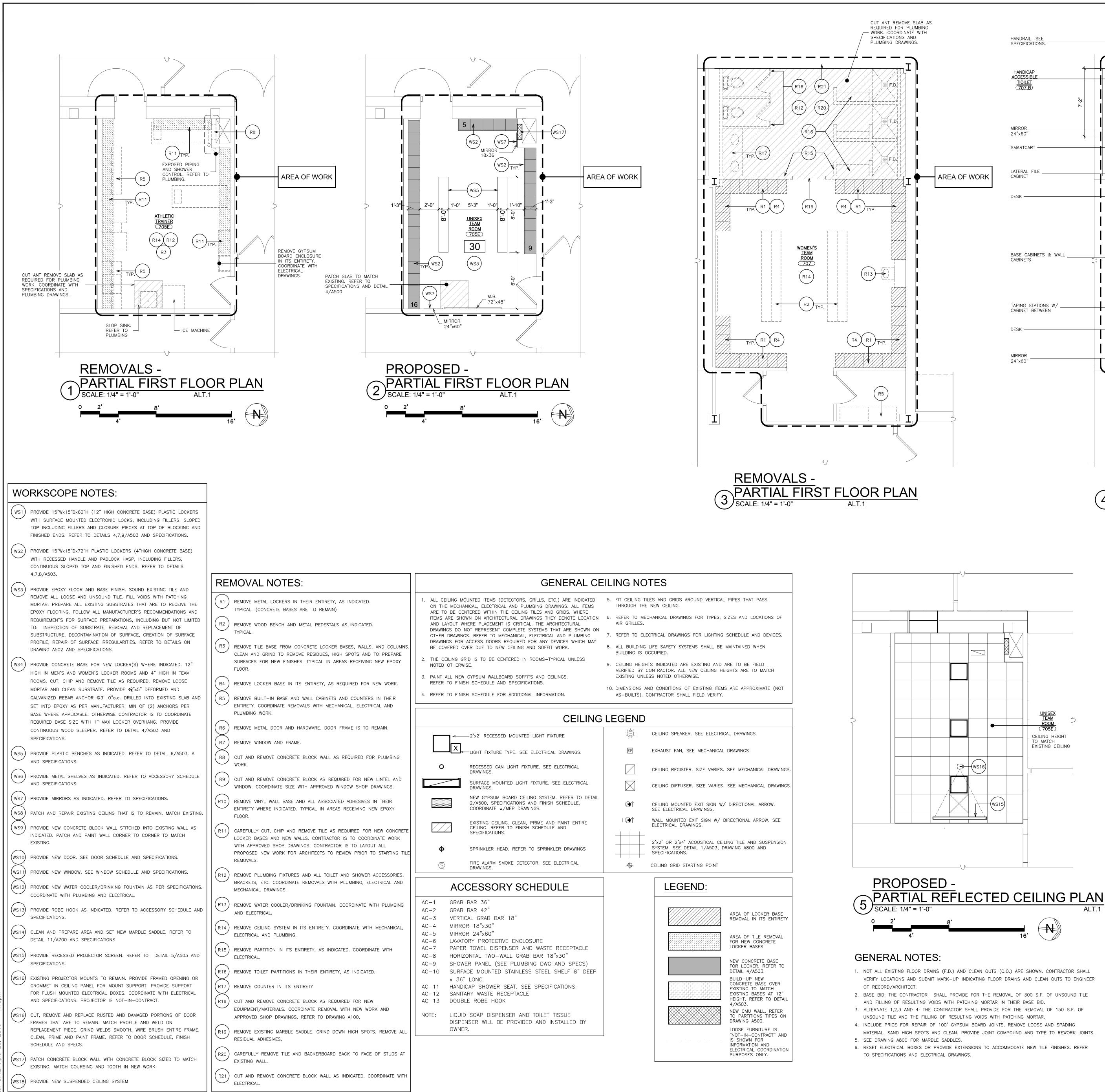


BASE BID

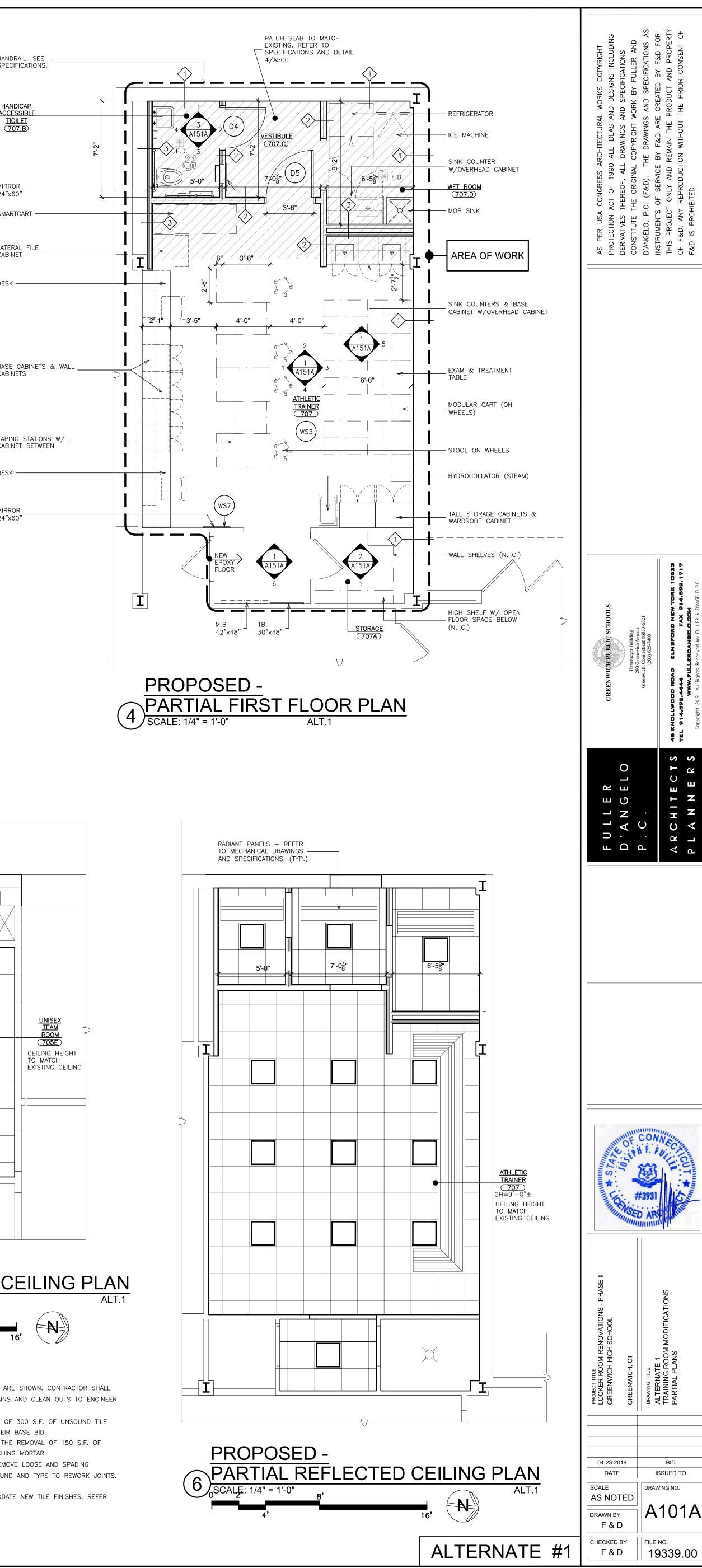


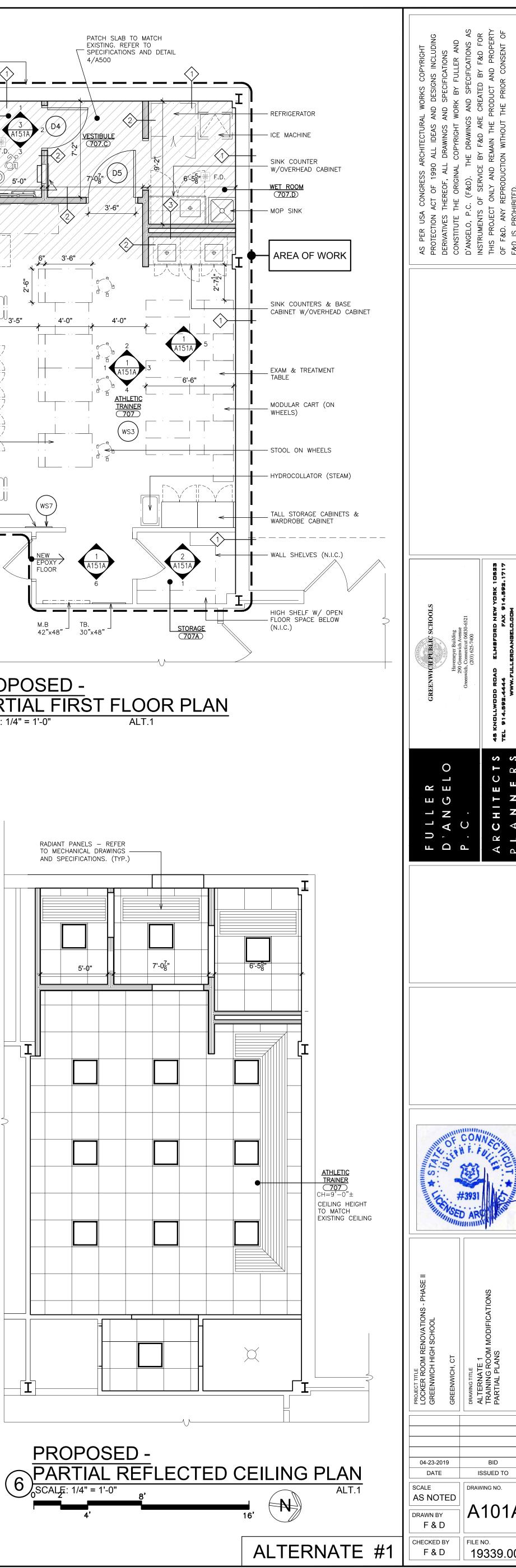
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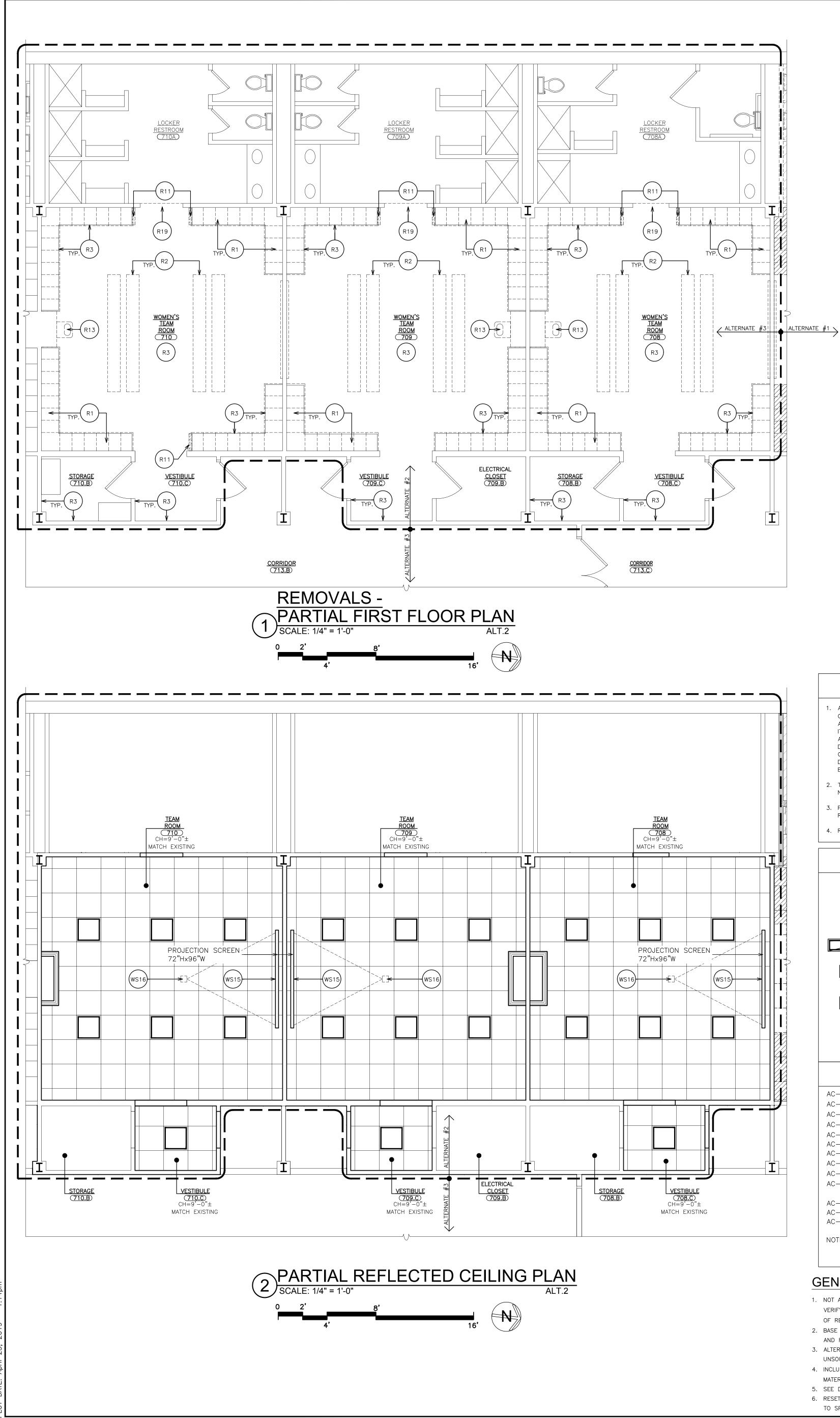
| BID | | | N.I.C. | |
|---|--|--|---|---|
| 04-23-2019BIDDATEISSUED TOSCALEISSUED TOAS NOTEDDRAWING NO.DRAWN BYF & DF & DFILE NO.CHECKED BYF & DF & D19339.00 | PROJECT TITLE LOCKER ROOM RENOVATIONS - PHASE II GREENWICH HIGH SCHOOL GREENWICH, CT DRAWING TITLE BASE BID LOCKER ROOM MODIFICATIONS. PARTIAL FIRST FLOOR PLAN | CONVECTION GOVERNMENT | FULLER GREENWICH PUBLIC SCHOOLS D ' A N G E L O Harenere Building P . C . A R C H I T E C T S A R C H I T E C T S A S Conservich Areaue A R C H I T E C T S A S C MOLLWOOD ROAD ELMEFORD NEW YORK 10533 P L A N N E R S Copyright 2009 ALI Robers & FAX 814.5823.1717 WWW.FULLERDANGELD.COM Copyright 2009 ALI Robers & FAX 814.5823.1717 | AS PER USA CONGRESS ARCHITECTURAL WORKS COPYRIGHT PROTECTION ACT OF 1990 ALL IDEAS AND DESIGNS INCLUDING DERIVATIVES THEREOF, ALL DRAWINGS AND SPECIFICATIONS CONSTITUTE THE ORIGINAL COPYRIGHT WORK BY FULLER AND D'ANGELO, P.C. (F&D). THE DRAWINGS AND SPECIFICATIONS AS INSTRUMENTS OF SERVICE BY F&D ARE CREATED BY F&D FOR THIS PROJECT ONLY AND REMAIN THE PRODUCT AND PROPERTY OF F&D. ANY REPRODUCTION WITHOUT THE PRIOR CONSENT OF F&D IS PROHIBITED. |

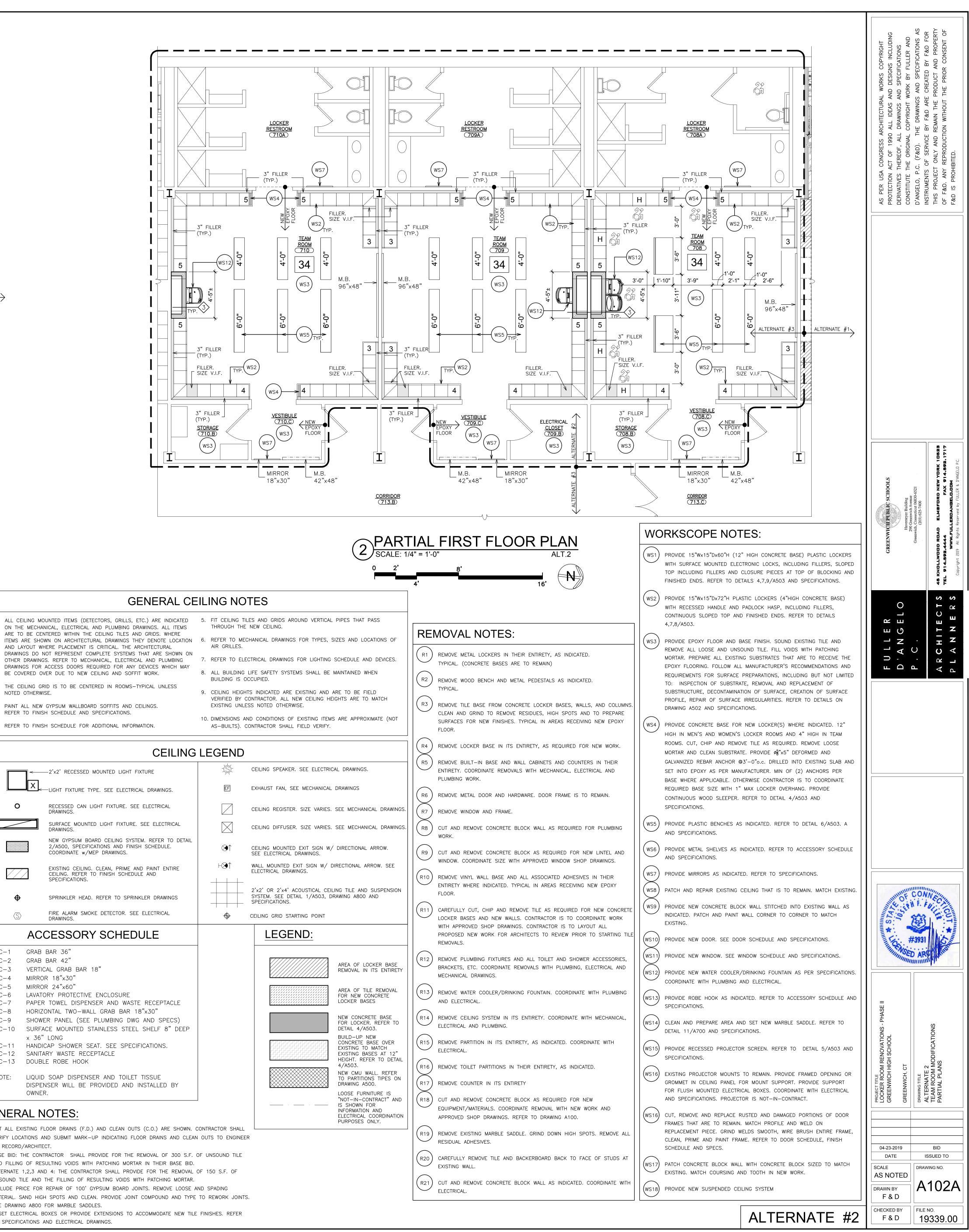


| | ACCESSORY SCHEDULE | LEGEND. | |
|-------|--|---------------------------------------|--|
| AC-1 | GRAB BAR 36" | | |
| AC-2 | GRAB BAR 42" | | AREA OF LOCKER BASE |
| AC-3 | VERTICAL GRAB BAR 18" | | REMOVAL IN ITS ENTIRETY |
| AC-4 | MIRROR 18"x30" | | |
| AC-5 | MIRROR 24"x60" | | AREA OF TILE REMOVAL |
| AC-6 | LAVATORY PROTECTIVE ENCLOSURE | | FOR NEW CONCRETE |
| AC-7 | PAPER TOWEL DISPENSER AND WASTE RECEPTACLE | | LOCKER BASES |
| AC-8 | HORIZONTAL TWO-WALL GRAB BAR 18"x30" | | |
| AC-9 | SHOWER PANEL (SEE PLUMBING DWG AND SPECS) | | NEW CONCRETE BASE FOR LOCKER. REFER TO |
| AC-10 | SURFACE MOUNTED STAINLESS STEEL SHELF 8" DEEP | | DETAIL 4/A503. |
| | x 36"LONG | | BUILD–UP NEW CONCRETE BASE OVER |
| AC-11 | HANDICAP SHOWER SEAT. SEE SPECIFICATIONS. | | EXISTING TO MATCH |
| AC-12 | SANITARY WASTE RECEPTACLE | | EXISTING BASES AT 12" HEIGHT. REFER TO DETAIL |
| AC-13 | DOUBLE ROBE HOOK | | 4/A503. |
| | | | NEW CMU WALL. REFER |
| NOTE: | LIQUID SOAP DISPENSER AND TOILET TISSUE DISPENSER WILL BE PROVIDED AND INSTALLED BY | | TO PARTITIONS TIPES ON DRAWING A500. |
| | OWNER. | | LOOSE FURNITURE IS |
| | Owner. | | "NOT-IN-CONTRACT" AND |
| | | · · · · · · · · · · · · · · · · · · · | IS SHOWN FOR INFORMATION AND |
| | | | ELECTRICAL COORDINATION |









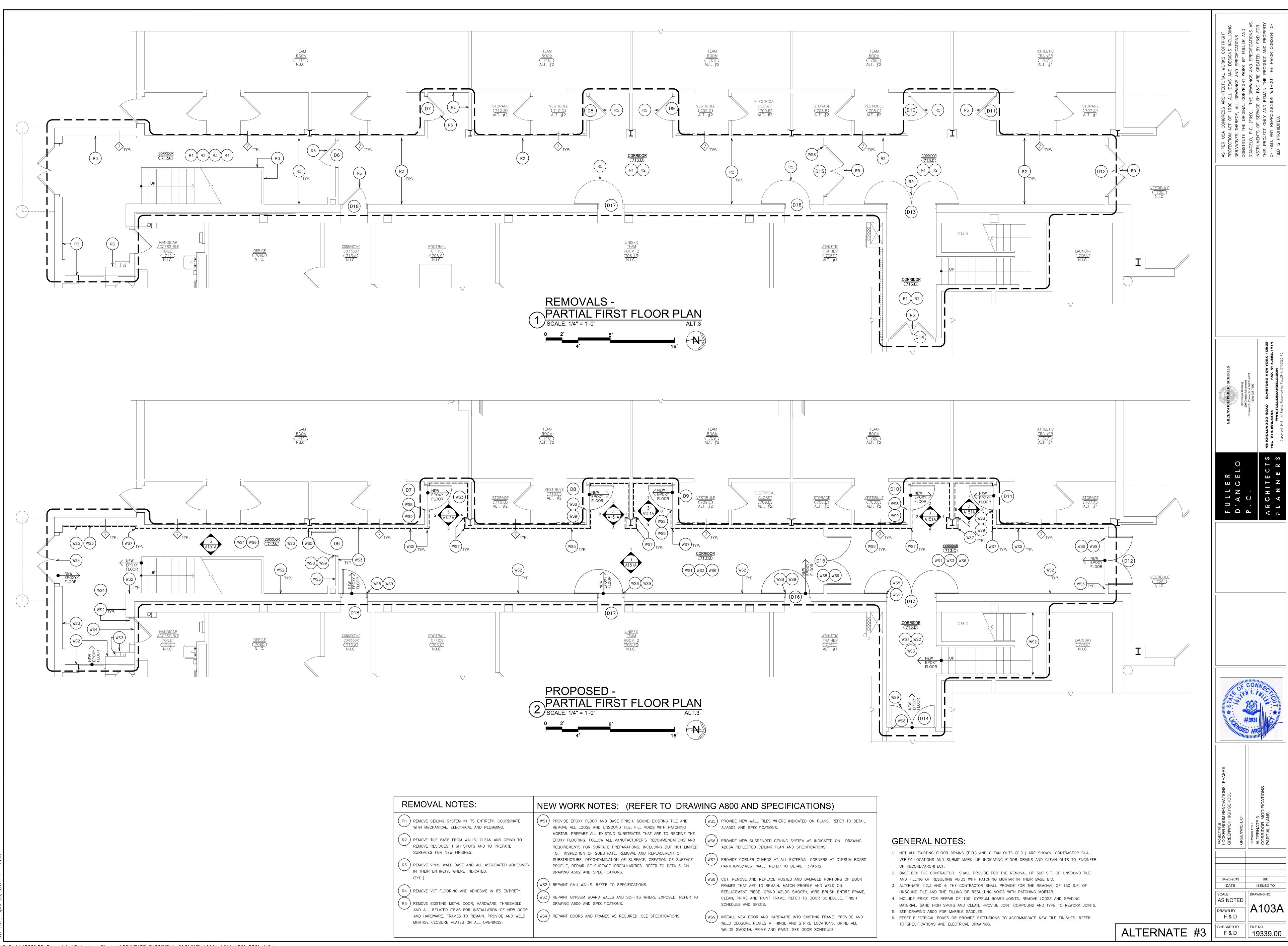
GENERAL CEILING NOTES

- ON THE MECHANICAL, ELECTRICAL AND PLUMBING DRAWINGS. ALL ITEMS ARE TO BE CENTERED WITHIN THE CEILING TILES AND GRIDS. WHERE AND LAYOUT WHERE PLACEMENT IS CRITICAL. THE ARCHITECTURAL DRAWINGS DO NOT REPRESENT COMPLETE SYSTEMS THAT ARE SHOWN ON OTHER DRAWINGS. REFER TO MECHANICAL, ELECTRICAL AND PLUMBING DRAWINGS FOR ACCESS DOORS REQUIRED FOR ANY DEVICES WHICH MAY BE COVERED OVER DUE TO NEW CEILING AND SOFFIT WORK.
- . THE CEILING GRID IS TO BE CENTERED IN ROOMS-TYPICAL UNLESS NOTED OTHERWISE.
- 3. PAINT ALL NEW GYPSUM WALLBOARD SOFFITS AND CEILINGS. REFER TO FINISH SCHEDULE AND SPECIFICATIONS.
- 4. REFER TO FINISH SCHEDULE FOR ADDITIONAL INFORMATION.

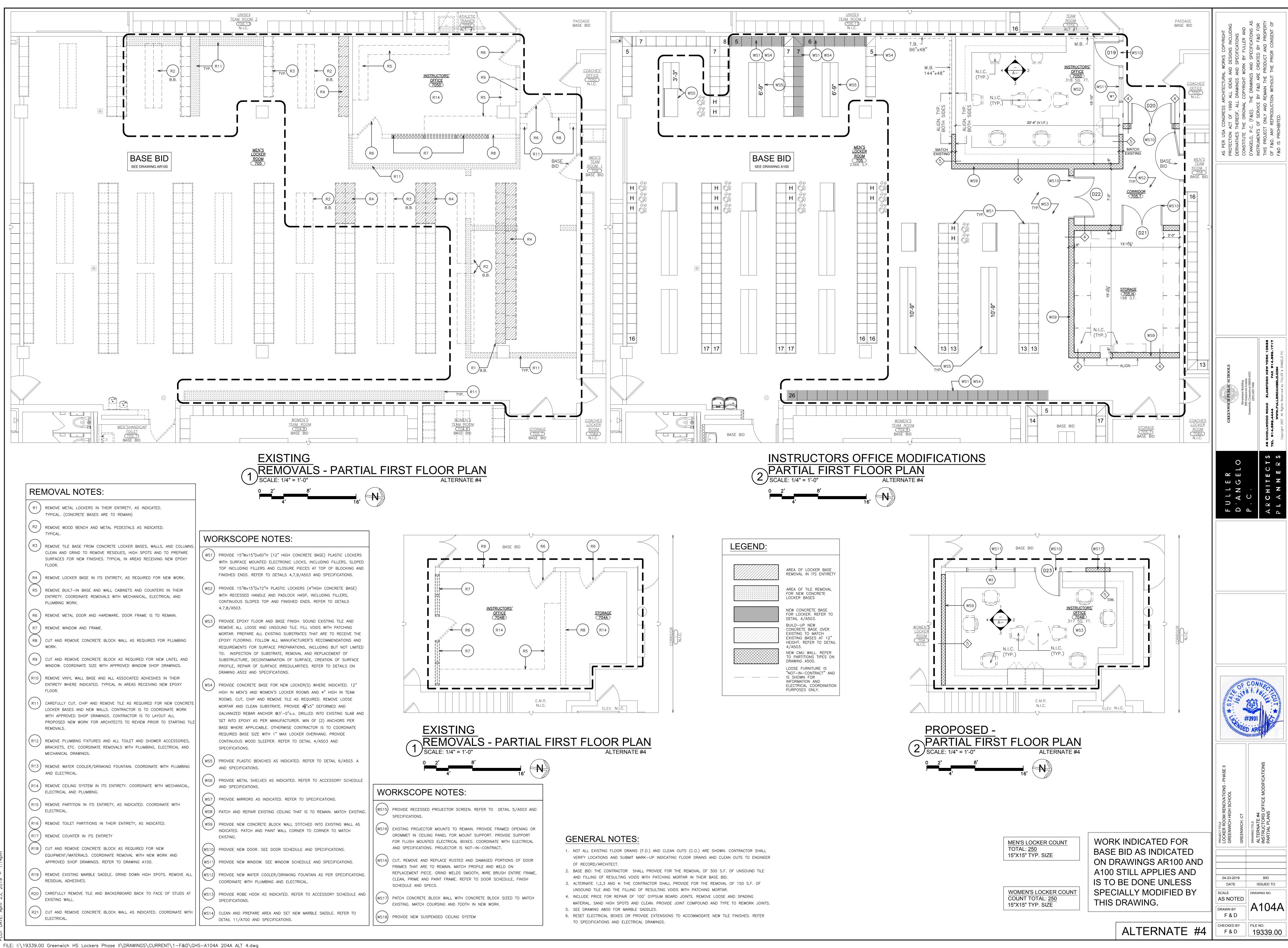
| | CEILING | LEGEND | |
|------------------------------|--|------------|-------------------------------------|
| | 2'x2' RECESSED MOUNTED LIGHT FIXTURE | -Ś. | CEILING SI |
| | LIGHT FIXTURE TYPE. SEE ELECTRICAL DRAWINGS. | EF | EXHAUST I |
| 0 | RECESSED CAN LIGHT FIXTURE. SEE ELECTRICAL DRAWINGS. | | CEILING RI |
| | SURFACE MOUNTED LIGHT FIXTURE. SEE ELECTRICAL DRAWINGS. | | CEILING DI |
| | NEW GYPSUM BOARD CEILING SYSTEM. REFER TO DETAIL 2/A500, SPECIFICATIONS AND FINISH SCHEDULE. COORDINATE w/MEP DRAWINGS. | | CEILING M SEE ELEC |
| | EXISTING CEILING. CLEAN, PRIME AND PAINT ENTIRE CEILING. REFER TO FINISH SCHEDULE AND SPECIFICATIONS. | | WALL MOU ELECTRICA |
| \$ | SPRINKLER HEAD. REFER TO SPRINKLER DRAWINGS | | 2'x2' OR SYSTEM. S SPECIFICAT |
| Ś | FIRE ALARM SMOKE DETECTOR. SEE ELECTRICAL DRAWINGS. | + (| CEILING GF |
| | ACCESSORY SCHEDULE | | LE |
| AC-1 AC-2 AC-3 | GRAB BAR 36" GRAB BAR 42" VERTICAL GRAB BAR 18" | | |
| AC-4 AC-5 AC-6 AC-7 | MIRROR 18"x30" MIRROR 24"x60" LAVATORY PROTECTIVE ENCLOSURE PAPER TOWEL DISPENSER AND WASTE RECEPTACLE | | |
| AC-8 AC-9 AC-10 | HORIZONTAL TWO-WALL GRAB BAR 18"x30" SHOWER PANEL (SEE PLUMBING DWG AND SPECS) SURFACE MOUNTED STAINLESS STEEL SHELF 8" DEEP x 36" LONG | | |
| AC-11 AC-12 AC-13 | HANDICAP SHOWER SEAT. SEE SPECIFICATIONS. SANITARY WASTE RECEPTACLE DOUBLE ROBE HOOK | | |
| NOTE: | LIQUID SOAP DISPENSER AND TOILET TISSUE DISPENSER WILL BE PROVIDED AND INSTALLED BY OWNER. | | |

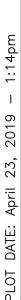
GENERAL NOTES:

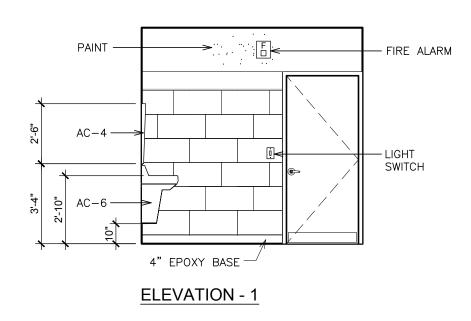
- 1. NOT ALL EXISTING FLOOR DRAINS (F.D.) AND CLEAN OUTS (C.O.) ARE SHOWN. CONTRACTOR SHALL VERIFY LOCATIONS AND SUBMIT MARK-UP INDICATING FLOOR DRAINS AND CLEAN OUTS TO ENGINEER OF RECORD/ARCHITECT.
- 2. BASE BID: THE CONTRACTOR SHALL PROVIDE FOR THE REMOVAL OF 300 S.F. OF UNSOUND TILE
- AND FILLING OF RESULTING VOIDS WITH PATCHING MORTAR IN THEIR BASE BID. 3. ALTERNATE 1,2,3 AND 4: THE CONTRACTOR SHALL PROVIDE FOR THE REMOVAL OF 150 S.F. OF
- UNSOUND TILE AND THE FILLING OF RESULTING VOIDS WITH PATCHING MORTAR. 4. INCLUDE PRICE FOR REPAIR OF 100' GYPSUM BOARD JOINTS. REMOVE LOOSE AND SPADING
- MATERIAL. SAND HIGH SPOTS AND CLEAN. PROVIDE JOINT COMPOUND AND TYPE TO REWORK JOINTS.
- 5. SEE DRAWING A800 FOR MARBLE SADDLES. 6. RESET ELECTRICAL BOXES OR PROVIDE EXTENSIONS TO ACCOMMODATE NEW TILE FINISHES. REFER
- TO SPECIFICATIONS AND ELECTRICAL DRAWINGS.

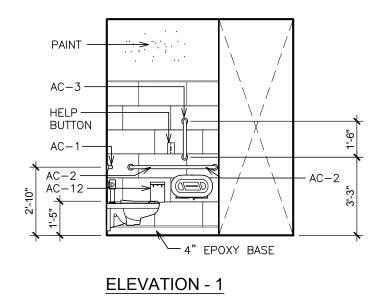


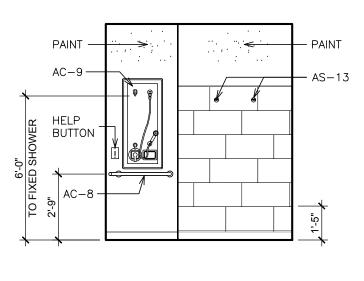
| REMOVAL NOTES: | NEW WORK NOTES: (REFER TO DRAW | ING A800 AND S |
|---|--|--|
| R1 REMOVE CEILING SYSTEM IN ITS ENTIRETY. COORDINATE WITH MECHANICAL, ELECTRICAL AND PLUMBING. R2 REMOVE TILE BASE FROM WALLS. CLEAN AND GRIND TO REMOVE RESIDUES, HIGH SPOTS AND TO PREPARE SURFACES FOR NEW FINISHES. R3 REMOVE VINYL WALL BASE AND ALL ASSOCIATED ADHESIVES IN THEIR ENTIRETY, WHERE INDICATED. (TYP.) R4 REMOVE VCT FLOORING AND ADHESIVE IN ITS ENTIRETY. R5 REMOVE EXISTING METAL DOOR, HARDWARE, THRESHOLD AND ALL RELATED ITEMS FOR INSTALLATION OF NEW DOOR AND HARDWARE. FRAMES TO REMAIN. PROVIDE AND WELD MORTISE CLOSURE PLATES ON ALL OPENINGS. | WS1 PROVIDE EPOXY FLOOR AND BASE FINISH. SOUND EXISTING TILE AND REMOVE ALL LOOSE AND UNSOUND TILE. FILL VOIDS WITH PATCHING MORTAR. PREPARE ALL EXISTING SUBSTRATES THAT ARE TO RECEIVE THE EPOXY FLOORING. FOLLOW ALL MANUFACTURER'S RECOMMENDATIONS AND REQUIREMENTS FOR SURFACE PREPARATIONS, INCLUDING BUT NOT LIMITED TO: INSPECTION OF SUBSTRATE, REMOVAL AND REPLACEMENT OF SUBSTRUCTURE, DECONTAMINATION OF SURFACE, CREATION OF SURFACE PROFILE, REPAIR OF SURFACE IRREGULARITIES. REFER TO DETAILS ON DRAWING A502 AND SPECIFICATIONS. WS2 REPAINT CMU WALLS. REFER TO SPECIFICATIONS. WS3 REPAINT GYPSUM BOARD WALLS AND SOFFITS WHERE EXPOSED. REFER TO DRAWING A800 AND SPECIFICATIONS. WS4 REPAINT DOORS AND FRAMES AS REQUIRED. SEE SPECIFICATIONS. | WS5 PROVIDE NEW WALL T 3/A502 AND SPECIFIC WS6 PROVIDE NEW SUSPEN A203A REFLECTED CE WS7 PROVIDE CORNER GUA PARTITIONS/WEST WALL WS8 CUT, REMOVE AND RE FRAMES THAT ARE TO REPLACEMENT PIECE. CLEAN, PRIME AND PA SCHEDULE AND SPECS WS9 INSTALL NEW DOOR A WELD CLOSURE PLATE WELDS SMOOTH, PRIME |



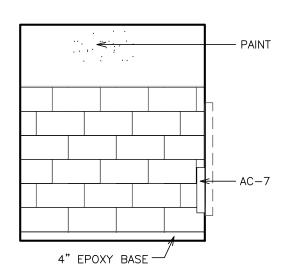




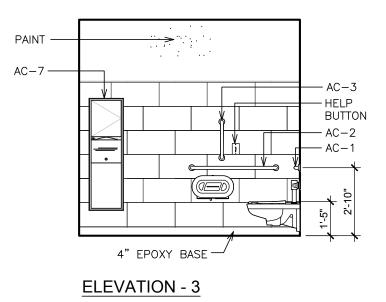


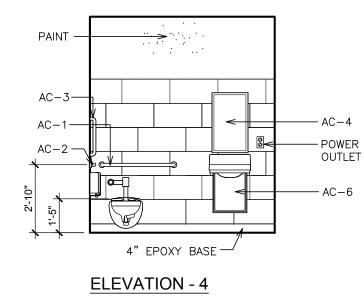


ELEVATION - 5

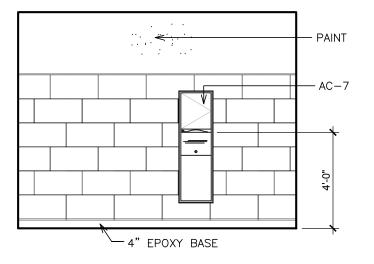


ELEVATION - 2

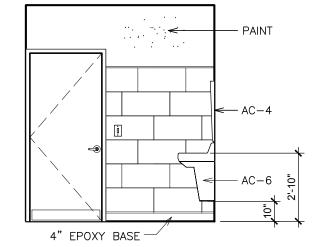




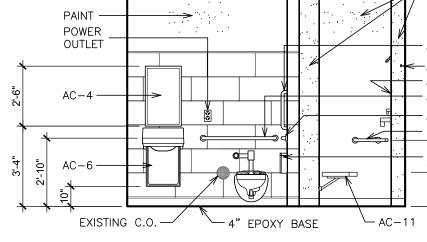






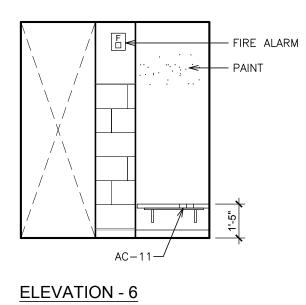






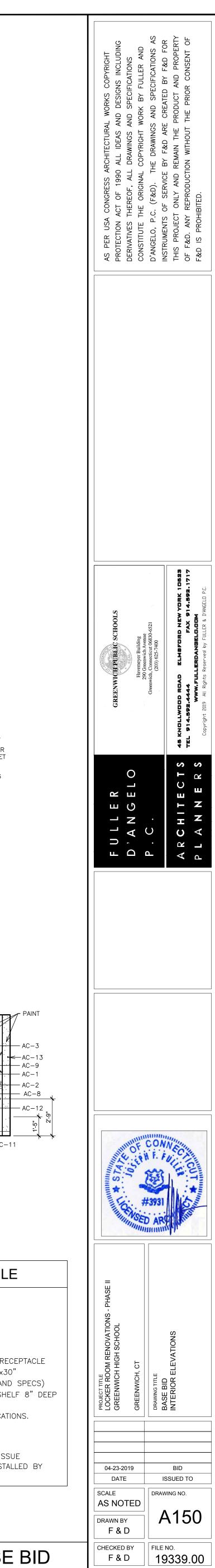
ELEVATION - 4

| | ACCESSORY SCHEDULE |
|-------|--|
| AC-1 | GRAB BAR 36" |
| AC-2 | GRAB BAR 42" |
| AC-3 | VERTICAL GRAB BAR 18" |
| AC-4 | MIRROR 18"×30" |
| AC-5 | MIRROR 24"×60" |
| AC-6 | LAVATORY PROTECTIVE ENCLOSURE |
| AC-7 | PAPER TOWEL DISPENSER AND WASTE RECEP |
| AC-8 | HORIZONTAL TWO-WALL GRAB BAR 18"x30" |
| AC-9 | SHOWER PANEL (SEE PLUMBING DWG AND SE |
| AC-10 | SURFACE MOUNTED STAINLESS STEEL SHELF |
| | x 36"LONG |
| AC-11 | HANDICAP SHOWER SEAT. SEE SPECIFICATIONS |
| AC-12 | SANITARY WASTE RECEPTACLE |
| AC-13 | DOUBLE ROBE HOOK |
| NOTE | |
| NOTE: | LIQUID SOAP DISPENSER AND TOILET TISSUE DISPENSER WILL BE PROVIDED AND INSTALLE |
| | OWNER. |



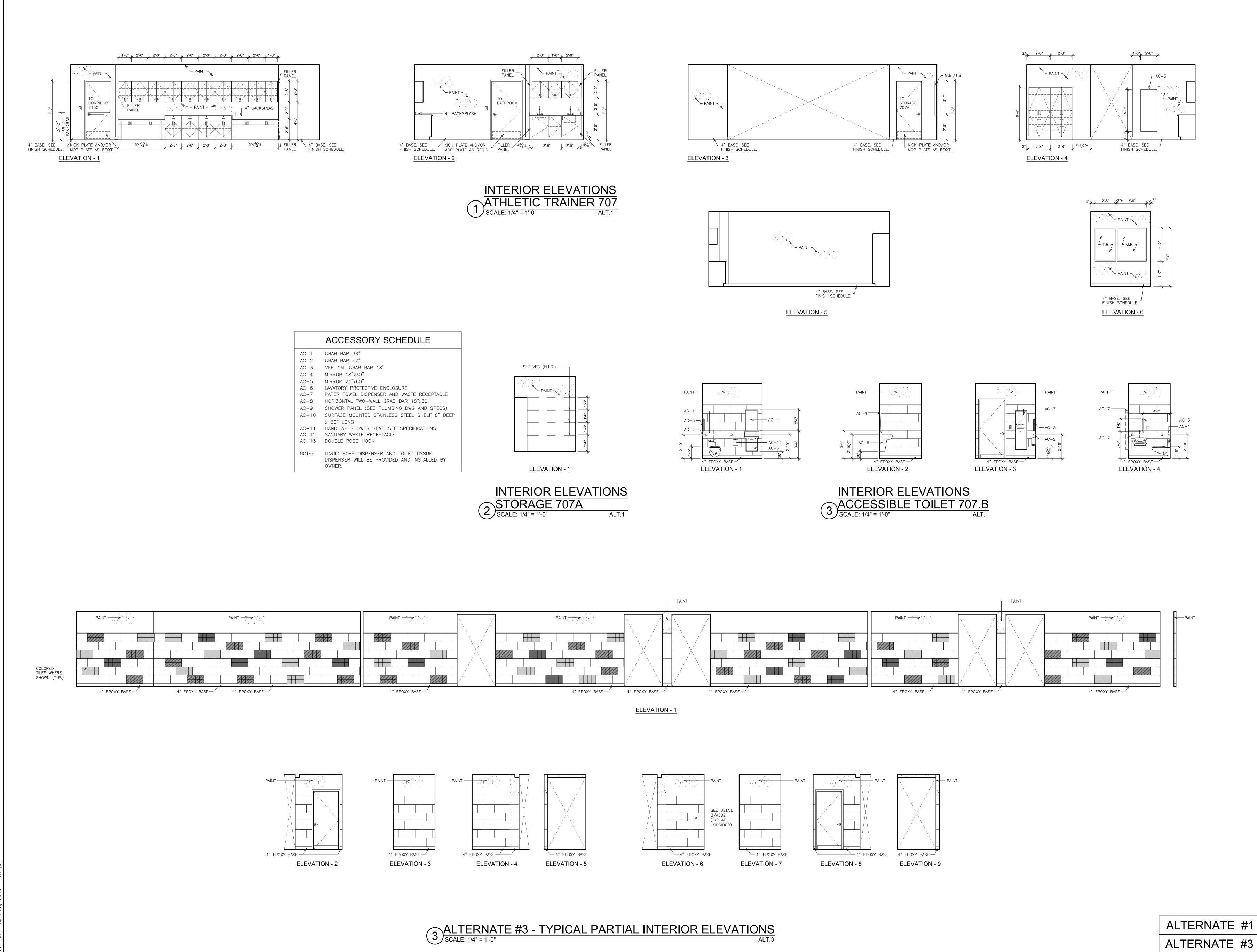
| | | ELEVATIONS |
|------------|---------------------|-----------------------------------|
| \bigcirc | WOMEN'S | HANDICAP TOILET 704.7 BASE BID |
| | SCALE: 1/4" = 1'-0" | BASE BID |





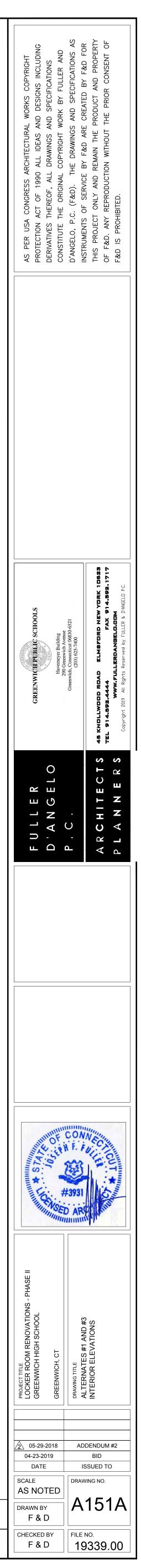
RECEPTACLE "x30" AND SPECS) SHELF 8" DEEP CATIONS.

TISSUE ISTALLED BY



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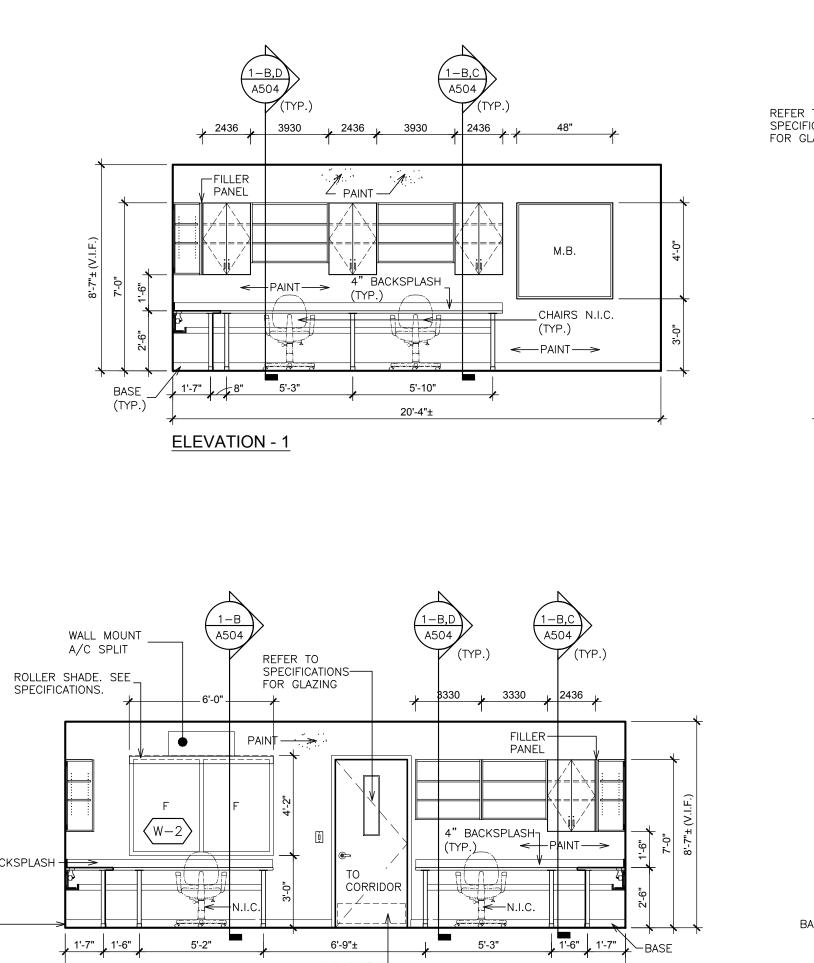


4"BACKSPLASH – (TYP.)

ELEVATION - 1

BASE------

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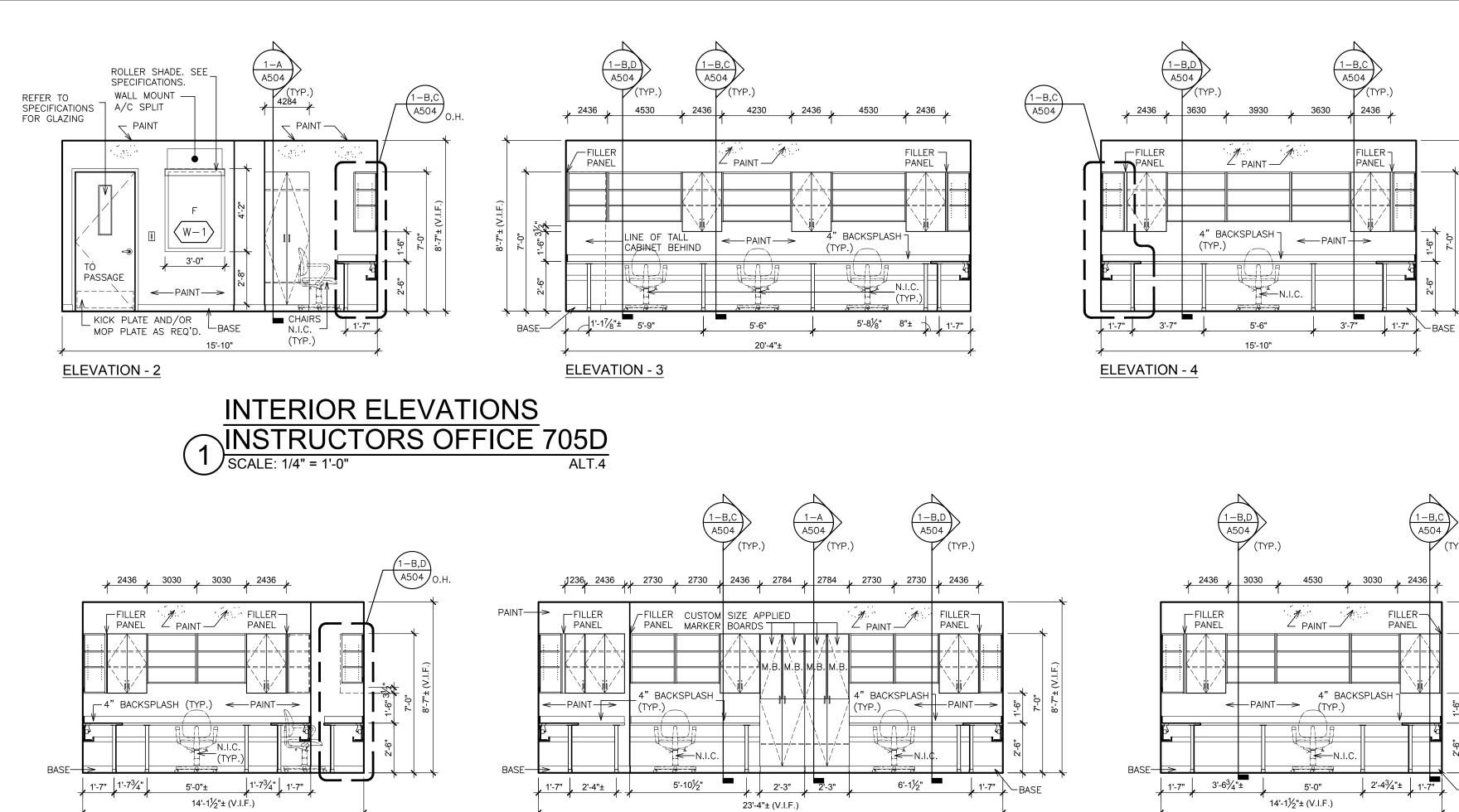


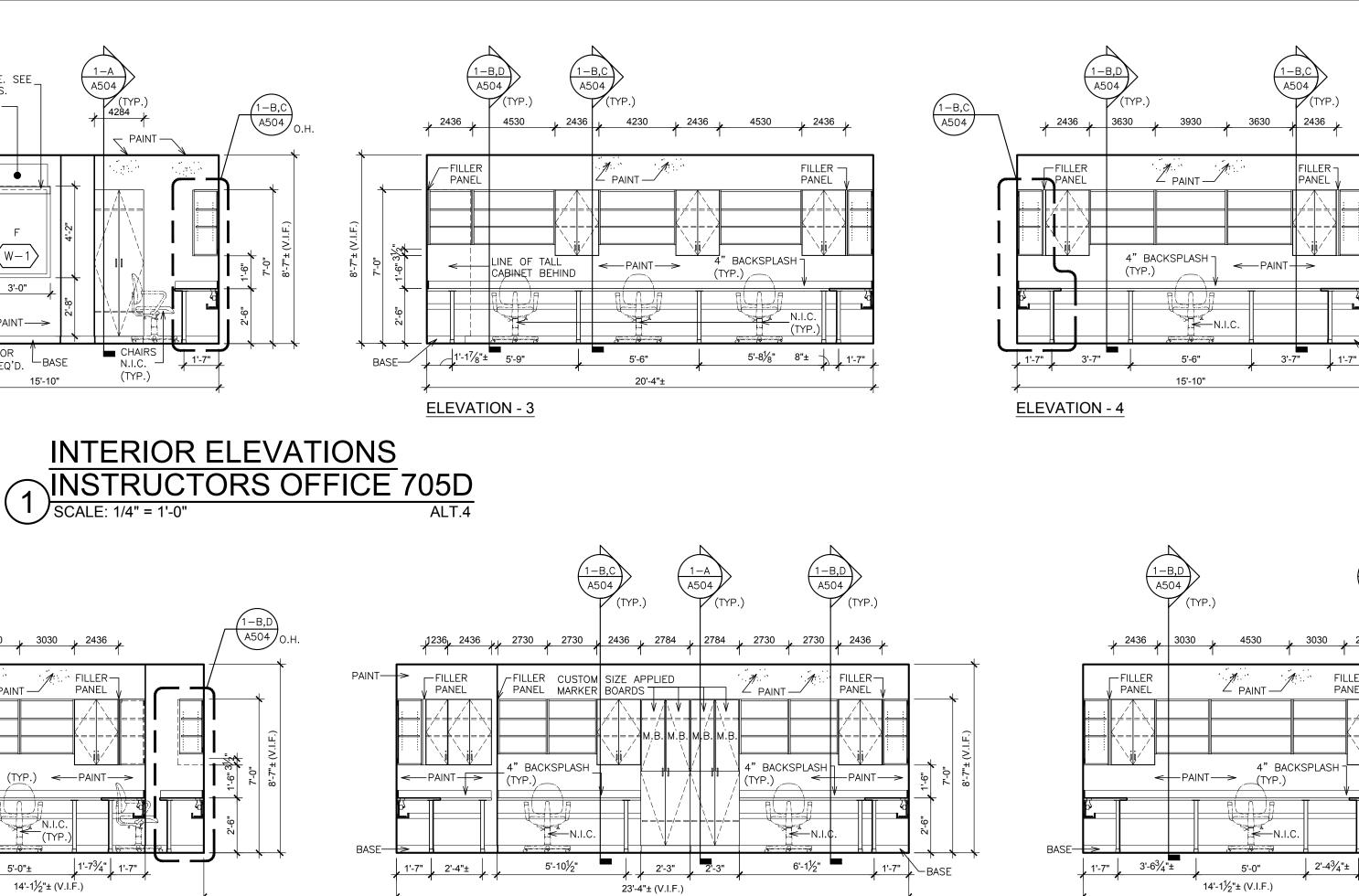
6'-9"±

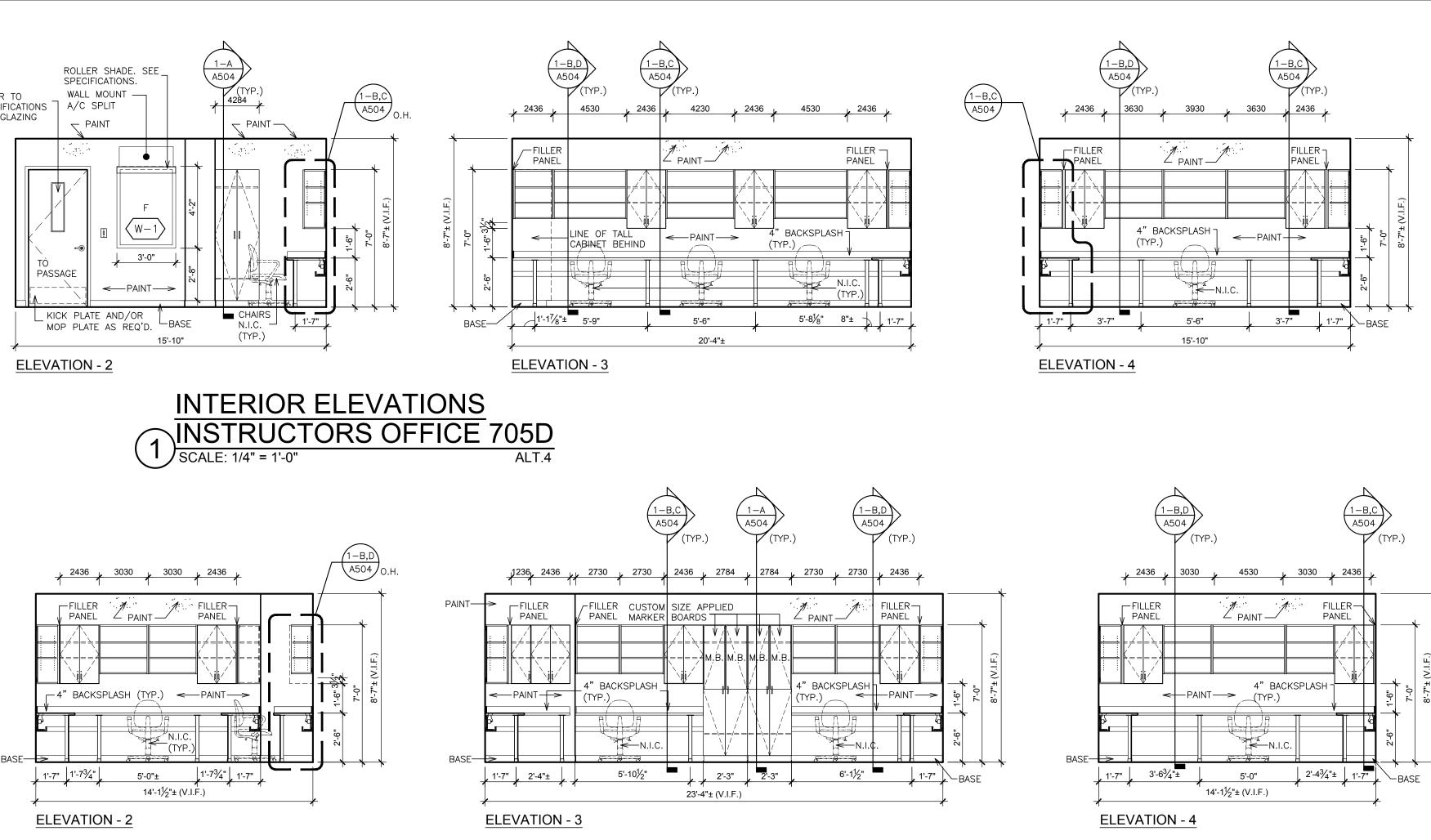
23'-4"± (V.I.F.)

5'-3" 1'-6" 1'-7" -BASE

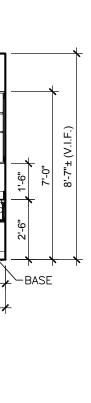
_ KICK PLATE AND/OR MOP PLATE AS REQ'D.

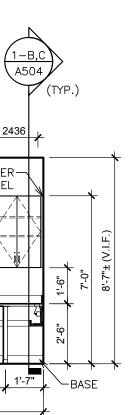


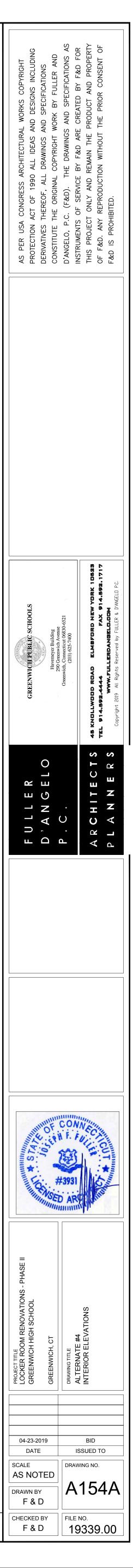


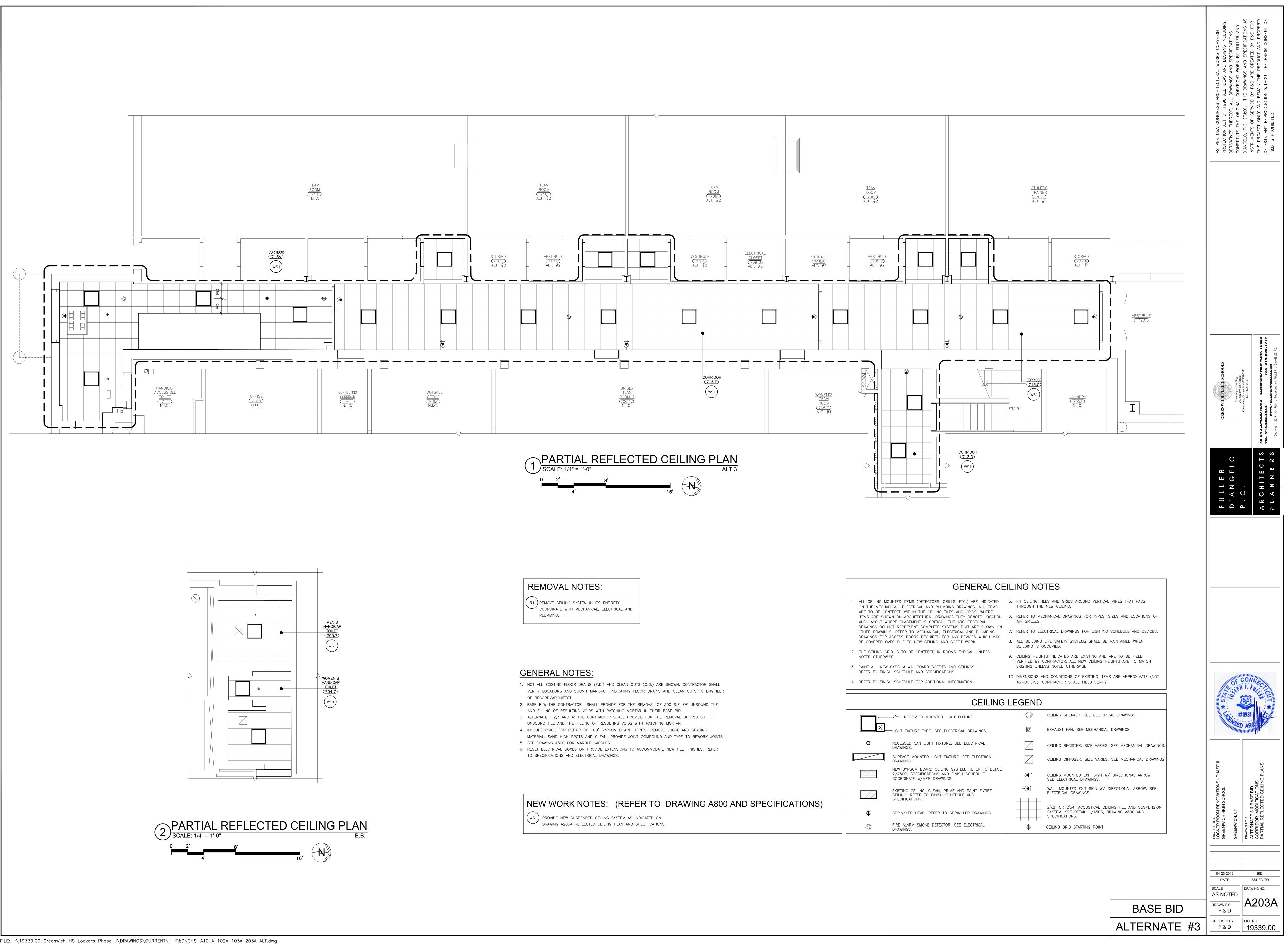


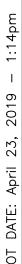


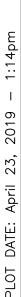












GENERAL CEILING NOTES

THROUGH THE NEW CEILING.

AIR GRILLES.

(S)

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______ SPECIFICATIONS.

.____

. ALL CEILING MOUNTED ITEMS (DETECTORS, GRILLS, ETC.) ARE INDICATED 5. FIT CEILING TILES AND GRIDS AROUND VERTICAL PIPES THAT PASS ON THE MECHANICAL, ELECTRICAL AND PLUMBING DRAWINGS. ALL ITEMS ARE TO BE CENTERED WITHIN THE CEILING TILES AND GRIDS. WHERE ITEMS ARE SHOWN ON ARCHITECTURAL DRAWINGS THEY DENOTE LOCATION 6. REFER TO MECHANICAL DRAWINGS FOR TYPES, SIZES AND LOCATIONS OF AND LAYOUT WHERE PLACEMENT IS CRITICAL. THE ARCHITECTURAL DRAWINGS DO NOT REPRESENT COMPLETE SYSTEMS THAT ARE SHOWN ON OTHER DRAWINGS. REFER TO MECHANICAL, ELECTRICAL AND PLUMBING 7. REFER TO ELECTRICAL DRAWINGS FOR LIGHTING SCHEDULE AND DEVICES. DRAWINGS FOR ACCESS DOORS REQUIRED FOR ANY DEVICES WHICH MAY BE COVERED OVER DUE TO NEW CEILING AND SOFFIT WORK.

- THE CEILING GRID IS TO BE CENTERED IN ROOMS-TYPICAL UNLESS NOTED OTHERWISE.
- 3. PAINT ALL NEW GYPSUM WALLBOARD SOFFITS AND CEILINGS. REFER TO FINISH SCHEDULE AND SPECIFICATIONS.

DRAWINGS.

- 4. REFER TO FINISH SCHEDULE FOR ADDITIONAL INFORMATION.
- 8. ALL BUILDING LIFE SAFETY SYSTEMS SHALL BE MAINTAINED WHEN BUILDING IS OCCUPIED. 9. CEILING HEIGHTS INDICATED ARE EXISTING AND ARE TO BE FIELD VERIFIED BY CONTRACTOR. ALL NEW CEILING HEIGHTS ARE TO MATCH EXISTING UNLESS NOTED OTHERWISE. 10. DIMENSIONS AND CONDITIONS OF EXISTING ITEMS ARE APPROXIMATE (NOT AS-BUILTS). CONTRACTOR SHALL FIELD VERIFY.

CEILING SPEAKER. SEE ELECTRICAL DRAWINGS.

CEILING REGISTER. SIZE VARIES. SEE MECHANICAL DRAWINGS.

CEILING DIFFUSER. SIZE VARIES. SEE MECHANICAL DRAWINGS.

WALL MOUNTED EXIT SIGN W/ DIRECTIONAL ARROW. SEE

2'x2' OR 2'x4' ACOUSTICAL CEILING TILE AND SUSPENSION

SYSTEM. SEE DETAIL 1/A503, DRAWING A800 AND

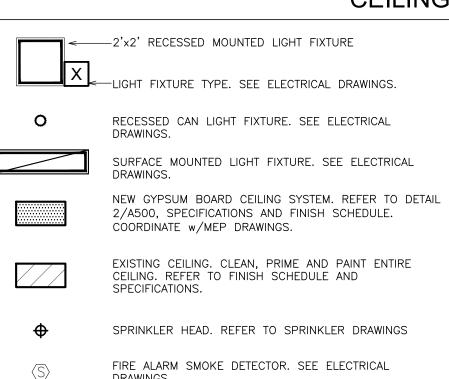
EXHAUST FAN, SEE MECHANICAL DRAWINGS

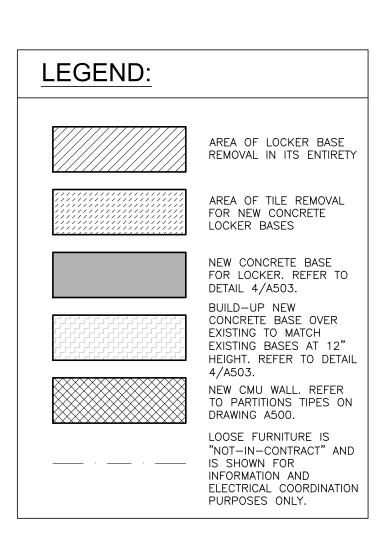
 \bigcirc CEILING MOUNTED EXIT SIGN W/ DIRECTIONAL ARROW. SEE ELECTRICAL DRAWINGS.

ELECTRICAL DRAWINGS.

 \oplus CEILING GRID STARTING POINT

CEILING LEGEND





GENERAL NOTES:

- 1. NOT ALL EXISTING FLOOR DRAINS (F.D.) AND CLEAN OUTS (C.O.) ARE SHOWN. CONTRACTOR SHALL VERIFY LOCATIONS AND SUBMIT MARK-UP INDICATING FLOOR DRAINS AND CLEAN OUTS TO ENGINEER
- OF RECORD/ARCHITECT. 2. BASE BID: THE CONTRACTOR SHALL PROVIDE FOR THE REMOVAL OF 300 S.F. OF UNSOUND TILE AND FILLING OF RESULTING VOIDS WITH PATCHING MORTAR IN THEIR BASE BID.
- 3. ALTERNATE 1,2,3 AND 4: THE CONTRACTOR SHALL PROVIDE FOR THE REMOVAL OF 150 S.F. OF UNSOUND TILE AND THE FILLING OF RESULTING VOIDS WITH PATCHING MORTAR.
- 4. INCLUDE PRICE FOR REPAIR OF 100' GYPSUM BOARD JOINTS. REMOVE LOOSE AND SPADING MATERIAL. SAND HIGH SPOTS AND CLEAN. PROVIDE JOINT COMPOUND AND TYPE TO REWORK JOINTS.
- 5. SEE DRAWING A800 FOR MARBLE SADDLES.
- 6. RESET ELECTRICAL BOXES OR PROVIDE EXTENSIONS TO ACCOMMODATE NEW TILE FINISHES. REFER TO SPECIFICATIONS AND ELECTRICAL DRAWINGS.

| WC | RKSCOPE NOTES: |
|--------|--|
| WS1) | PROVIDE 15"Wx15"Dx60"H (12" HIGH CONCRETE BASE) PLASTIC WITH SURFACE MOUNTED ELECTRONIC LOCKS, INCLUDING FILLER TOP INCLUDING FILLERS AND CLOSURE PIECES AT TOP OF BLO FINISHED ENDS. REFER TO DETAILS 4,7,9/A503 AND SPECIFICAT |
| WS2 | PROVIDE 15"Wx15"Dx72"H PLASTIC LOCKERS (4"HIGH CONCRETE WITH RECESSED HANDLE AND PADLOCK HASP, INCLUDING FILLE CONTINUOUS SLOPED TOP AND FINISHED ENDS. REFER TO DETA 4,7,8/A503. |
| WS3 | PROVIDE EPOXY FLOOR AND BASE FINISH. SOUND EXISTING TILE REMOVE ALL LOOSE AND UNSOUND TILE. FILL VOIDS WITH PATC MORTAR. PREPARE ALL EXISTING SUBSTRATES THAT ARE TO REC EPOXY FLOORING. FOLLOW ALL MANUFACTURER'S RECOMMENDAT REQUIREMENTS FOR SURFACE PREPARATIONS, INCLUDING BUT N TO: INSPECTION OF SUBSTRATE, REMOVAL AND REPLACEMENT SUBSTRUCTURE, DECONTAMINATION OF SURFACE, CREATION OF SU PROFILE, REPAIR OF SURFACE IRREGULARITIES. REFER TO DETAIL DRAWING A502 AND SPECIFICATIONS. |
| WS4 | PROVIDE CONCRETE BASE FOR NEW LOCKER(S) WHERE INDICATE HIGH IN MEN'S AND WOMEN'S LOCKER ROOMS AND 4" HIGH IN ROOMS. CUT, CHIP AND REMOVE TILE AS REQUIRED. REMOVE LE MORTAR AND CLEAN SUBSTRATE. PROVIDE ϕ_8^5 "x5" DEFORMED AN GALVANIZED REBAR ANCHOR $@3'-0$ "o.c. DRILLED INTO EXISTING SET INTO EPOXY AS PER MANUFACTURER. MIN OF (2) ANCHORS BASE WHERE APPLICABLE. OTHERWISE CONTRACTOR IS TO COOR REQUIRED BASE SIZE WITH 1" MAX LOCKER OVERHANG. PROVID CONTINUOUS WOOD SLEEPER. REFER TO DETAIL 4/A503 AND SPECIFICATIONS. |
| WS5 | PROVIDE PLASTIC BENCHES AS INDICATED. REFER TO DETAIL 6/ AND SPECIFICATIONS. |
| WS6 | PROVIDE METAL SHELVES AS INDICATED. REFER TO ACCESSORY AND SPECIFICATIONS. |
| WS7 | PROVIDE MIRRORS AS INDICATED. REFER TO SPECIFICATIONS. |
| WS8 | PATCH AND REPAIR EXISTING CEILING THAT IS TO REMAIN. MATC |
| WS9 | PROVIDE NEW CONCRETE BLOCK WALL STITCHED INTO EXISTING INDICATED. PATCH AND PAINT WALL CORNER TO CORNER TO MA EXISTING. |
| (WS10) | PROVIDE NEW DOOR. SEE DOOR SCHEDULE AND SPECIFICATIONS |
| (WS11) | PROVIDE NEW WINDOW. SEE WINDOW SCHEDULE AND SPECIFICAT |
| WS12 | PROVIDE NEW WATER COOLER/DRINKING FOUNTAIN AS PER SPECOORDINATE WITH PLUMBING AND ELECTRICAL. |
| WS13 | PROVIDE ROBE HOOK AS INDICATED. REFER TO ACCESSORY SCH SPECIFICATIONS. |
| WS14 | CLEAN AND PREPARE AREA AND SET NEW MARBLE SADDLE. READETAIL 11/A700 AND SPECIFICATIONS. |
| WS15 | PROVIDE RECESSED PROJECTOR SCREEN. REFER TO DETAIL 5/ SPECIFICATIONS. |
| WS16 | EXISTING PROJECTOR MOUNTS TO REMAIN. PROVIDE FRAMED OP GROMMET IN CEILING PANEL FOR MOUNT SUPPORT. PROVIDE SU FOR FLUSH MOUNTED ELECTRICAL BOXES. COORDINATE WITH EL AND SPECIFICATIONS. PROJECTOR IS NOT-IN-CONTRACT. |
| (WS16) | CUT, REMOVE AND REPLACE RUSTED AND DAMAGED PORTIONS OF FRAMES THAT ARE TO REMAIN. MATCH PROFILE AND WELD ON REPLACEMENT PIECE. GRIND WELDS SMOOTH, WIRE BRUSH ENTI CLEAN, PRIME AND PAINT FRAME. REFER TO DOOR SCHEDULE, SCHEDULE AND SPECS. |
| WS17 | PATCH CONCRETE BLOCK WALL WITH CONCRETE BLOCK SIZED T |

EXISTING. MATCH COURSING AND TOOTH IN NEW WORK. (WS18) PROVIDE NEW SUSPENDED CEILING SYSTEM

ES:

HIGH CONCRETE BASE) PLASTIC LOCKERS TRONIC LOCKS, INCLUDING FILLERS, SLOPED CLOSURE PIECES AT TOP OF BLOCKING AND TAILS 4,7,9/A503 AND SPECIFICATIONS.

ASTIC LOCKERS (4"HIGH CONCRETE BASE) PADLOCK HASP, INCLUDING FILLERS, FINISHED ENDS. REFER TO DETAILS

ASE FINISH. SOUND EXISTING TILE AND OUND TILE. FILL VOIDS WITH PATCHING SUBSTRATES THAT ARE TO RECEIVE THE MANUFACTURER'S RECOMMENDATIONS AND REPARATIONS, INCLUDING BUT NOT LIMITED , REMOVAL AND REPLACEMENT OF TION OF SURFACE, CREATION OF SURFACE IRREGULARITIES. REFER TO DETAILS ON IONS.

NEW LOCKER(S) WHERE INDICATED. 12" LOCKER ROOMS AND 4" HIGH IN TEAM E TILE AS REQUIRED. REMOVE LOOSE . PROVIDE Ø⁵3"x5" DEFORMED AND 5'-0"o.c. DRILLED INTO EXISTING SLAB AND FACTURER. MIN OF (2) ANCHORS PER ERWISE CONTRACTOR IS TO COORDINATE MAX LOCKER OVERHANG. PROVIDE

INDICATED. REFER TO DETAIL 6/A503. A

DICATED. REFER TO ACCESSORY SCHEDULE

EILING THAT IS TO REMAIN. MATCH EXISTING.

WALL STITCHED INTO EXISTING WALL AS WALL CORNER TO CORNER TO MATCH

SCHEDULE AND SPECIFICATIONS.

NDOW SCHEDULE AND SPECIFICATIONS. DRINKING FOUNTAIN AS PER SPECIFICATIONS. AND ELECTRICAL.

ATED. REFER TO ACCESSORY SCHEDULE AND

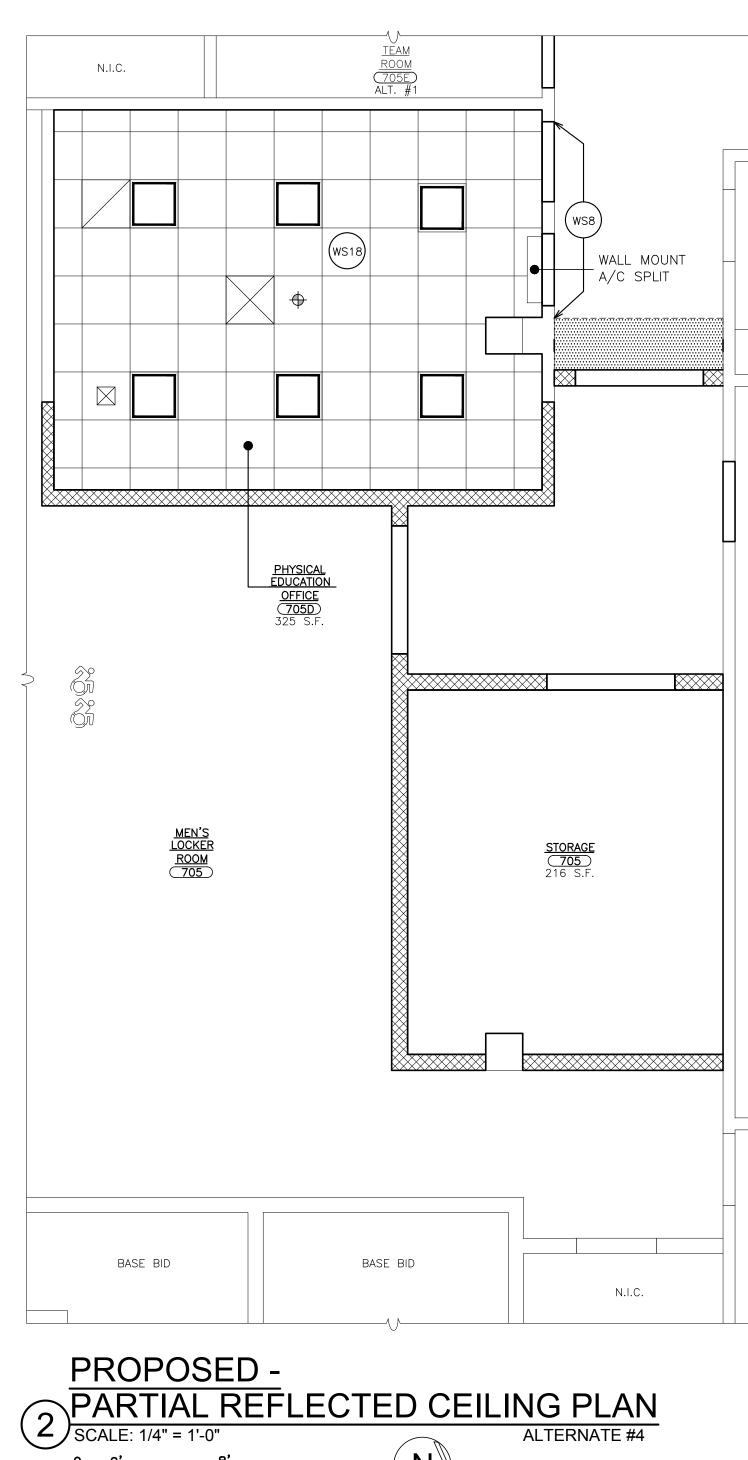
) SET NEW MARBLE SADDLE. REFER TO ATIONS.

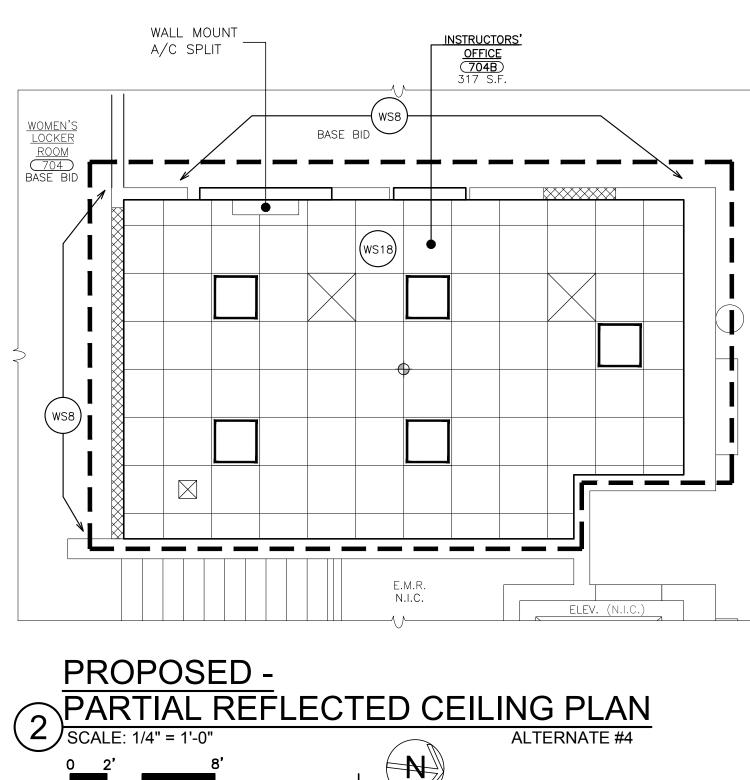
SCREEN. REFER TO DETAIL 5/A503 AND

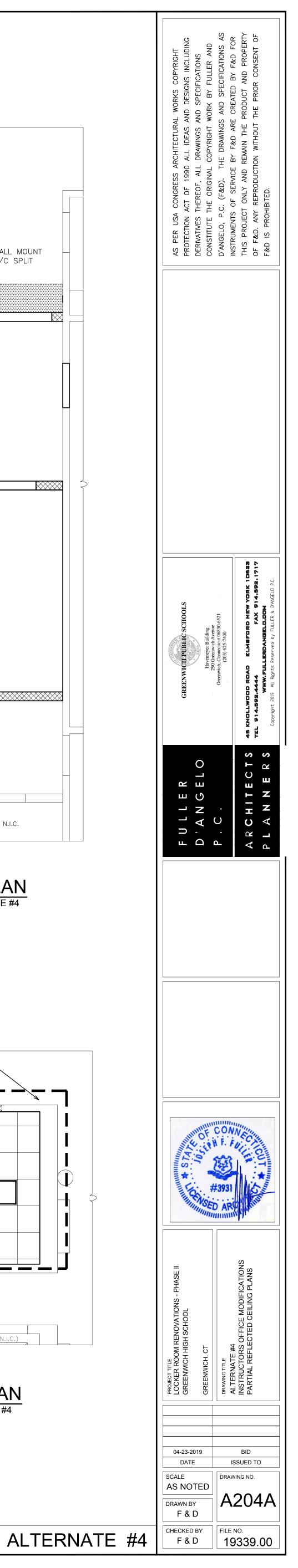
TO REMAIN. PROVIDE FRAMED OPENING OR FOR MOUNT SUPPORT. PROVIDE SUPPORT ICAL BOXES. COORDINATE WITH ELECTRICAL TOR IS NOT-IN-CONTRACT.

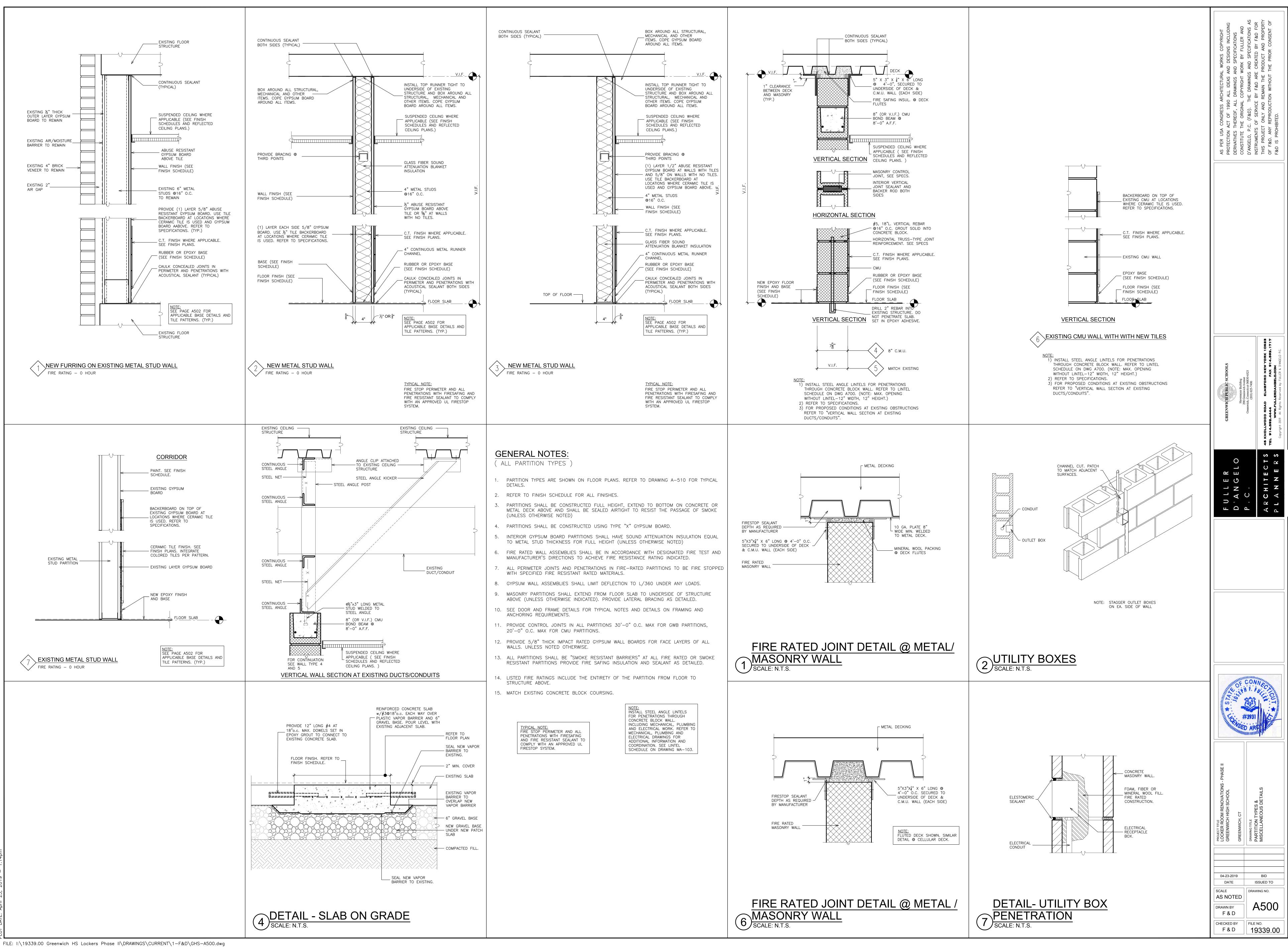
USTED AND DAMAGED PORTIONS OF DOOR MATCH PROFILE AND WELD ON ELDS SMOOTH, WIRE BRUSH ENTIRE FRAME, E. REFER TO DOOR SCHEDULE, FINISH

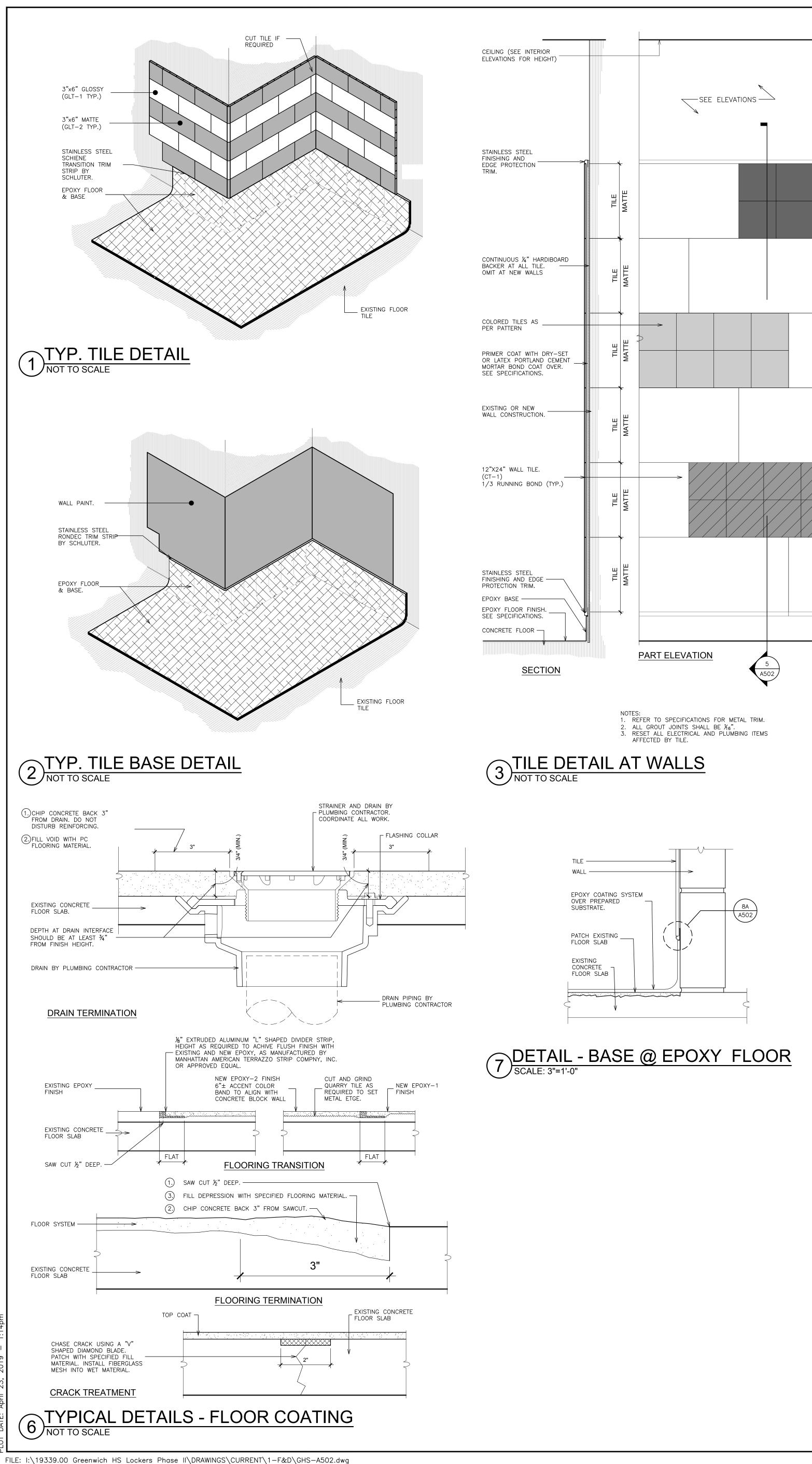
WITH CONCRETE BLOCK SIZED TO MATCH



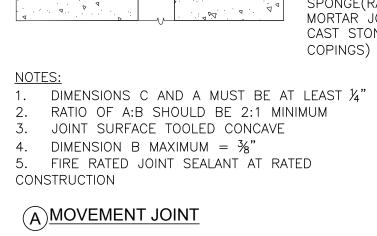


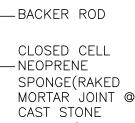






12 DETAIL - TYPICAL SEALANT JOINTS NOT TO SCALE

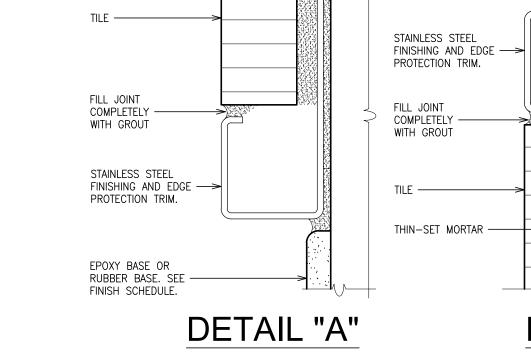




SEALANT

DETAIL "B"

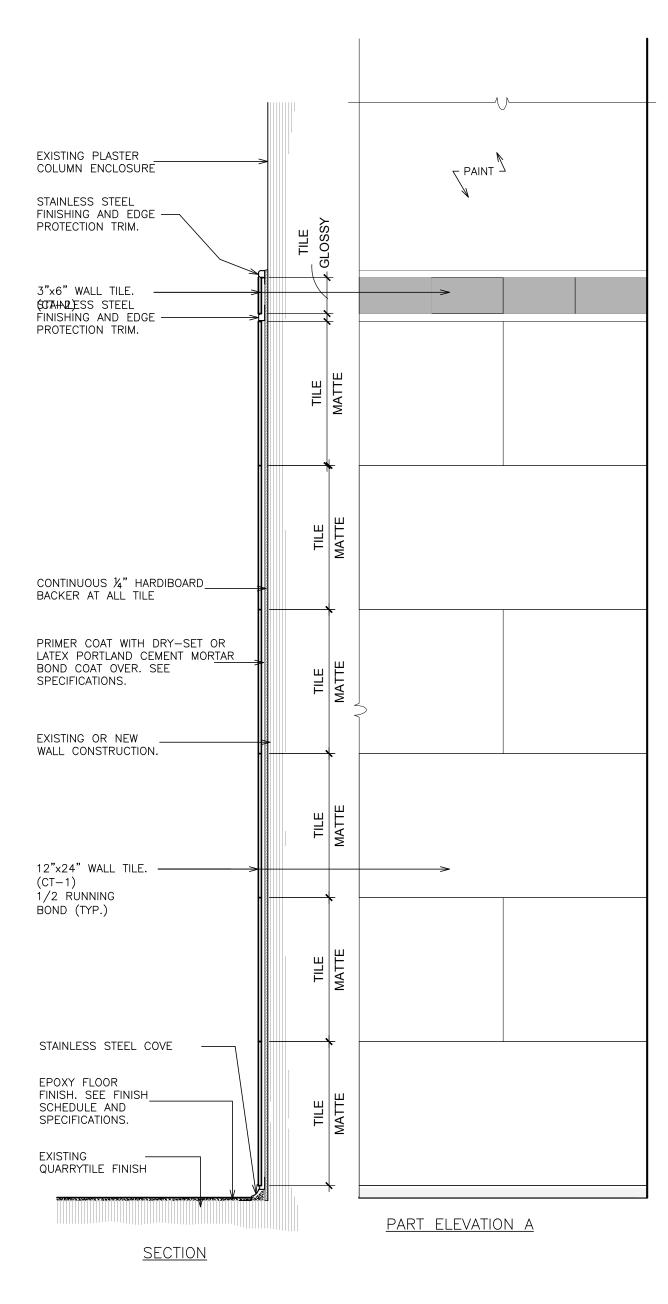
8 WAINSCOT TILE TRIM

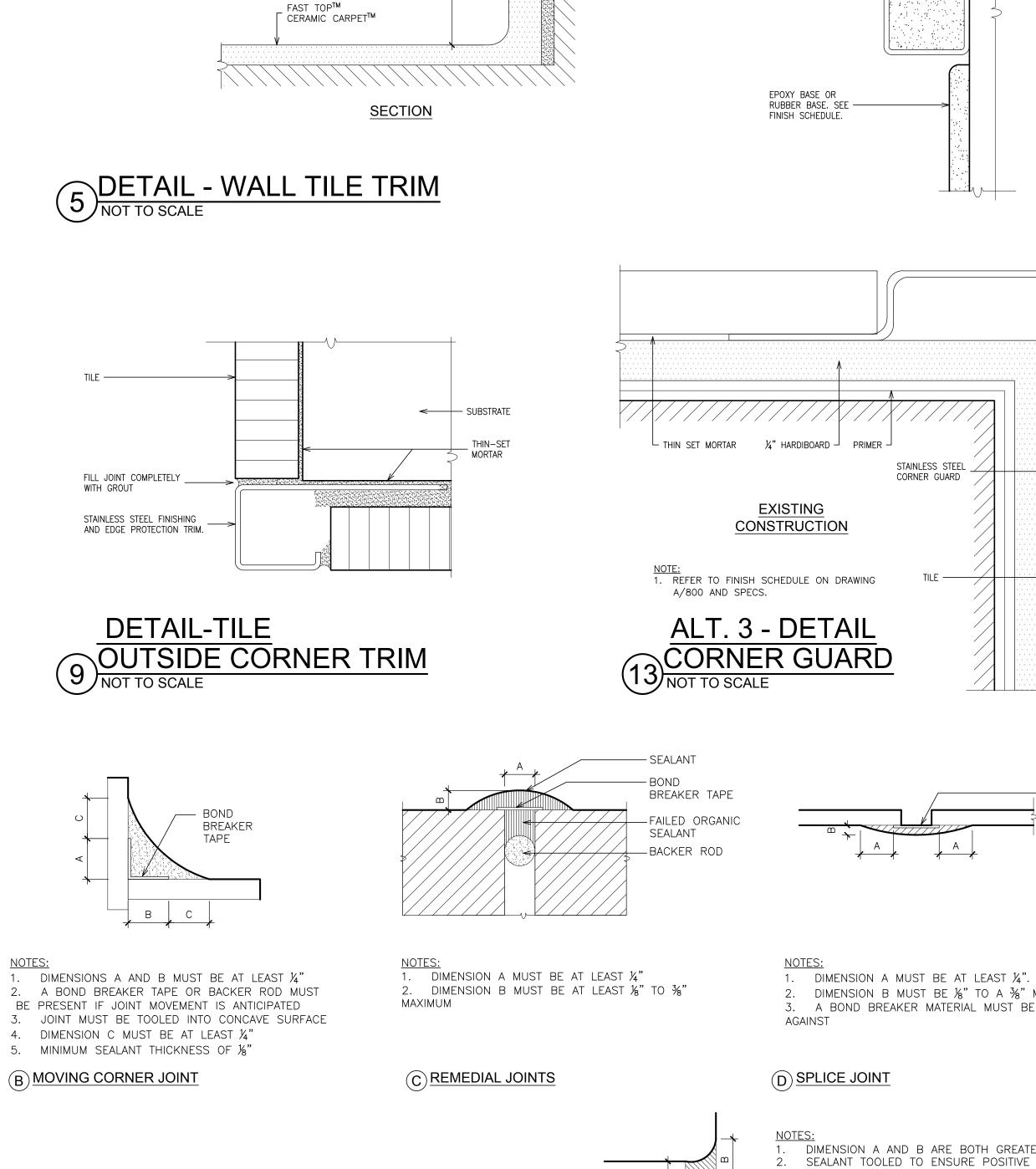


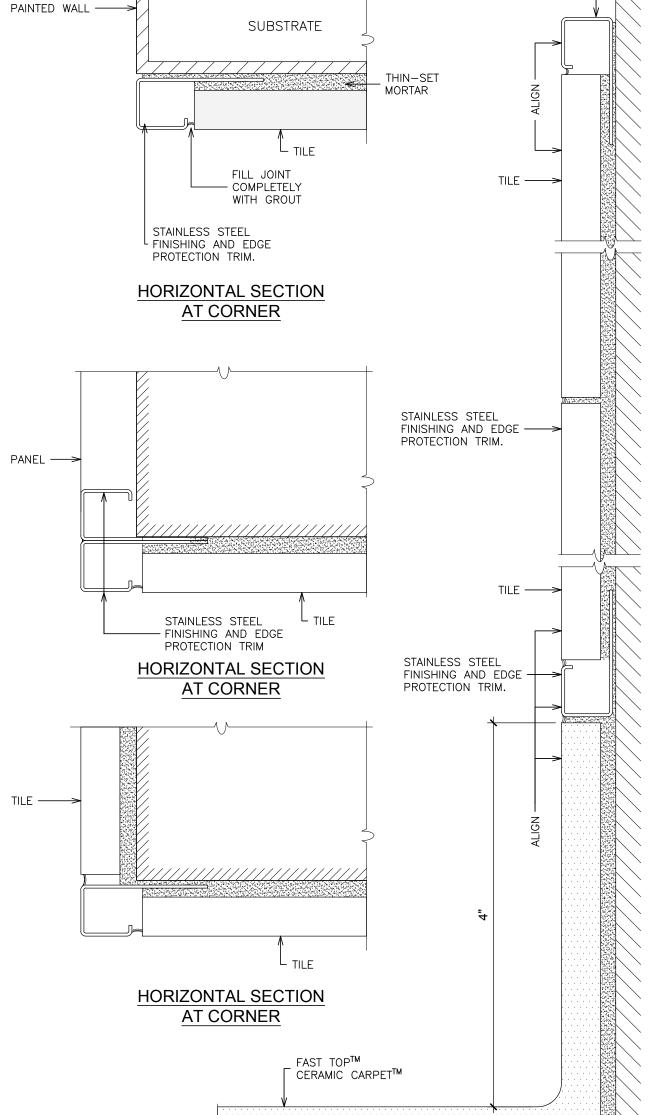
DETAIL -

THIN-SET MORTAR — LINE OF WALL -STAINLESS STEEL

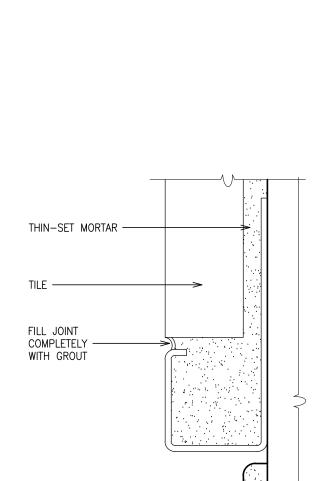
NOTES:
1. REFER TO SPECIFICATIONS FOR METAL TRIM.
2. ALL GROUT JOINTS SHALL BE ¼6".
3. RESET ALL ELECTRICAL AND PLUMBING ITEMS AFFECTED BY TILE. 4 TILE DETAIL AT COLUMNS NOT TO SCALE

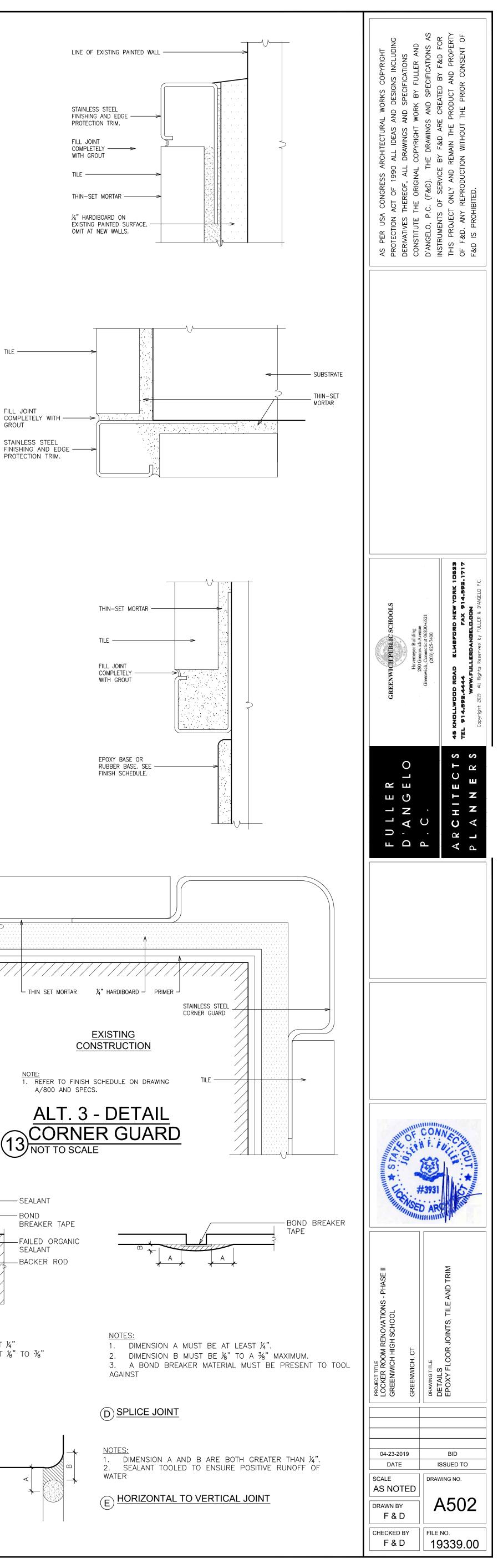


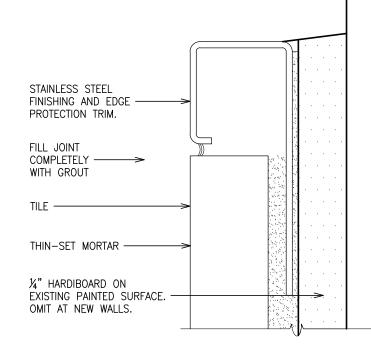




STAINLESS STEEL FINISHING AND EDGE – PROTECTION TRIM.



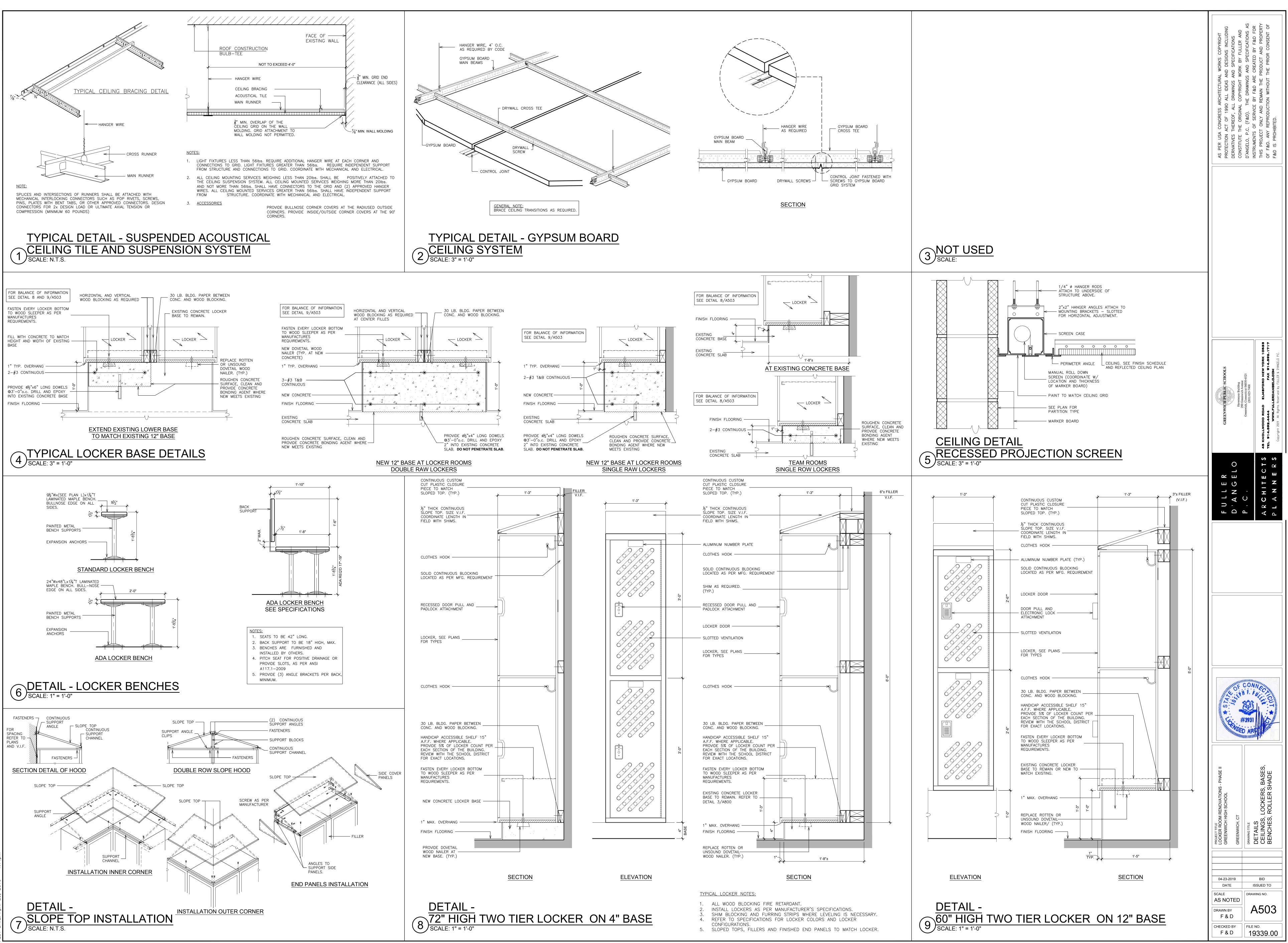




FILL JOINT

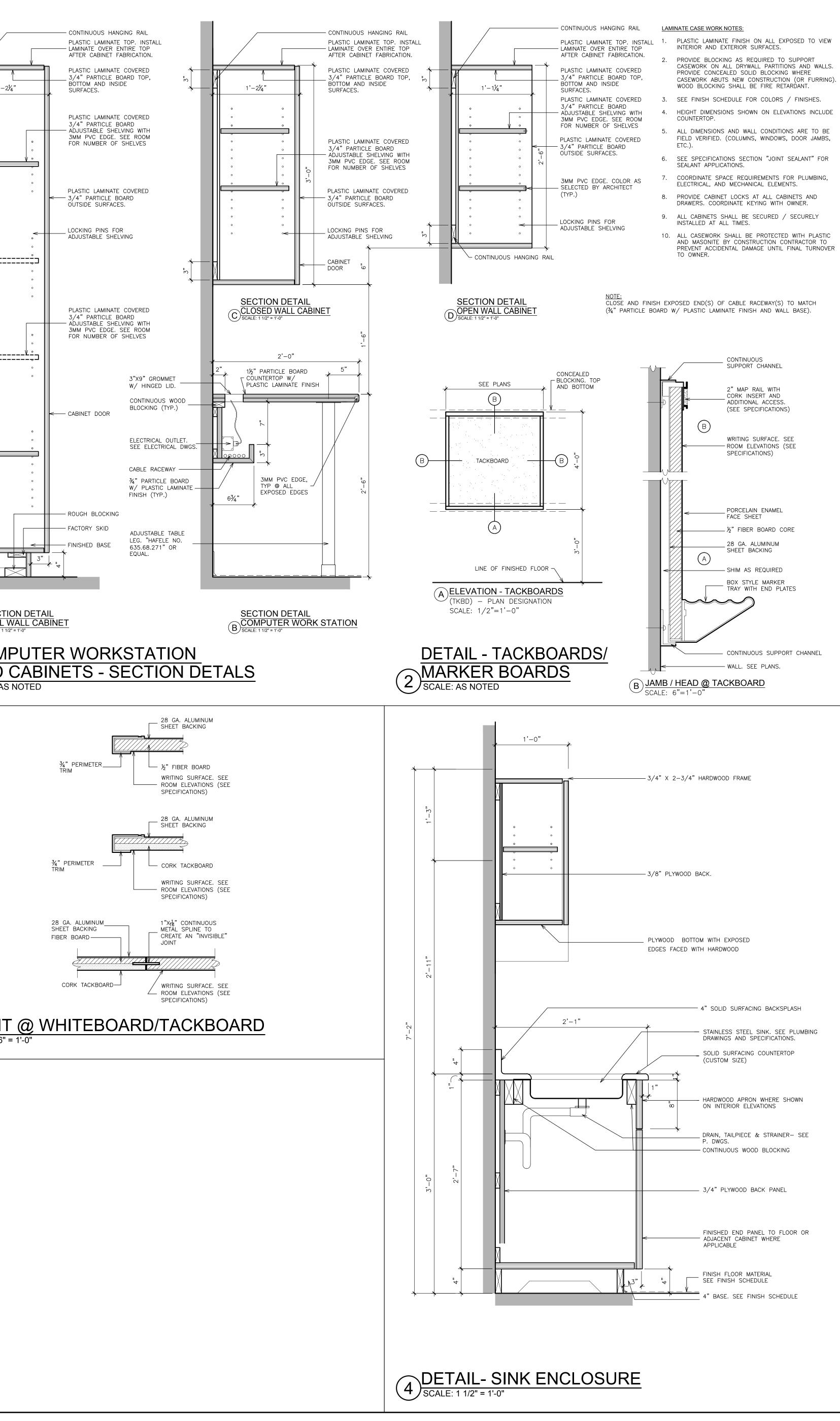
STAINLESS STEEL

GROUT

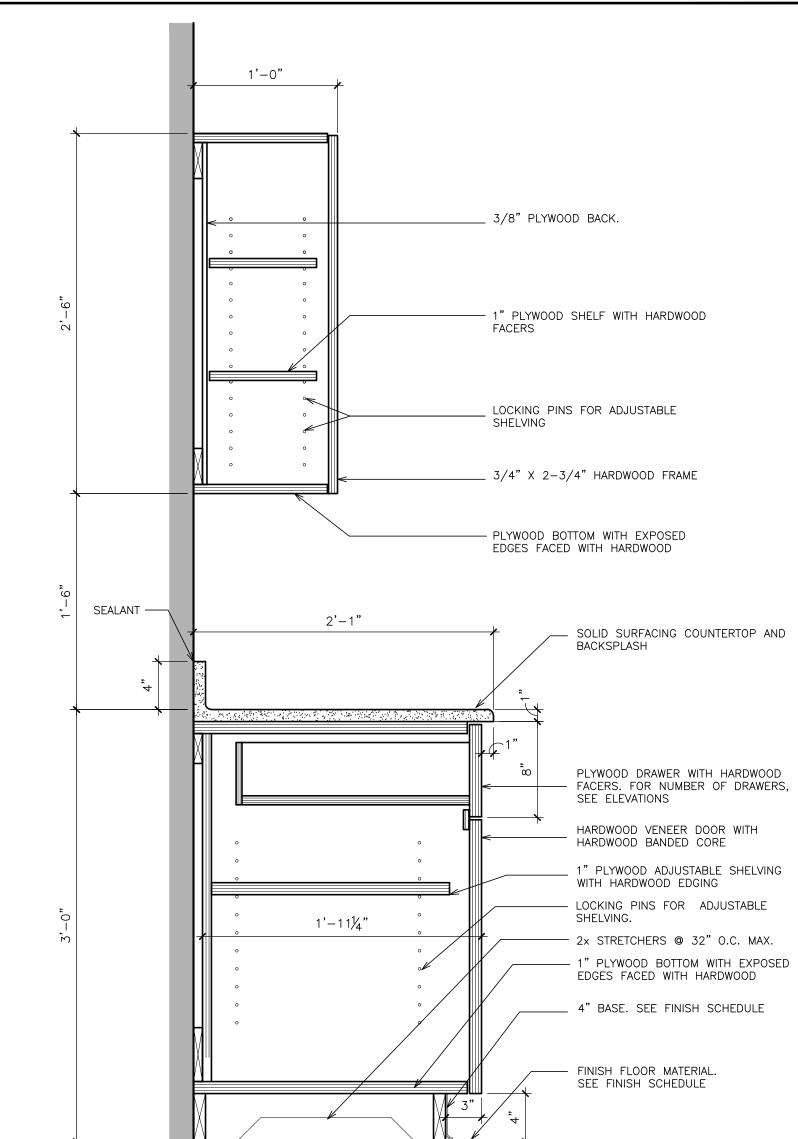


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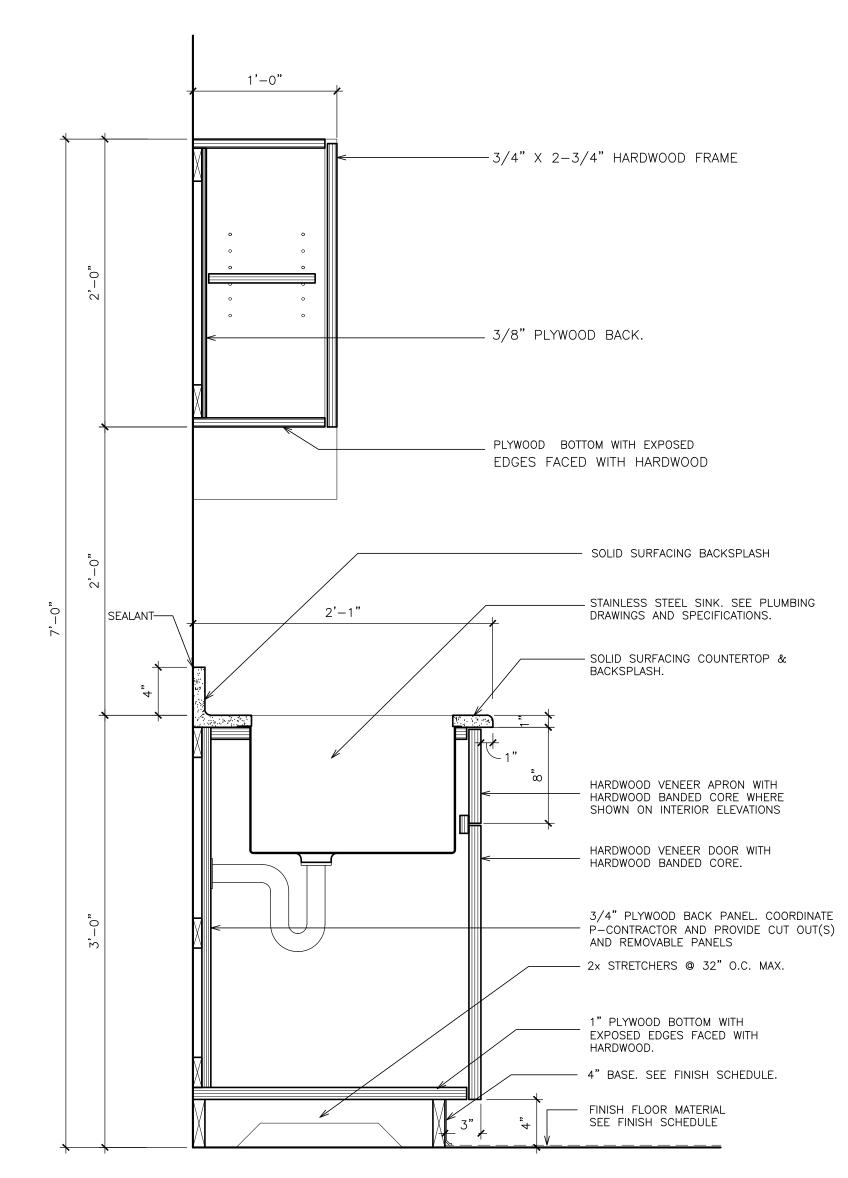
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| | SECT TALL SCALE: 11/2 COM AND SCALE: AS |
| | |
| | 3 JOIN SCALE: 6" |
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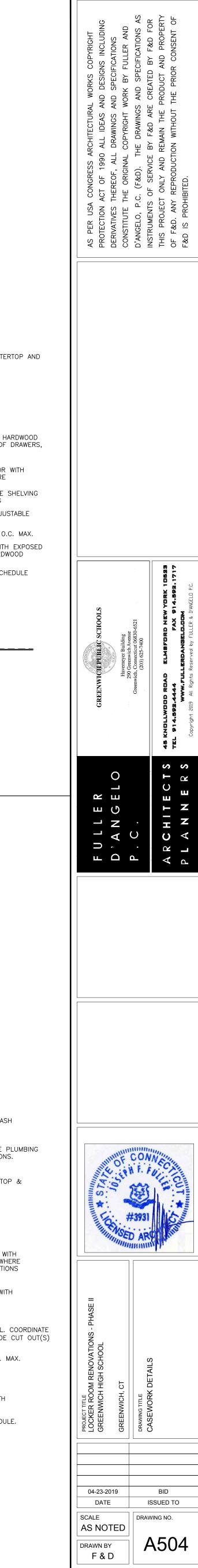


5 DETAIL- SINK ENCLOSURE SCALE: 1 1/2" = 1'-0"



6 DETAIL- BASE AND WALL CABINET SCALE: 1 1/2" = 1'-0"



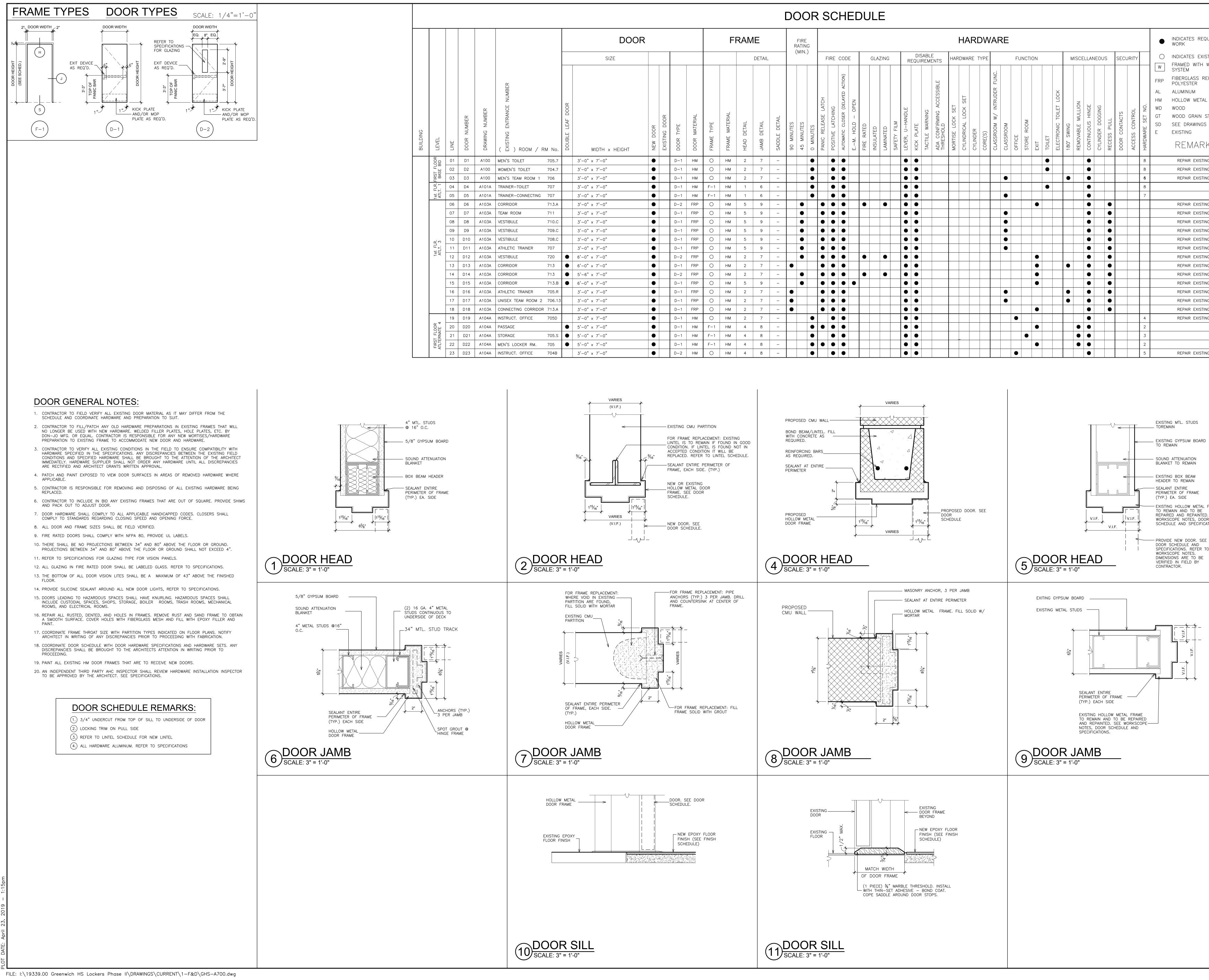


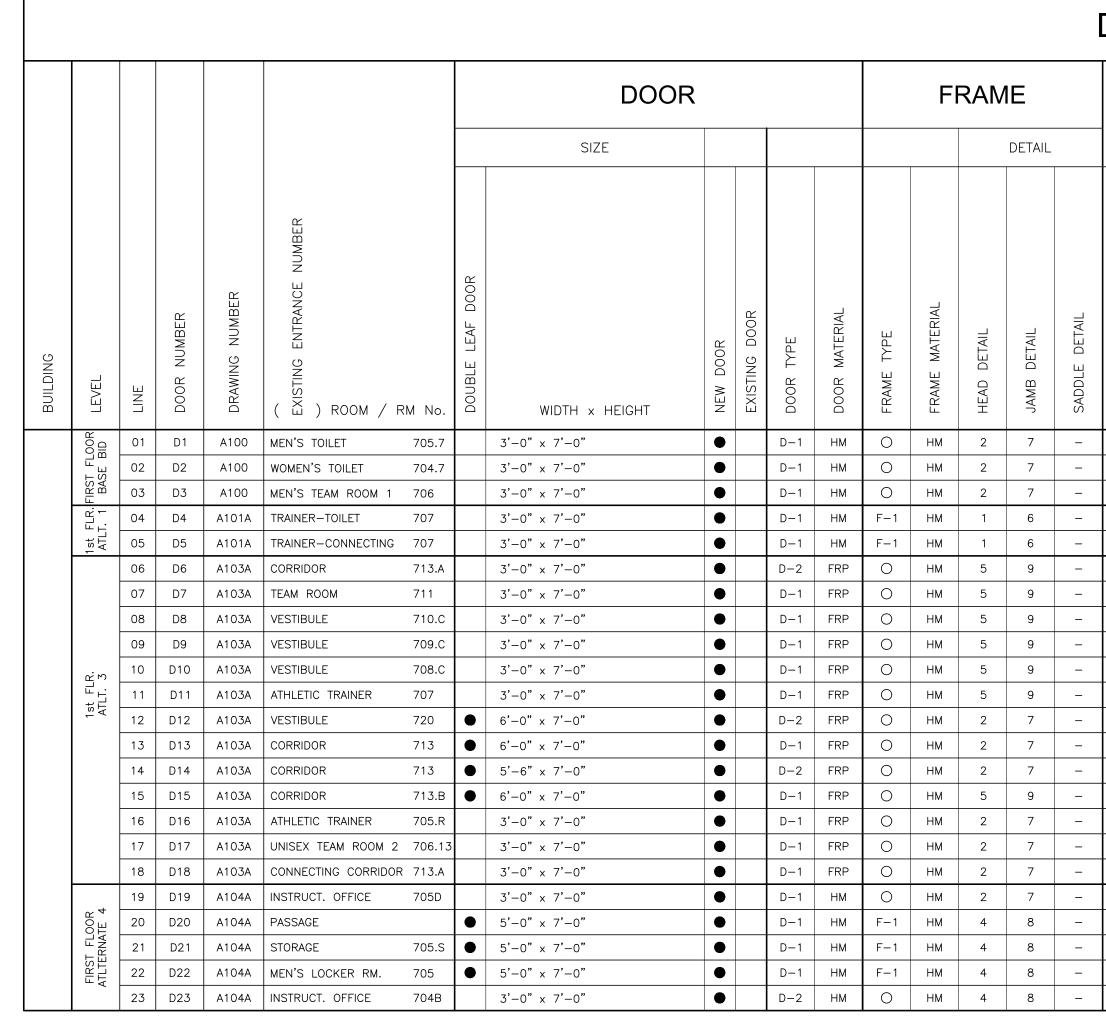
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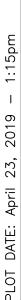
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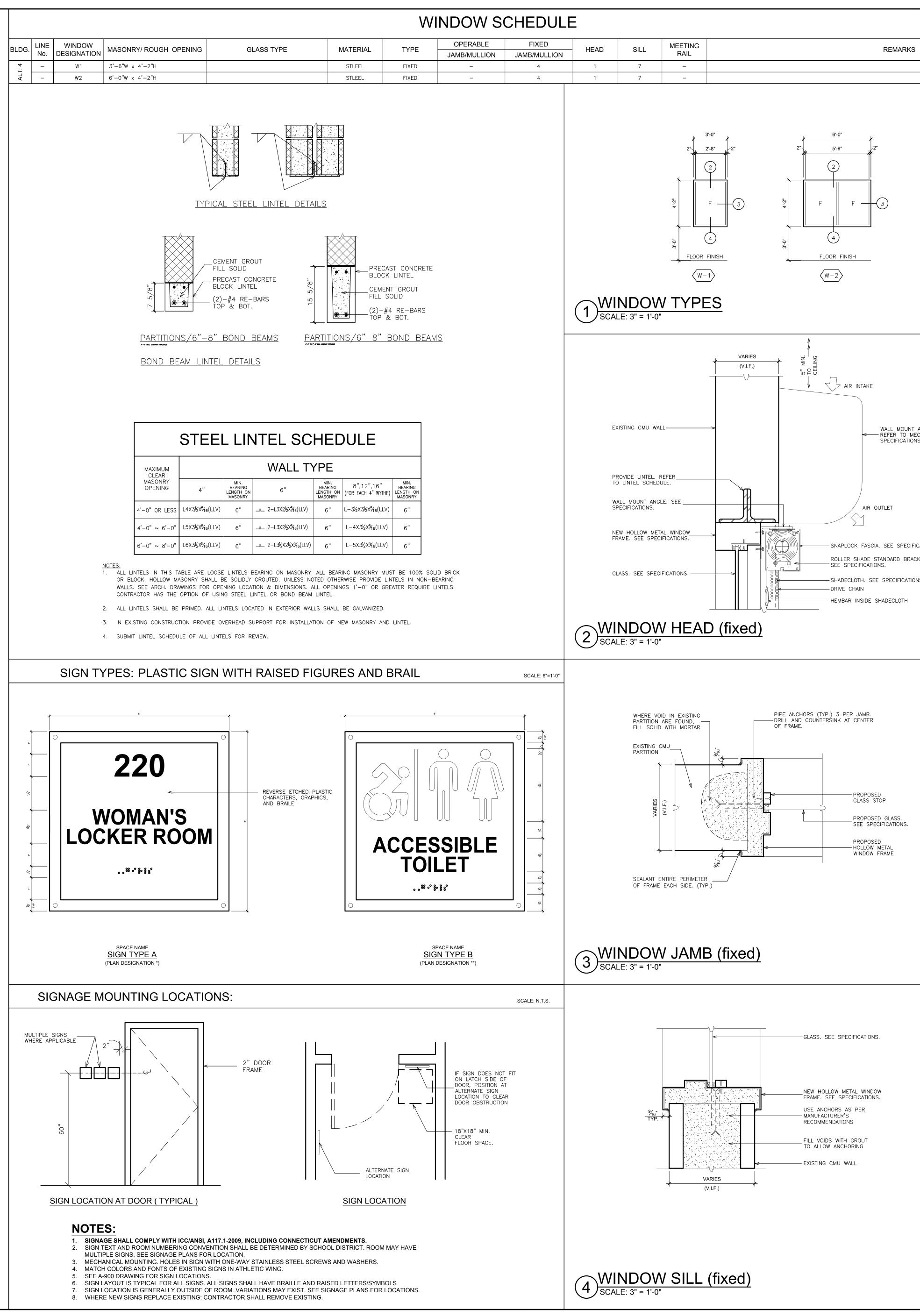


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| gu minules | 45 MINUTES | 0 MINUTES | PANIC RELEASE LATCH | POSITIVE LATCHING | AUTOMATIC CLOSER (DELAYED ACTION) | EM. HOLD - OPEN | FIRE RATED | INSULATED | LAMINATED | SAFETY FILM | LEVER, U-HANDLE | KICK PLATE | TACTILE WARNING | ADA CONFIRMING ACCESSIBLE THRESHOLD | MORTISE LOCK SET | CYLINDRICAL LOCK SET | CYLINDER | CORE(S) | CLASSROOM W/ INTRUDER FUNC. | CLASSROOM | OFFICE | STORE ROOM | EXIT | TOILET | ELECTRONIC TOILET LOCK | 180° SWING | REMOVABLE MULLION | CONTINUOUS HINGE | CYLINDER DOGGING | RECESS PULL | DOOR CONTACTS | ACCESS CONTROL | HARDWARE SET NO. | FRP AL HM WD GT SD E | FRAMED WITH SYSTEM FIBERGLASS F POLYESTER ALUMINUM HOLLOW META WOOD WOOD GRAIN SEE DRAWING EXISTING REMAR |
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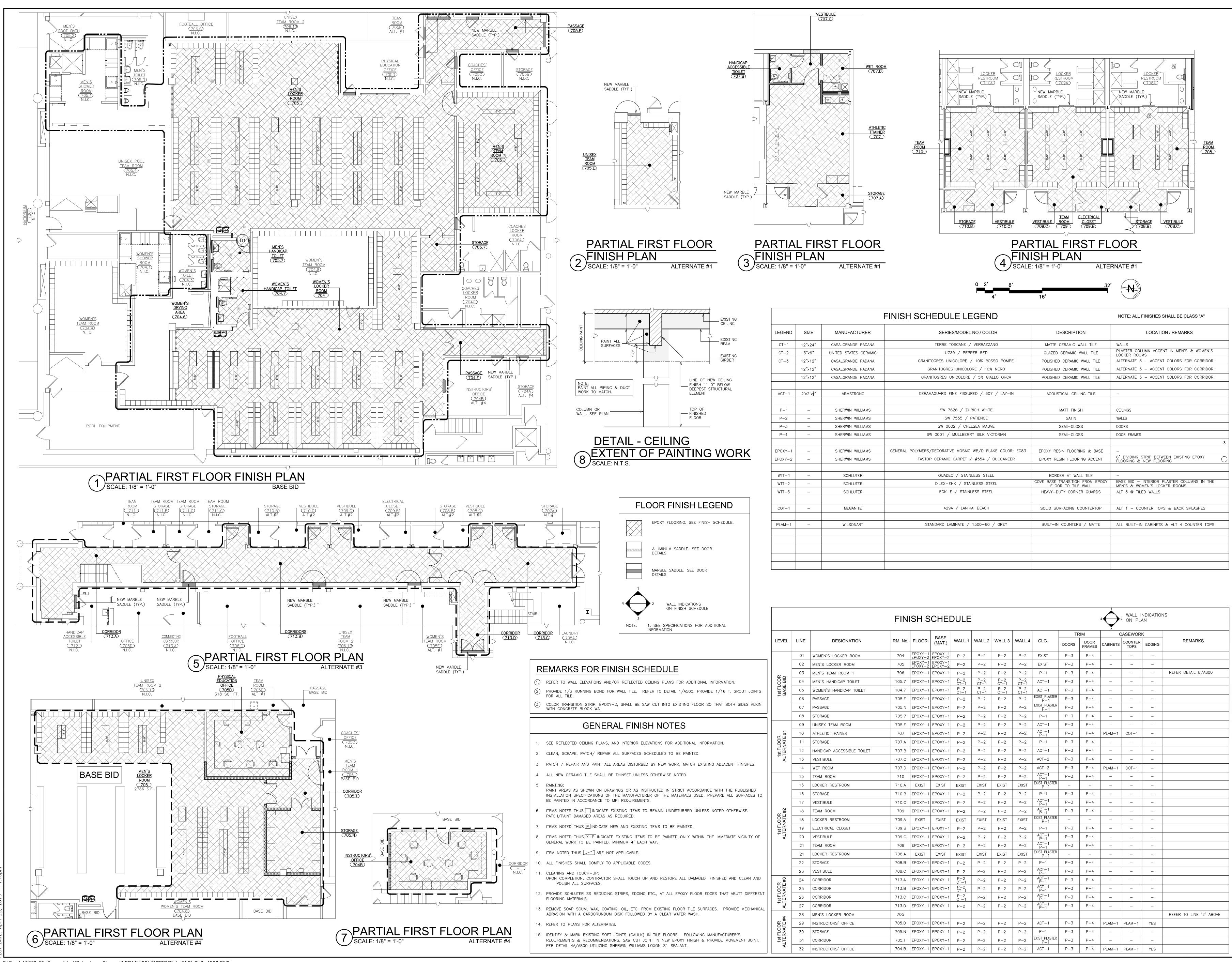
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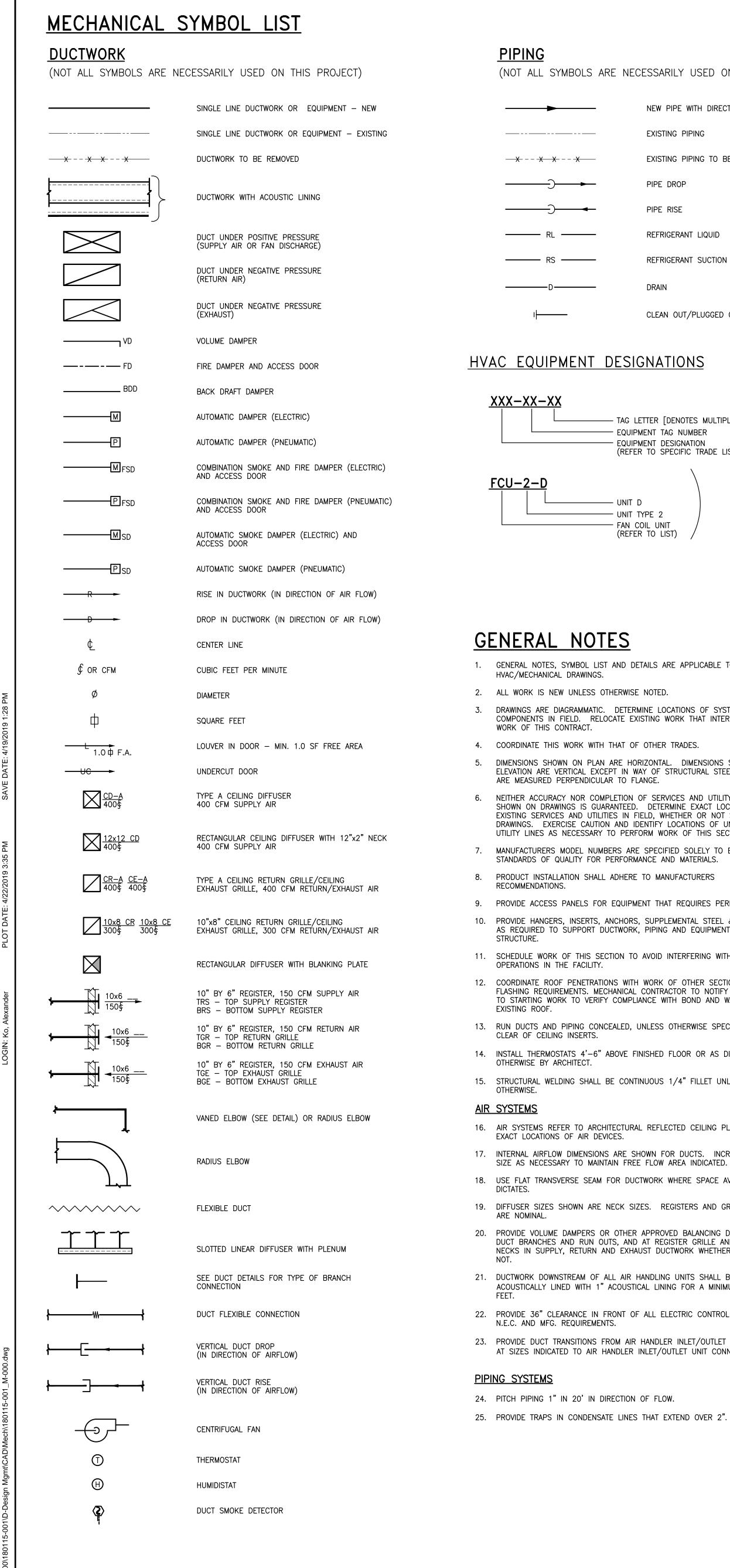


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| LEGEND | SIZE | MANUFACTURER | SERIES/MODEL NO./ COLOR | DESCRIPTION | LOCATION / REM. |
|---------|-----------------------|-----------------------|---|---|---|
| CT-1 | 12"x24" | CASALGRANDE PADANA | TERRE TOSCANE / VERRAZZANO | MATTE CERAMIC WALL TILE | WALLS |
| CT-2 | 3"×6" | UNITED STATES CERAMIC | U739 / PEPPER RED | GLAZED CERAMIC WALL TILE | PLASTER COLUMN ACCENT IN ME |
| CT-3 | 12"x12" | CASALGRANDE PADANA | GRANITOGRES UNICOLORE / 10% ROSSO POMPEI | POLISHED CERAMIC WALL TILE | ALTERNATE 3 – ACCENT COLORS |
| | 12"x12" | CASALGRANDE PADANA | GRANITOGRES UNICOLORE / 10% NERO | POLISHED CERAMIC WALL TILE | ALTERNATE 3 - ACCENT COLORS |
| | 12"x12" | CASALGRANDE PADANA | GRANITOGRES UNICOLORE / 5% GIALLO ORCA | POLISHED CERAMIC WALL TILE | ALTERNATE 3 – ACCENT COLORS |
| ACT-1 | 2'x2'x ³ " | ARMSTRONG | CERAMAGUARD FINE FISSURED / 607 / LAY-IN | ACOUSTICAL CEILING TILE | _ |
| P-1 | _ | SHERWIN WILLIAMS | SW 7626 / ZURICH WHITE | MATT FINISH | CEILINGS |
| P-2 | _ | SHERWIN WILLIAMS | SW 7555 / PATIENCE | SATIN | WALLS |
| P-3 | _ | SHERWIN WILLIAMS | SW 0002 / CHELSEA MAUVE | SEMI-GLOSS | DOORS |
| P-4 | _ | SHERWIN WILLIAMS | SW 0001 / MULLBERRY SILK VICTORIAN | SEMI-GLOSS | DOOR FRAMES |
| EPOXY-1 | _ | SHERWIN WILLIAMS | GENERAL POLYMERS/DECORATIVE MOSAIC WB/D FLAKE COLOR: EC83 | EPOXY RESIN FLOORING & BASE | _ |
| EPOXY-2 | _ | SHERWIN WILLIAMS | FASTOP CERAMIC CARPET / #554 / BUCCANEER | EPOXY RESIN FLOORING ACCENT | 6" DIVIDING STRIP BETWEEN EXIS FLOORING & NEW FLOORING |
| WTT-1 | _ | SCHLUTER | QUADEC / STAINLESS STEEL | BORDER AT WALL TILE | _ |
| WTT-2 | _ | SCHLUTER | DILEX-EHK / STAINLESS STEEL | COVE BASE TRANSITION FROM EPOXY FLOOR TO TILE WALL | BASE BID – INTERIOR PLASTER (MEN'S & WOMEN'S LOCKER ROO |
| WTT-3 | _ | SCHLUTER | ECK-E / STAINLESS STEEL | HEAVY-DUTY CORNER GUARDS | ALT 3 @ TILED WALLS |
| COT-1 | _ | MEGANITE | 429A / LANIKAI BEACH | SOLID SURFACING COUNTERTOP | ALT 1 – COUNTER TOPS & BAC |
| PLAM-1 | _ | WILSONART | STANDARD LAMINATE / 1500–60 / GREY | BUILT-IN COUNTERS / MATTE | ALL BUILT–IN CABINETS & ALT 4 |
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| | | | FIN | ISH S | CHEI | DULE | | | | | | | 4 | WALL I 2 ON PL | NDICATION AN | ٧S |
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| | | | | | DACE | | | | | | TF | RIM | | CASEWOR | K | |
| LEVEL | LINE | DESIGNATION | RM. No. | FLOOR | BASE (MAT.) | WALL 1 | WALL 2 | WALL 3 | WALL 4 | CLG. | DOORS | DOOR FRAMES | CABINETS | COUNTER TOPS | EDGING | |
| | 01 | WOMEN'S LOCKER ROOM | 704 | EPOXY-1 EPOXY-2 | EPOXY-1 EPOXY-2 | P-2 | P-2 | P-2 | P-2 | EXIST | P-3 | P-4 | - | _ | _ | |
| | 02 | MEN'S LOCKER ROOM | 705 | | EPOXY-1 EPOXY-2 | P-2 | P-2 | P-2 | P-2 | EXIST | P-3 | P-4 | - | _ | _ | |
| | 03 | MEN'S TEAM ROOM 1 | 706 | | EPOXY-1 | P-2 | P-2 | P-2 | P-2 | P-1 | P-3 | P-4 | - | _ | - | REFER |
| 1st FLOOR BASE BID | 04 | MEN'S HANDICAP TOILET | 105.7 | EPOXY-1 | EPOXY-1 | P-2 CT-1 | P-2 CT-1 | P-2 CT-1 | P-2 CT-1 | ACT-1 | P-3 | P-4 | - | - | - | |
| st FL 3ASE | 05 | WOMEN'S HANDICAP TOILET | 104.7 | EPOXY-1 | EPOXY-1 | P-2 CT-1 | P-2 CT-1 | P-2 CT-1 | P-2 CT-1 | ACT-1 | P-3 | P-4 | _ | - | - | |
| Т — Ш | 06 | PASSAGE | 705.F | EPOXY-1 | EPOXY-1 | P-2 | P-2 | P-2 | P-2 | EXIST PLASTER | P-3 | P-4 | - | - | - | |
| | 07 | PASSAGE | 705.N | EPOXY-1 | EPOXY-1 | P-2 | P-2 | P-2 | P-2 | EXIST PLASTER | P-3 | P-4 | _ | _ | _ | |
| | 08 | STORAGE | 705.7 | EPOXY-1 | EPOXY-1 | P-2 | P-2 | P-2 | P-2 | P-1 | P-3 | P-4 | _ | - | _ | |
| | 09 | UNISEX TEAM ROOM | 705.E | EPOXY-1 | EPOXY-1 | P-2 | P-2 | P-2 | P-2 | ACT-1 | P-3 | P-4 | _ | _ | _ | |
| ۲ × ۳ | 10 | ATHLETIC TRAINER | 707 | EPOXY-1 | EPOXY-1 | P-2 | P-2 | P-2 | P-2 | ACT-1 P-1 | P-3 | P-4 | PLAM-1 | COT-1 | - | |
| 1st FLOOR ALTERNATE #1 | 11 | STORAGE | 707.A | EPOXY-1 | EPOXY-1 | P-2 | P-2 | P-2 | P-2 | P-1 | P-3 | P-4 | - | - | - | |
| st FL TERN | 12 | HANDICAP ACCESSIBLE TOILET | 707.B | EPOXY-1 | EPOXY-1 | P-2 | P-2 | P-2 | P-2 | ACT-1 | P-3 | P-4 | - | - | - | |
| 4 LIA | 13 | VESTIBULE | 707.C | EPOXY-1 | EPOXY-1 | P-2 | P-2 | P-2 | P-2 | ACT-2 | P-3 | P-4 | _ | _ | - | |
| | 14 | WET ROOM | 707.D | EPOXY-1 | EPOXY-1 | P-2 | P-2 | P-2 | P-2 | ACT-2 | P-3 | P-4 | PLAM-1 | COT-1 | - | |
| | 15 | TEAM ROOM | 710 | EPOXY-1 | EPOXY-1 | P-2 | P-2 | P-2 | P-2 | ACT-1 P-1 | P-3 | P-4 | _ | - | - | |
| | 16 | LOCKER RESTROOM | 710.A | EXIST | EXIST | EXIST | EXIST | EXIST | EXIST | EXIST PLASTER | — | - | _ | _ | - | |
| | 16 | STORAGE | 710.B | EPOXY-1 | EPOXY-1 | P-2 | P-2 | P-2 | P-2 | P-1 | P-3 | P-4 | - | _ | - | |
| | 17 | VESTIBULE | 710.C | EPOXY-1 | EPOXY-1 | P-2 | P-2 | P-2 | P-2 | ACT-1 P-1 | P-3 | P-4 | _ | - | - | |
| ;#2 | 18 | TEAM ROOM | 709 | EPOXY-1 | EPOXY-1 | P-2 | P-2 | P-2 | P-2 | ACT-1 P-1 | P-3 | P-4 | - | - | - | |
| 1st FLOOR ALTERNATE # | 18 | LOCKER RESTROOM | 709.A | EXIST | EXIST | EXIST | EXIST | EXIST | EXIST | EXIST PLASTER | - | - | - | - | - | |
| st FL TERN | 19 | ELECTRICAL CLOSET | 709.B | EPOXY-1 | EPOXY-1 | P-2 | P-2 | P-2 | P-2 | P-1 | P-3 | P-4 | - | - | - | |
| 4LT | 20 | VESTIBULE | 709.C | EPOXY-1 | EPOXY-1 | P-2 | P-2 | P-2 | P-2 | ACT-1 P-1 | P-3 | P-4 | - | - | - | |
| | 21 | TEAM ROOM | 708 | EPOXY-1 | EPOXY-1 | P-2 | P-2 | P-2 | P-2 | ACT-1 P-1 | P-3 | P-4 | _ | _ | - | |
| | 21 | LOCKER RESTROOM | 708.A | EXIST | EXIST | EXIST | EXIST | EXIST | EXIST | EXIST PLASTER | _ | _ | _ | _ | _ | |
| | 22 | STORAGE | 708.B | EPOXY-1 | EPOXY-1 | P-2 | P-2 | P-2 | P-2 | P-1 | P-3 | P-4 | _ | - | _ | |
| | 23 | VESTIBULE | 708.C | EPOXY-1 | EPOXY-1 | P-2 | P-2 | P-2 | P-2 | ACT-1 P-1 | P-3 | P-4 | _ | _ | _ | |
| ۲ : #3 | 24 | CORRIDOR | 713.A | EPOXY-1 | EPOXY-1 | P-2 CT-1 | P-2 | P-2 | P-2 | ACT-1 P-1 | P-3 | P-4 | _ | - | - | |
| IATE | 25 | CORRIDOR | 713.B | EPOXY-1 | EPOXY-1 | P-2 CT-1 | P-2 | P-2 | P-2 | ACT-1 P-1 | P-3 | P-4 | - | - | - | |
| st FL ERN | 26 | CORRIDOR | 713.C | EPOXY-1 | EPOXY-1 | P-2 CT-1 | P-2 | P-2 | P-2 | ACT-1 P-1 | P-3 | P-4 | _ | - | - | |
| 1st FLOOR ALTERNATE #3 | 27 | CORRIDOR | 713.D | EPOXY-1 | EPOXY-1 | P-2 | P-2 | P-2 | P-2 | ACT-1 P-1 | P-3 | P-4 | _ | - | _ | |
| | 28 | MEN'S LOCKER ROOM | 705 | | | | | | | | | | | | | REFER |
| OR TE# | 29 | INSTRUCTORS' OFFICE | 705.D | EPOXY-1 | EPOXY-1 | P-2 | P-2 | P-2 | P-2 | ACT-1 | P-3 | P-4 | PLAM-1 | PLAM-1 | YES | |
| FLO | 30 | STORAGE | 705.N | EPOXY-1 | EPOXY-1 | P-2 | P-2 | P-2 | P-2 | P-1 | P-3 | P-4 | _ | - | _ | |
| 1st FLOOR ALTERNATE #4 | 31 | CORRIDOR | 705.T | EPOXY-1 | EPOXY-1 | P-2 | P-2 | P-2 | P-2 | EXIST PLASTER P-1 | P-3 | P-4 | _ | - | - | |
| ◄ | 32 | INSTRUCTORS' OFFICE | 704.B | EPOXY-1 | EPOXY-1 | P-2 | P-2 | P-2 | P-2 | ACT-1 | P-3 | P-4 | PLAM-1 | PLAM-1 | YES | |





| ECESSARILY USED ON THIS PROJECT) |
|----------------------------------|
| NEW PIPE WITH DIRECTION OF FLOW |
| EXISTING PIPING |
| EXISTING PIPING TO BE REMOVED |
| PIPE DROP |
| PIPE RISE |
| REFRIGERANT LIQUID |
| REFRIGERANT SUCTION |
| DRAIN |
| CLEAN OUT/PLUGGED OUTLET |
| |

| - TAG LETTER [DENOTES MULTIPLE UNITS OF THE SAME TYPE] |
|--|
| – EQUIPMENT TAG NUMBER |
| EQUIPMENT DESIGNATION (REFER TO SPECIFIC TRADE LIST) |
| \mathbf{N} |

– UNIT D - UNIT TYPE 2 - FAN COIL UNIT (REFER TO LIST)

| DETAILS ARE APPLICABLE TO ALL |
|--|
| SE NOTED. |
| RMINE LOCATIONS OF SYSTEMS AND XISTING WORK THAT INTERFERES WITH |
| OF OTHER TRADES. |
| ORIZONTAL. DIMENSIONS SHOWN IN WAY OF STRUCTURAL STEEL, DIMENSIONS FLANGE. |
| OF SERVICES AND UTILITY LOCATIONS D. DETERMINE EXACT LOCATIONS OF FIELD, WHETHER OR NOT SHOWN ON IDENTIFY LOCATIONS OF UNMARKED FORM WORK OF THIS SECTION. |
| RE SPECIFIED SOLELY TO ESTABLISH MANCE AND MATERIALS. |
| E TO MANUFACTURERS |
| MENT THAT REQUIRES PERIODIC SERVICE. |
| S, SUPPLEMENTAL STEEL & SUPPORTS K, PIPING AND EQUIPMENT FROM |
| O AVOID INTERFERING WITH EXISTING |
| TH WORK OF OTHER SECTIONS AND WITH L CONTRACTOR TO NOTIFY OWNER PRIOR LIANCE WITH BOND AND WARRANTY OF |
| UNLESS OTHERWISE SPECIFIED AND |
| FINISHED FLOOR OR AS DIRECTED |
| ITINUOUS 1/4" FILLET UNLESS REQUIRED |
| RAL REFLECTED CEILING PLANS FOR |
| SHOWN FOR DUCTS. INCREASE DUCT EE FLOW AREA INDICATED. |
| JCTWORK WHERE SPACE AVAILABLE |
| IZES. REGISTERS AND GRILLE SIZES |
| R APPROVED BALANCING DEVICES AT D AT REGISTER GRILLE AND DIFFUSER IAUST DUCTWORK WHETHER SHOWN OR |
| HANDLING UNITS SHALL BE FICAL LINING FOR A MINIMUM OF 10 |
| OF ALL ELECTRIC CONTROL PANELS PER |
| R HANDLER INLET/OUTLET DUCT WORK INLET/OUTLET UNIT CONNECTIONS. |

ABBREVIATIONS

ACS

CFM

CW

HWP

(NOT ALL ABBREV. ARE NECESSARILY USED ON THIS PROJECT)

| | AMPERES |
|---|---|
| , | AUTOMATIC AIR VENT AIR CONDITIONING |
| CU | AIR COOLED CONDENSING UNIT |
| 5 | AUTOMATIC CONTROL SYSTEM |
| J | AIR CONDITIONING UNIT |
| | ACCESS DOOR ABOVE FINISHED FLOOR |
| J | AIR HANDLING UNIT |
| | ALUMINUM |
| | BOOSTER FAN |
| - | BOTTOM EXHAUST GRILLE BOTTOM RETURN GRILLE |
| 2 | BRAKE HORSEPOWER |
| N | BACKWARD INCLINE DOUBLE WIDTH |
| N | BACKWARD INCLINE SINGLE WIDTH |
| 6 | BUILDING MANAGEMENT SYSTEM |
|) | BOTTOM SUPPLY REGISTER BOTTOM THROAT |
| l | BRITISH THERMAL UNIT |
| ΙH | BTU PER HOUR |
| | DEGREES CENTIGRADE (CELSIUS) |
| v | COOLING COIL COUNTER CLOCKWISE |
| v | CEILING DIFFUSER |
| C | CAP FOR FUTURE CONNECTION |
| 1 | CUBIC FEET PER MINUTE |
| | CEILING GRILLE |
| , ND | CEILING CONDENSATE |
| | CONDENSATE PUMP |
| | CEILING REGISTER |
| IN | CUBIC INCHES |
| 1 | CABINET UNIT HEATER CONSTANT VOLUME |
| | CLOCKWISE |
| D | CONDENSER WATER PUMP |
| | DRY BULB |
| М | DIRECT EXPANSION DIAMETER |
| PR | DAMPER |
| | DOWN |
| | EXISTING TO REMAIN |
| | EACH ENTERING AIR TEMPERATURE |
| } | ENTERING DRY BULB TEMPERATURE |
| | EXHAUST FAN |
| С | |
| 1 | ELECTRIC DUCT HEATER |
| 1 | EQUAL |
| | EQUAL EXISTING TO BE REMOVED |
|) | |
|) R) I | EXISTING TO BE REMOVED EXISTING TO BE REMOVED & RELOCATED ELECTRIC UNIT HEATER |
|) R) | EXISTING TO BE REMOVED EXISTING TO BE REMOVED & RELOCATED ELECTRIC UNIT HEATER ENTERING WET BULB |
|) R) I | EXISTING TO BE REMOVED EXISTING TO BE REMOVED & RELOCATED ELECTRIC UNIT HEATER |
|) R) I 3 | EXISTING TO BE REMOVED EXISTING TO BE REMOVED & RELOCATED ELECTRIC UNIT HEATER ENTERING WET BULB ENTERING WATER TEMPERATURE |
|) R) I 3 | EXISTING TO BE REMOVED EXISTING TO BE REMOVED & RELOCATED ELECTRIC UNIT HEATER ENTERING WET BULB ENTERING WATER TEMPERATURE EXHAUST EXISTING DEGREES FAHRENHEIT |
|) R) I 3 | EXISTING TO BE REMOVED EXISTING TO BE REMOVED & RELOCATED ELECTRIC UNIT HEATER ENTERING WET BULB ENTERING WATER TEMPERATURE EXHAUST EXISTING DEGREES FAHRENHEIT FREE AREA (SQ.FT.) |
|) R) I 3 | EXISTING TO BE REMOVED EXISTING TO BE REMOVED & RELOCATED ELECTRIC UNIT HEATER ENTERING WET BULB ENTERING WATER TEMPERATURE EXHAUST EXISTING DEGREES FAHRENHEIT |
|) R) I 3 | EXISTING TO BE REMOVED EXISTING TO BE REMOVED & RELOCATED ELECTRIC UNIT HEATER ENTERING WET BULB ENTERING WATER TEMPERATURE EXHAUST EXISTING DEGREES FAHRENHEIT FREE AREA (SQ.FT.) FLEXIBLE CONNECTION |
|) R) I 3 | EXISTING TO BE REMOVED EXISTING TO BE REMOVED & RELOCATED ELECTRIC UNIT HEATER ENTERING WET BULB ENTERING WATER TEMPERATURE EXHAUST EXISTING DEGREES FAHRENHEIT FREE AREA (SQ.FT.) FLEXIBLE CONNECTION FAN COIL UNIT FIRE DAMPER FINISHED FLOOR |
|) R) H B F H ST | EXISTING TO BE REMOVED EXISTING TO BE REMOVED & RELOCATED ELECTRIC UNIT HEATER ENTERING WET BULB ENTERING WATER TEMPERATURE EXHAUST EXISTING DEGREES FAHRENHEIT FREE AREA (SQ.FT.) FLEXIBLE CONNECTION FAN COIL UNIT FIRE DAMPER |
|) R) H B F L | EXISTING TO BE REMOVED EXISTING TO BE REMOVED & RELOCATED ELECTRIC UNIT HEATER ENTERING WET BULB ENTERING WATER TEMPERATURE EXHAUST EXISTING DEGREES FAHRENHEIT FREE AREA (SQ.FT.) FLEXIBLE CONNECTION FAN COIL UNIT FIRE DAMPER FINISHED FLOOR FULL LOAD AMPERES |
|) R) H B F L | EXISTING TO BE REMOVED EXISTING TO BE REMOVED & RELOCATED ELECTRIC UNIT HEATER ENTERING WET BULB ENTERING WATER TEMPERATURE EXHAUST EXISTING DEGREES FAHRENHEIT FREE AREA (SQ.FT.) FLEXIBLE CONNECTION FAN COIL UNIT FIRE DAMPER FINISHED FLOOR FULL LOAD AMPERES FEET PER MINUTE |
|) R) H B F L | EXISTING TO BE REMOVED EXISTING TO BE REMOVED & RELOCATED ELECTRIC UNIT HEATER ENTERING WET BULB ENTERING WATER TEMPERATURE EXHAUST EXISTING DEGREES FAHRENHEIT FREE AREA (SQ.FT.) FLEXIBLE CONNECTION FAN COIL UNIT FIRE DAMPER FINISHED FLOOR FULL LOAD AMPERES FEET PER MINUTE FEET PER SECOND FLOOR REGISTER FEET |
|) R) H B F L | EXISTING TO BE REMOVED EXISTING TO BE REMOVED & RELOCATED ELECTRIC UNIT HEATER ENTERING WET BULB ENTERING WATER TEMPERATURE EXHAUST EXISTING DEGREES FAHRENHEIT FREE AREA (SQ.FT.) FLEXIBLE CONNECTION FAN COIL UNIT FIRE DAMPER FINISHED FLOOR FULL LOAD AMPERES FEET PER MINUTE FEET PER SECOND FLOOR REGISTER |
|) R) H B - H ST FL H S | EXISTING TO BE REMOVED EXISTING TO BE REMOVED & RELOCATED ELECTRIC UNIT HEATER ENTERING WET BULB ENTERING WATER TEMPERATURE EXHAUST EXISTING DEGREES FAHRENHEIT FREE AREA (SQ.FT.) FLEXIBLE CONNECTION FAN COIL UNIT FIRE DAMPER FINISHED FLOOR FULL LOAD AMPERES FEET PER MINUTE FEET PER SECOND FLOOR REGISTER FEET FACE VELOCITY |
|) R) H B - H ST FL H S | EXISTING TO BE REMOVED EXISTING TO BE REMOVED & RELOCATED ELECTRIC UNIT HEATER ENTERING WET BULB ENTERING WATER TEMPERATURE EXHAUST EXISTING DEGREES FAHRENHEIT FREE AREA (SQ.FT.) FLEXIBLE CONNECTION FAN COIL UNIT FIRE DAMPER FINISHED FLOOR FULL LOAD AMPERES FEET PER MINUTE FEET PER SECOND FLOOR REGISTER FEET FACE VELOCITY GALLONS PER MINUTE GENERAL EXHAUST HUMIDIFIER |
|) R) H B - H ST FL H S | EXISTING TO BE REMOVED & RELOCATED EXISTING TO BE REMOVED & RELOCATED ELECTRIC UNIT HEATER ENTERING WET BULB ENTERING WATER TEMPERATURE EXHAUST EXISTING DEGREES FAHRENHEIT FREE AREA (SQ.FT.) FLEXIBLE CONNECTION FAN COL UNIT FIRE DAMPER FINISHED FLOOR FULL LOAD AMPERES FEET PER MINUTE FEET PER SECOND FLOOR REGISTER FEET FACE VELOCITY GALLONS PER MINUTE GENERAL EXHAUST |
|) R) H B F F L | EXISTING TO BE REMOVED EXISTING TO BE REMOVED & RELOCATED ELECTRIC UNIT HEATER ENTERING WET BULB ENTERING WATER TEMPERATURE EXHAUST EXISTING DEGREES FAHRENHEIT FREE AREA (SQ.FT.) FLEXIBLE CONNECTION FAN COIL UNIT FIRE DAMPER FINISHED FLOOR FULL LOAD AMPERES FEET PER MINUTE FEET PER SECOND FLOOR REGISTER FEET FACE VELOCITY GALLONS PER MINUTE GENERAL EXHAUST HUMIDIFIER |
|) R) H B F F L | EXISTING TO BE REMOVED EXISTING TO BE REMOVED & RELOCATED ELECTRIC UNIT HEATER ENTERING WET BULB ENTERING WATER TEMPERATURE EXHAUST EXHAUST EXISTING DEGREES FAHRENHEIT FREE AREA (SQ.FT.) FLEXIBLE CONNECTION FAN COIL UNIT FIRE DAMPER FINISHED FLOOR FULL LOAD AMPERES FEET PER MINUTE FEET PER SECOND FLOOR REGISTER FEET FACE VELOCITY GALLONS PER MINUTE GENERAL EXHAUST HUMIDIFIER HALON EXHAUST HEATING COIL |
|) R) H B F F L | EXISTING TO BE REMOVED & RELOCATED EXISTING TO BE REMOVED & RELOCATED ELECTRIC UNIT HEATER ENTERING WET BULB ENTERING WATER TEMPERATURE EXHAUST EXHAUST EXISTING DEGREES FAHRENHEIT FREE AREA (SQ.FT.) FLEXIBLE CONNECTION FAN COIL UNIT FIRE DAMPER FINISHED FLOOR FULL LOAD AMPERES FEET PER MINUTE FEET PER SECOND FLOOR REGISTER FEET FACE VELOCITY GALLONS PER MINUTE GENERAL EXHAUST HUMIDIFIER HALON EXHAUST HEATING COIL |
|) R) H B F F L | EXISTING TO BE REMOVED & RELOCATED ELISTING TO BE REMOVED & RELOCATED ELECTRIC UNIT HEATER ENTERING WET BULB ENTERING WATER TEMPERATURE EXHAUST EXISTING DEGREES FAHRENHEIT FREE AREA (SQ.FT.) FLEXIBLE CONNECTION FAN COIL UNIT FIRE DAMPER FINISHED FLOOR FULL LOAD AMPERES FEET PER MINUTE FEET PER SECOND FLOOR REGISTER FEET FACE VELOCITY GALLONS PER MINUTE GENERAL EXHAUST HUMIDIFIER HALON EXHAUST HEATING COIL HEAD HOT GAS REHEAT HOUR |
|) R) H B F F L | EXISTING TO BE REMOVED & RELOCATED EXISTING TO BE REMOVED & RELOCATED ELECTRIC UNIT HEATER ENTERING WET BULB ENTERING WATER TEMPERATURE EXHAUST EXISTING DEGREES FAHRENHEIT FREE AREA (SQ.FT.) FLEXIBLE CONNECTION FAN COIL UNIT FIRE DAMPER FINISHED FLOOR FULL LOAD AMPERES FEET PER MINUTE FEET PER SECOND FLOOR REGISTER FEET FACE VELOCITY GALLONS PER MINUTE GENERAL EXHAUST HUMIDIFIER HALON EXHAUST HEATING COIL HEAD HOT GAS REHEAT |

| HV | HEATING AND VENTILATING |
|-------------|---|
| HX | HEAT EXCHANGER |
| IN | INCH OR INCHES |
| IPS | IRON PIPE SIZE |
| KW | KILOWATT |
| L | LENGTH |
| LAT | LEAVING AIR TEMPERATURE |
| LBS | POUNDS |
| LD | LINEAR DIFFUSER |
| LDB | LEAVING DRY BULB TEMPERATURE |
| LF, LIN.FT. | LINEAR FEET |
| LL | REFRIGERANT LIQUID LINE |
| LR | LINEAR RETURN |
| LRA | LOCKED ROTOR AMPS |
| LWB | LEAVING WET BULB TEMPERATURE |
| LWT | LEAVING WATER TEMPERATURE |
| MAX | MAXIMUM |
| MB | MIXING BOX |
| MBH | THOUSAND BTU PER HOUR |
| MHP | MOTOR HORSEPOWER |
| | |
| MIN | MINIMUM |
| ММ | MILLIMETER |
| МОТ | MOTOR |
| MOV | MOTOR OPERATED VALVE |
| NC | NORMALLY CLOSED |
| NIC | NOT IN CONTRACT |
| N.O. | NORMALLY OPEN |
| NO. | NUMBER |
| NTS | NOT TO SCALE |
| OA | OUTSIDE AIR |
| Р | PUMP |
| PD | PRESSURE DROP |
| PHC | PREHEAT COIL |
| PSI | POUNDS PER SQUARE INCH |
| PSIA | PSI ABSOLUTE |
| PSIG | PSI GAUGE |
| PVC | POLYVINYL CHLORIDE |
| RA | RETURN AIR |
| (RE) | RELOCATED EXISTING |
| RF | RETURN FAN |
| RH | RELATIVE HUMIDITY |
| RHC | REHEAT COIL |
| | |
| RHWP | REHEAT WATER PUMP |
| RM | ROOM |
| RPM | REVOLUTIONS PER MINUTE |
| (RRO) | EXISTING TO BE REMOVED AND RET OWNER |
| RS | REFRIGERANT SUCTION LINE |
| RL | REFRIGERANT LIQUID LINE |
| SA | SUPPLY AIR |
| SAU | SOUND ATTENUATION UNIT |
| SD | SMOKE DAMPER |
| SF | SUPPLY FAN |
| SL | REFRIGERANT SUCTION LINE |
| SP | STATIC PRESSURE |
| JF T | THROAT |
| ' TDH | TOTAL DYNAMIC HEAD |
| | |
| TEMP | TEMPERATURE |
| TGE | TOP EXHAUST GRILLE |
| TGR | TOP RETURN REGISTER |
| TRD | TRANSFER DUCT |
| TRF | TRANSFER FAN |
| TRG | TRANSFER GRILLE |
| TRS | TOP SUPPLY REGISTER |
| Π | TOP THROAT |
| TYP | TYPICAL |
| ТХ | TOILET EXHAUST |
| UON | UNLESS OTHERWISE NOTED |
| UH | UNIT HEATER |
| V | VOLTS |
| W | WIDTH |
| W/ | WITH |
| w/o | WITHOUT |
| WB | WET BULB |
| WG | WATER GAUGE |
| WMS | WIRE MESH SCREEN |
| WSP | WORKING STEAM PRESSURE |
| | |

DEMOLITION NOTES

1. GENERAL

- A. THIS CONTRACTOR SHALL VISIT THE SITE AND ADJOINING AREAS AND EXAMINE THE EXISTING CONDITIONS TO BECOME FAMILIAR WITH THEM AND TO DETERMINE THE DIFFICULTIES WHICH WILL AFFECT THE EXECUTION OF THE WORK OF THIS CONTRACT. THIS CONTRACTOR SHALL PERFORM THIS PRIOR TO THE SUBMISSION OF HIS PROPOSAL. SUBMISSION OF A PROPOSAL WILL BE CONSTRUED AS EVIDENCE THAT SUCH AN EXAMINATION HAS BEEN MADE AND LATER CLAIMS WILL NOT BE RECOGNIZED FOR EXTRA LABOR, EQUIPMENT OR MATERIALS REQUIRED BECAUSE OF DIFFICULTIES ENCOUNTERED WHICH COULD HAVE BEEN FORESEEN HAD SUCH AN EXAMINATION BEEN MADE.
- B. THE DEMOLITION WORK SHALL INCLUDE, PROVIDING ALL MATERIALS, ALL NECESSARY EXTENSIONS, CONNECTIONS, CUTTING, REPAIRING, ADAPTING AND OTHER MECHANICAL WORK REQUIRED, TOGETHER WITH ANY REQUIRED TEMPORARY CONNECTIONS TO MAINTAIN SERVICE PENDING THE COMPLETION OF THE PERMANENT WORK. NOTES AND GRAPHIC REPRESENTATION SHALL NOT LIMIT THE EXTENT OF DEMOLITION REQUIRED. EXTENT OF DEMOLITION WORK SHALL BE COORDINATED WITH THE ARCHITECT AND BUILDING MANAGEMENT.
- C. REFER TO ARCHITECTS PLANS FOR AREA OF WORK.
- 2. SCOPE OF WORK
- A. EXISTING WORK INTERFERING WITH NEW.
- 1) ALL EXISTING WORK REQUIRED TO REMAIN BUT INTERFERING WITH PROPOSED NEW MECHANICAL (AS WELL AS ELECTRICAL AND GENERAL CONSTRUCTION WORK) SHALL BE RELOCATED AND RECONNECTED USING MATERIALS CONFORMING TO STANDARDS OF THIS CONTRACT.
- REMOVE ALL EXISTING AIR AND WATER COOLED, CEILING AND FLOOR 1) MOUNTED AIR CONDITIONING UNITS AND OUTDOOR HEAT REJECTION DEVICES WITH ALL ASSOCIATED DUCTWORK, TERMINAL BOXES, DIFFUSERS, GRILLES, HANGERS AND ACCESSORIES.
- 2) EXISTING STEEL DUNNAGE UNDER DRYCOOLERS TO REMAIN.

B. REMOVAL OF MECHANICAL EQUIPMENT DUCTWORK AND PIPING.

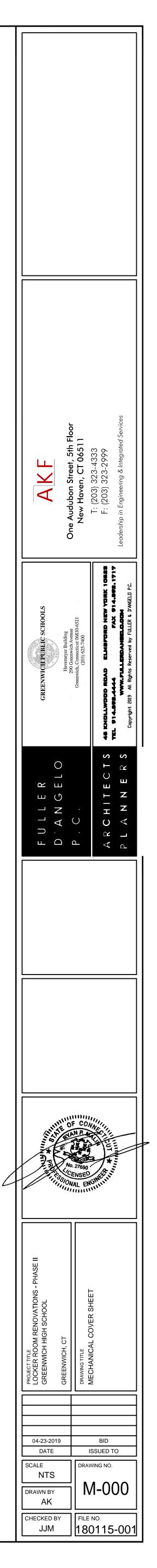
- 3) REMOVE ALL EXHAUST, RETURN AND TRANSFER FANS AND ASSOCIATED DUCTWORK.
- 4) REMOVE ALL PIPING, VALVING AND HANGERS ASSOCIATED WITH PIPING TO BE REMOVED BACK TO MAINS. IDENTIFY ALL PIPING BY SERVICE TYPE AND CAP AT MAINS.
- 5) REMOVE ALL PUMPS, VALVES AND ASSOCIATED ACCESSORIES.
- a) REMOVE ALL STARTERS, DISCONNECT SWITCHES, MOTORS, CONTROL (BOTH TEMPERATURE AND SYSTEM CONTROL) BACK TO MAIN PANELS AND CAP AT PANEL. COORDINATE WITH ELECTRICAL CONTRACTOR BEFORE REMOVAL OF ANY ELECTRICAL POWERED EQUIPMENT. ELECTRICAL CONTRACTOR IS TO DISCONNECT ALL POWER TO SUCH EQUIPMENT.
- C. REMOVAL OF DUCTWORK AND ACCESSORIES
- 1) REMOVE ALL SUPPLY AIR, RETURN AIR AND EXHAUST AIR DUCTWORK WITH ALL ASSOCIATED DIFFUSERS, TERMINAL BOXES, CONTROLS, COLLARS, DAMPERS, RETURN/EXHAUST GRILLES AND CONTROLS BACK TO THE EXISTING SUPPLY AND RETURN AIR SHAFTS, OR AS NOTED ON DRAWINGS.
- 2) ALL EXISTING BUILDING FIRE DAMPERS, FIRE/SMOKE DAMPERS, DUCT MOUNTED SMOKE DETECTORS AT SUPPLY AND RETURN AIR SHAFTS TO
- D. PERIMETER SERVICES

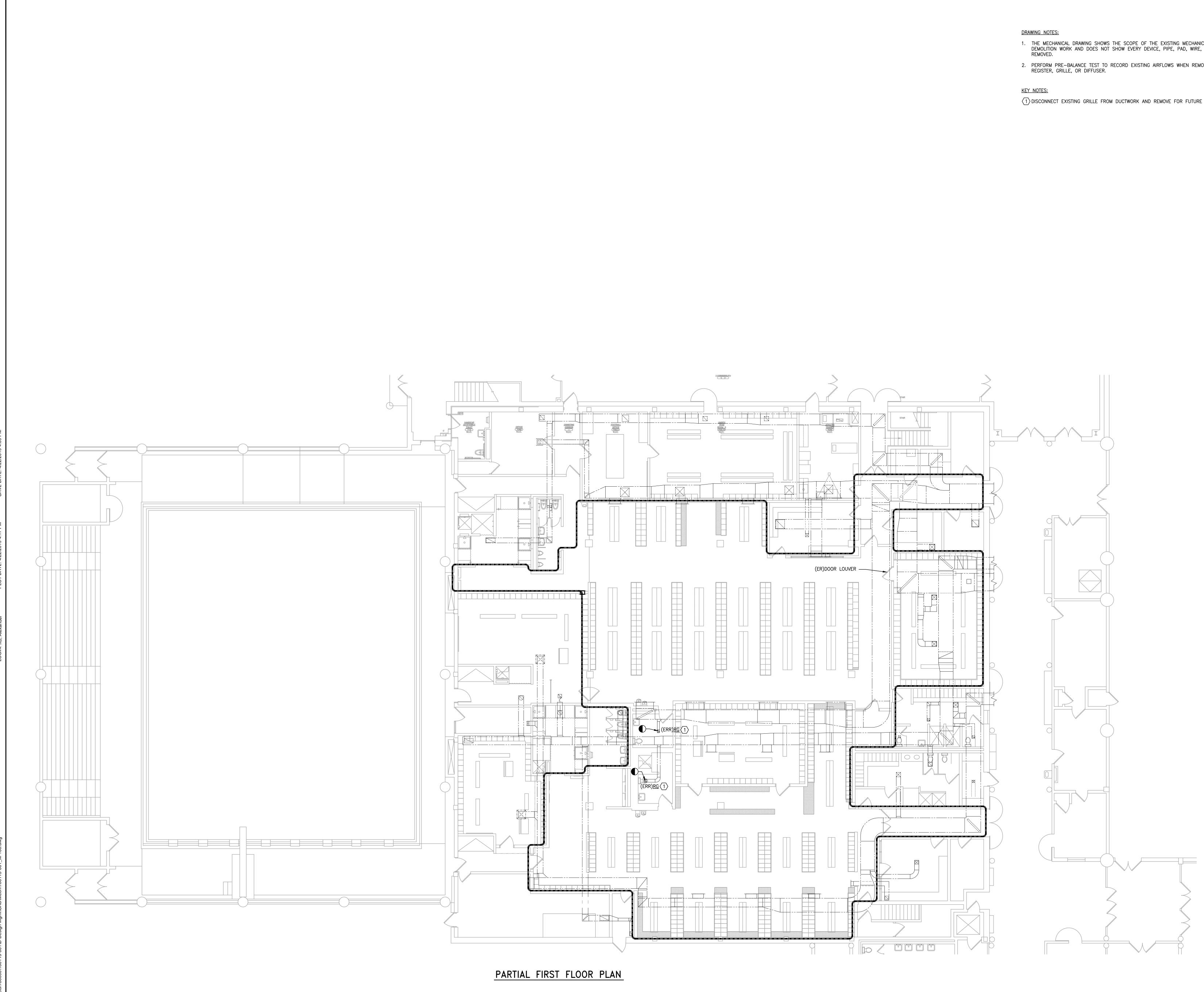
REMAIN.

- 1) REMOVE PERIMETER HEATING ELEMENTS, AS NOTED. REMOVE PIPING. FITTINGS, VALVES, DUCTS AND INSULATION FOR ALL EQUIPMENT TO BE REMOVED BACK TO MAIN AND CAP OR AS NOTED ON PLANS. PATCH AND CAP EXISTING AS REQUIRED FOR CONTINUED OPERATION.
- 2) LEAVE ALL BUILDING FREEZE PROTECTION SPACE HEATING INTACT.
- F. CONTRACTOR TO REPLACE/ PATCH WALLS AND FLOORS TO MATCH EXISTING.
- G. PROVIDE ADDITIONAL SUPPORT FOR ALL EXISTING DUCTS AND PIPING TO REMAIN WHICH ARE AFFECTED BY DEMOLITION OF EXISTING CEILING AND PARTITIONS.
- H. EQUIPMENT REQUIRED TO BE TURNED OVER TO THE OWNER SHALL BE PLACED IN A MUTUALLY ACCEPTABLE LOCATION. ALL MATERIALS AND EQUIPMENT REMOVED AS A RESULT OF DEMOLITION SHALL BE TAKEN FROM THE SITE AND DISPOSED OF IN ACCORDANCE WITH APPLICABLE LAWS AND ENVIRONMENTAL REGULATIONS.
- I. CONTRACTOR SHALL IDENTIFY ALL EXISTING WORK TO REMAIN BY ACCEPTABLE IDENTIFICATION MEANS TO CONFIRM PROPER SCOPE PRIOR TO COMMENCEMENT OF DEMOLITION.

| | DRAWING INDEX |
|-------------|---|
| DRAWING NO. | DRAWING TITLE |
| M-000 | MECHANICAL COVER SHEET |
| M-100 | MECHANICAL FLOOR PLAN - DEMOLITION |
| M-200 | MECHANICAL FLOOR PLAN – DUCTWORK |
| M-300 | MECHANICAL PARTIAL FLOOR PLAN – ALTERNATE 1 |
| M-301 | MECHANICAL PARTIAL FLOOR PLAN – ALTERNATE 2 |
| M-302 | MECHANICAL PARTIAL FLOOR PLAN – ALTERNATE 3 |
| M-303 | MECHANICAL PARTIAL FLOOR PLAN – ALTERNATE 4 |
| M-400 | MECHANICAL SCHEDULES |
| M-500 | MECHANICAL DETAILS |

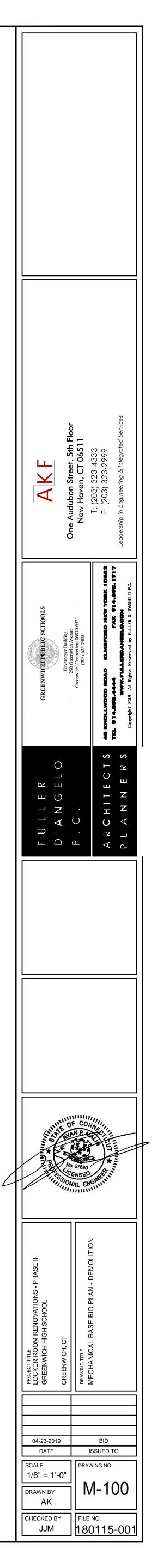
AND RETURN TO

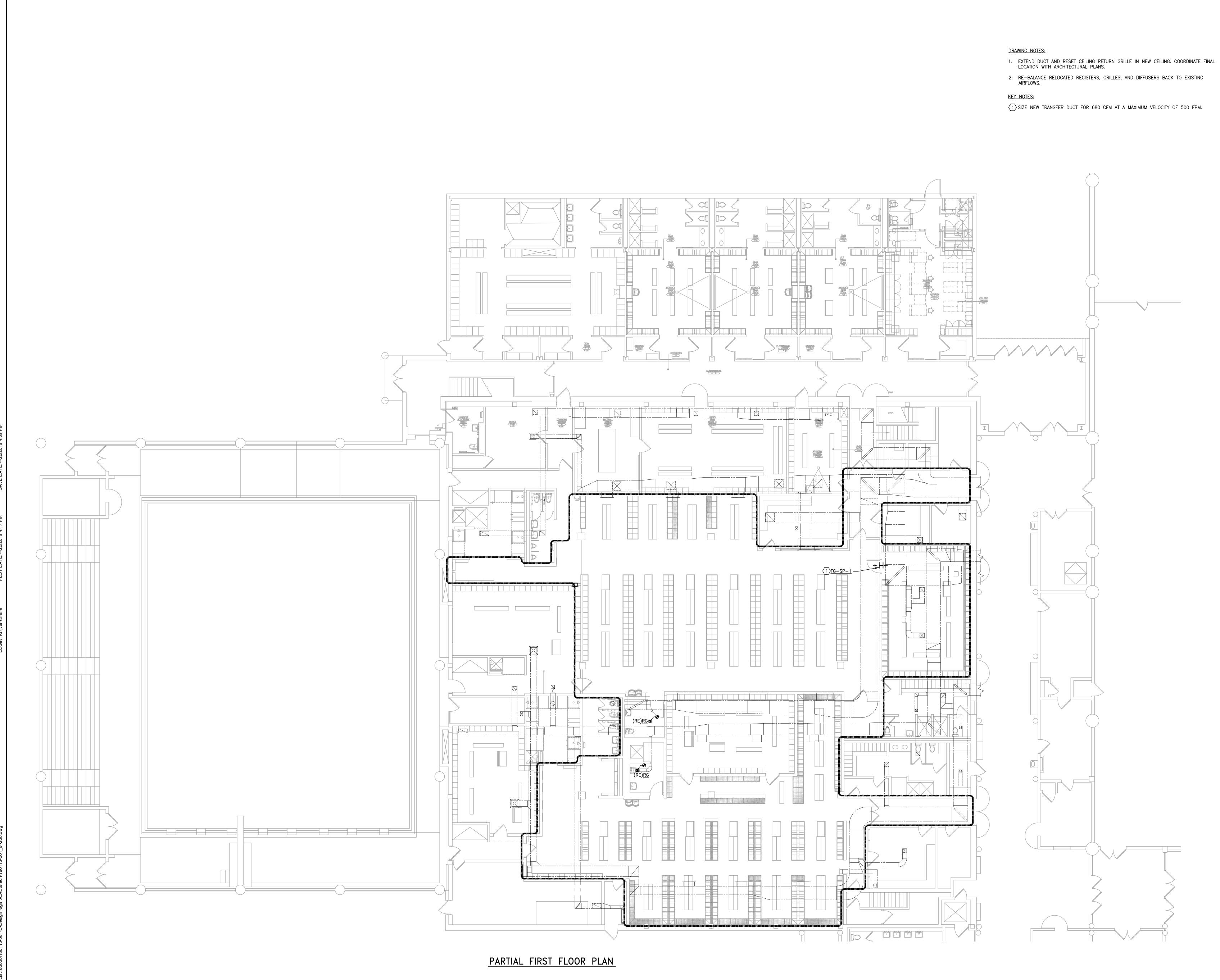


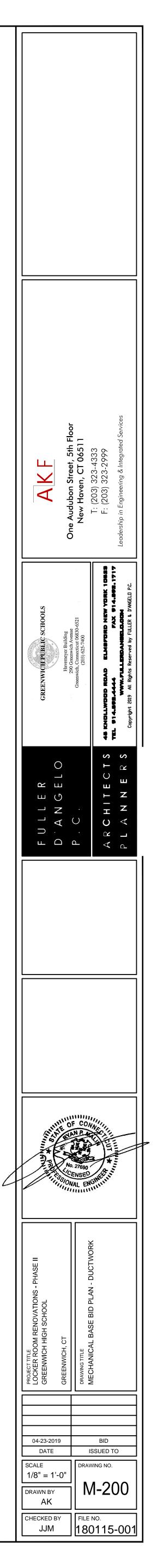


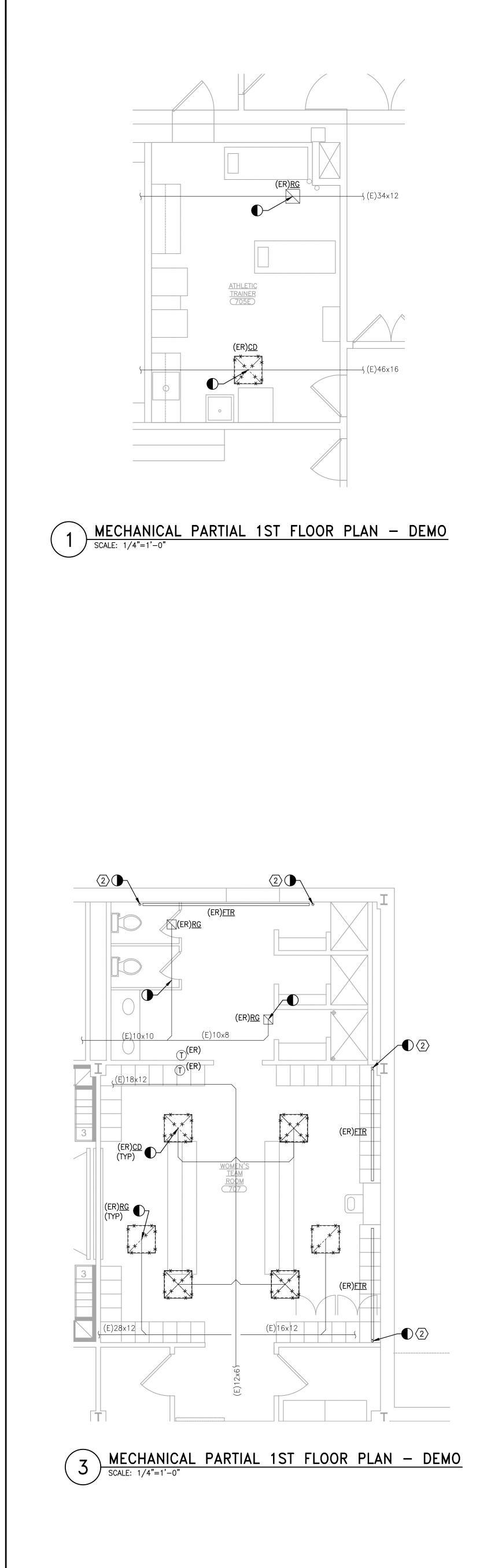
 $\overline{(1)}$ disconnect existing grille from ductwork and remove for future relocation.

- 2. PERFORM PRE-BALANCE TEST TO RECORD EXISTING AIRFLOWS WHEN REMOVING ANY REGISTER, GRILLE, OR DIFFUSER.
- THE MECHANICAL DRAWING SHOWS THE SCOPE OF THE EXISTING MECHANICAL DEMOLITION WORK AND DOES NOT SHOW EVERY DEVICE, PIPE, PAD, WIRE, ETC. TO BE REMOVED.



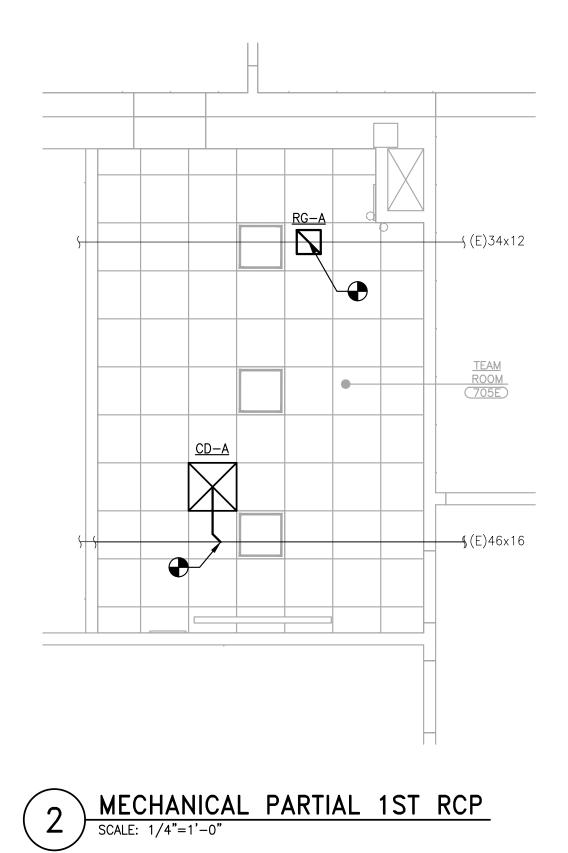


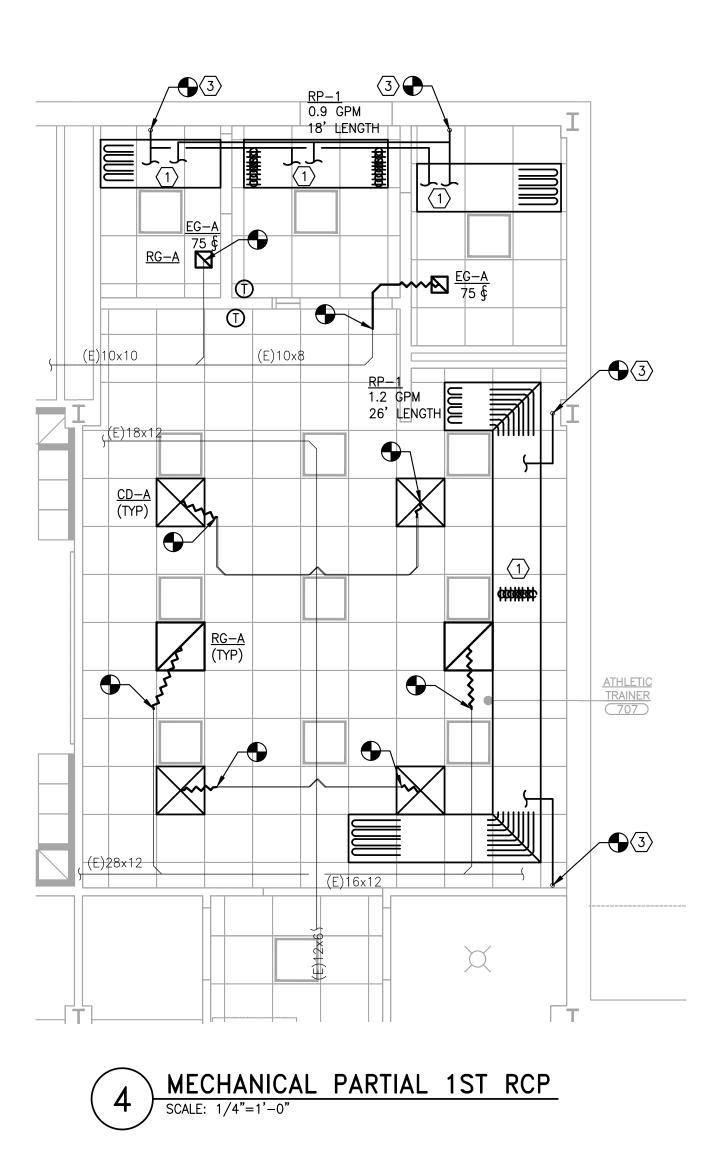




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DRAWING NOTES:

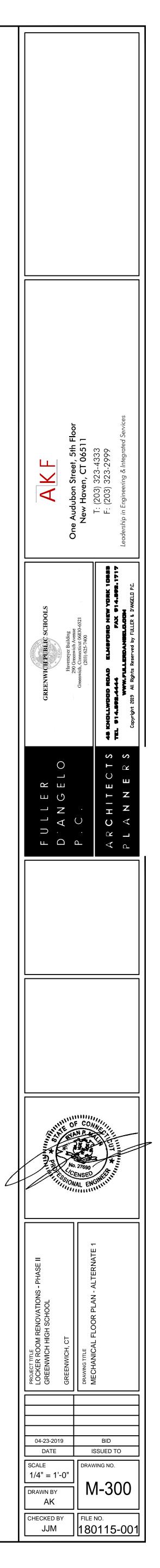
- THE MECHANICAL DRAWING SHOWS THE SCOPE OF THE EXISTING MECHANICAL DEMOLITION WORK AND DOES NOT SHOW EVERY DEVICE, PIPE, PAD, WIRE, ETC. TO BE REMOVED.
- 2. PERFORM PRE-BALANCE TEST TO RECORD EXISTING AIRFLOWS WHEN REMOVING ANY REGISTER, GRILLE, OR DIFFUSER.
- 3. EXTEND DUCT AND RESET CEILING REGISTERS, GRILLES, AND DIFFUSERS IN NEW CEILING. COORDINATE FINAL LOCATION WITH ARCHITECTURAL PLAN.
- 4. RE-BALANCE NEW REGISTERS, GRILLES, AND DIFFUSERS BACK TO EXISTING AIRFLOWS UNLESS NOTED OTHERWISE.

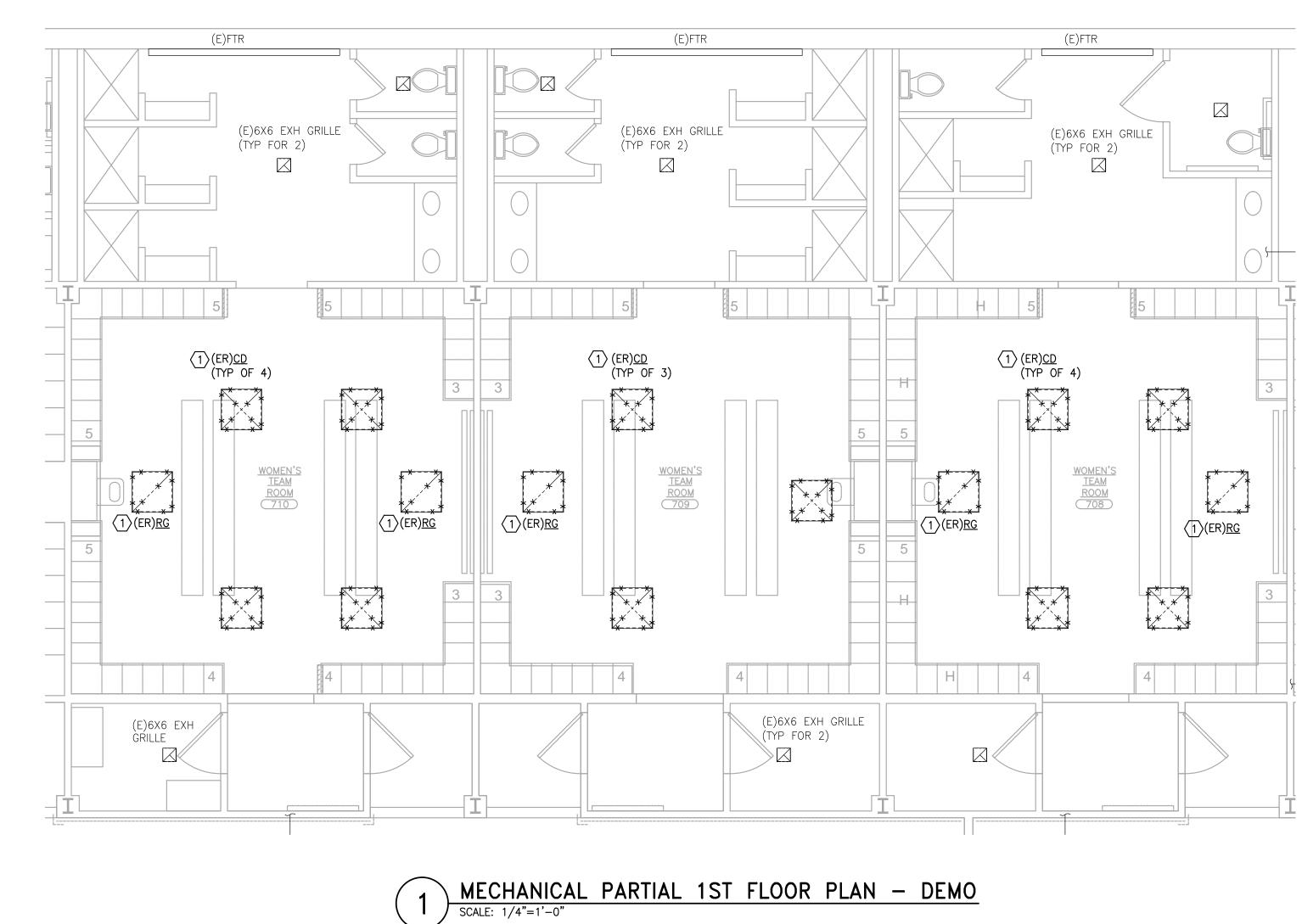
KEY NOTES:

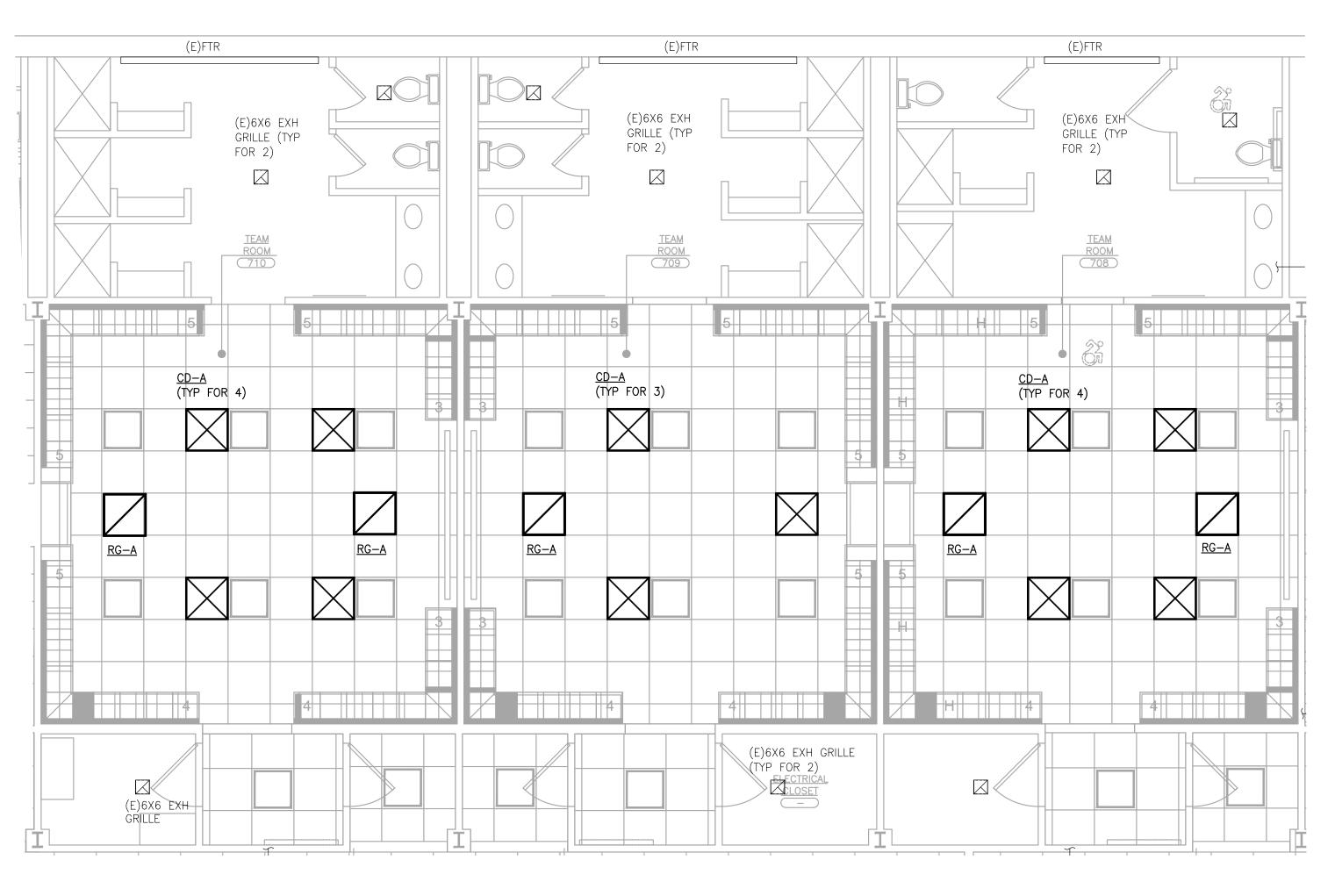
1 INSTALL PIPING PER MANUFACTURER'S REQUIREMENTS. REFER TO RADIANT PANEL DETAIL ON M-500. PROVIDE CONNECTION LOOPS BETWEEN PANEL SECTIONS AS REQUIRED. COORDINATE QUANTITY WITH MANUFACTURER.

 $\langle 2 \rangle$ DISCONNECT HOT WATER PIPING AND PROTECT.

 $\langle 3 \rangle$ EXTEND EXISTING HOT WATER PIPING AS REQUIRED TO <u>RP-1</u>. ROUTE PIPING ABOVE CEILING.







2 MECHANICAL PARTIAL 1ST FLOOR PLAN SCALE: 1/4"=1'-0"

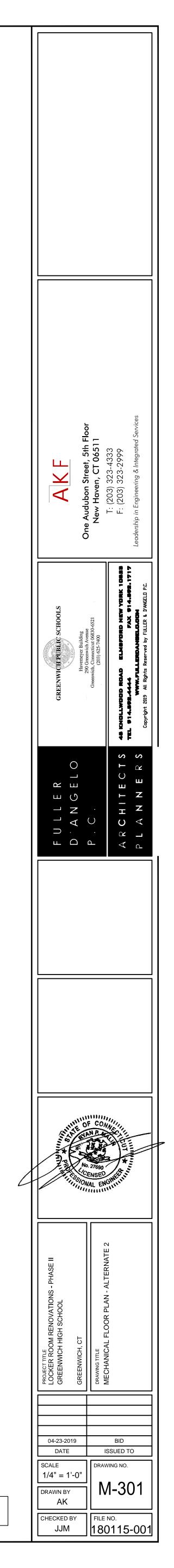
DRAWING NOTES:

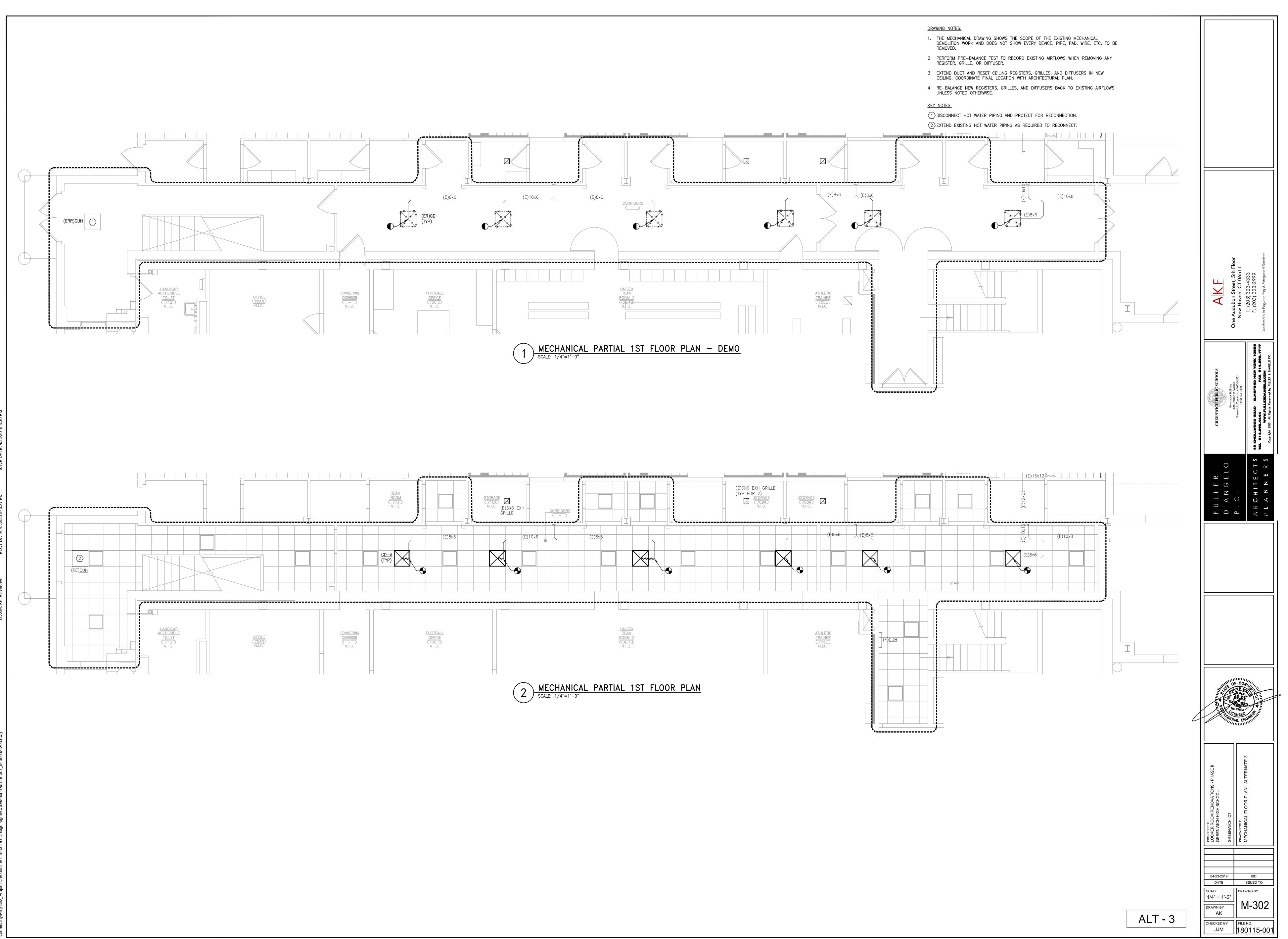
- 1. THE MECHANICAL DRAWING SHOWS THE SCOPE OF THE EXISTING MECHANICAL DEMOLITION WORK AND DOES NOT SHOW EVERY DEVICE, PIPE, PAD, WIRE, ETC. TO BE REMOVED.
- PERFORM PRE-BALANCE TEST TO RECORD EXISTING AIRFLOWS WHEN REMOVING ANY REGISTER, GRILLE, OR DIFFUSER.
- 3. EXTEND FLEX DUCT AS REQUIRED AND RESET CEILING REGISTERS, GRILLES, AND DIFFUSERS IN NEW CEILING. COORDINATE FINAL LOCATION WITH ARCHITECTURAL PLAN.
- 4. RE-BALANCE NEW REGISTERS, GRILLES, AND DIFFUSERS BACK TO EXISTING AIRFLOWS UNLESS NOTED OTHERWISE.

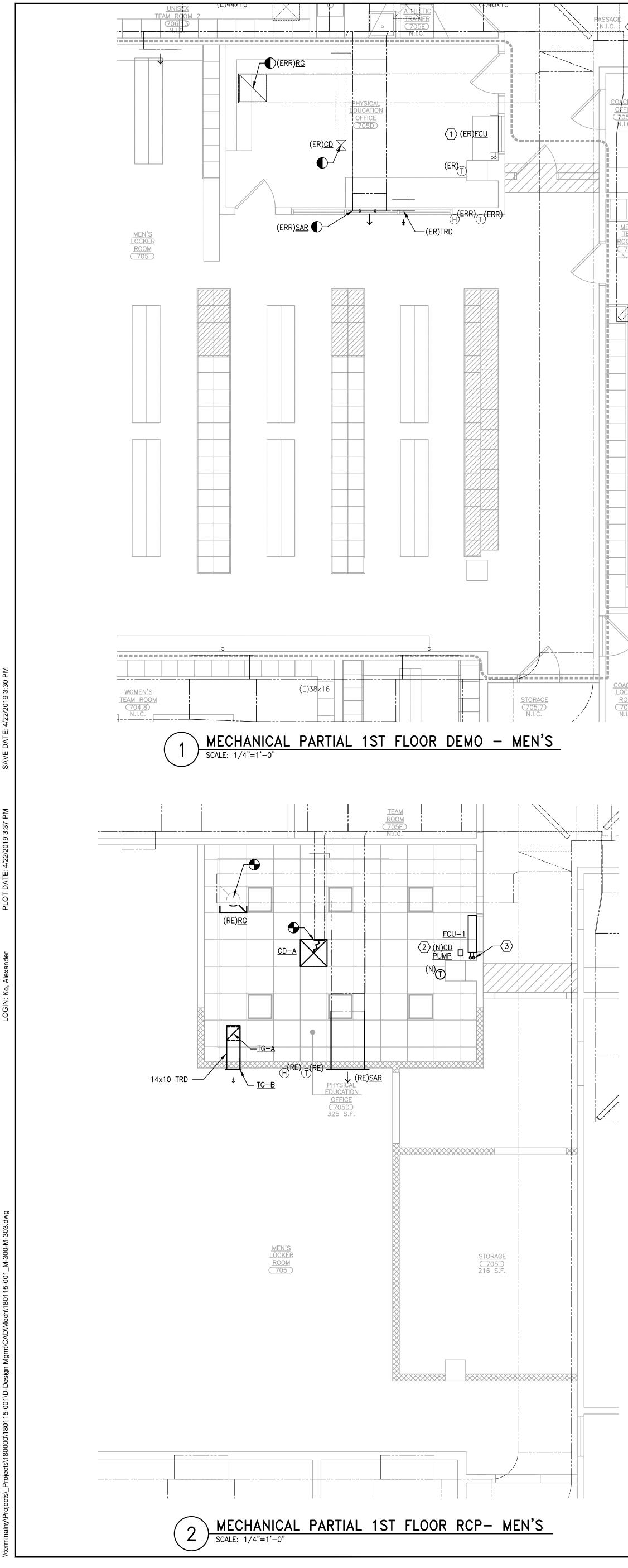
5. REFER TO DETAIL 3/M-300 FOR TYPICAL EXISTING DUCTWORK LAYOUT.

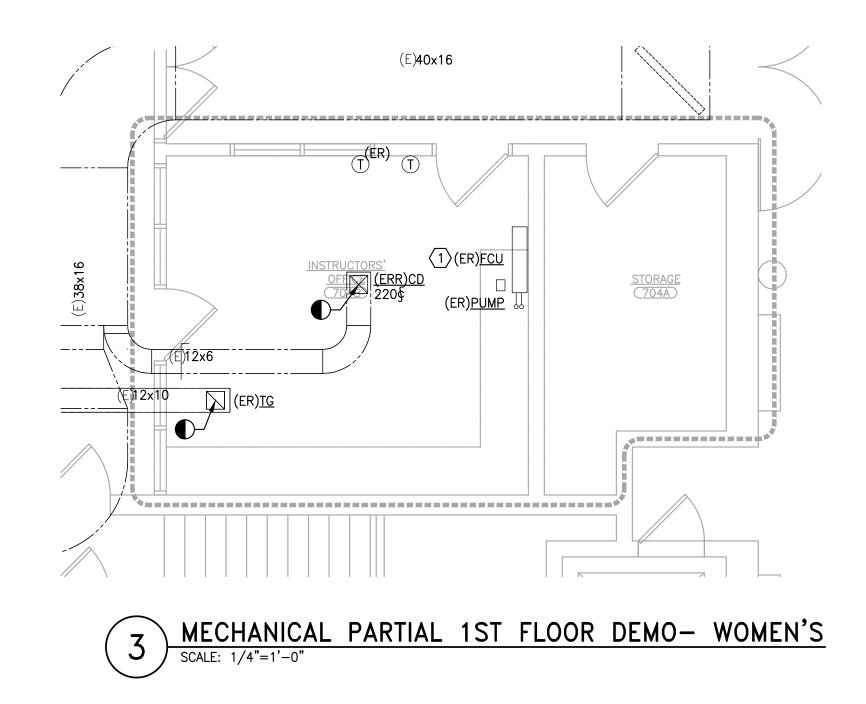
KEY NOTES:

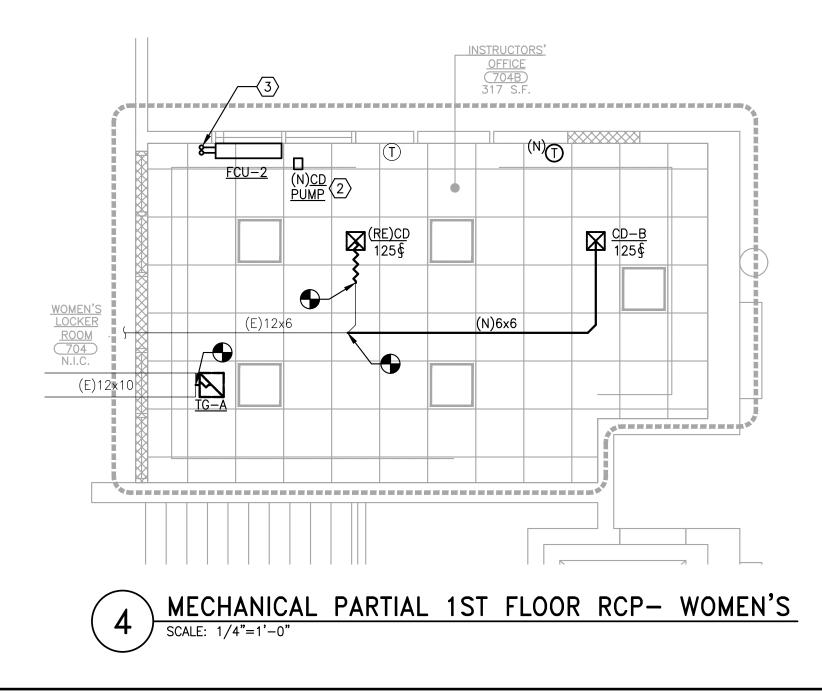
 $\overline{(1)}$ disconnect diffuser, register, or grille from existing duct.

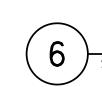


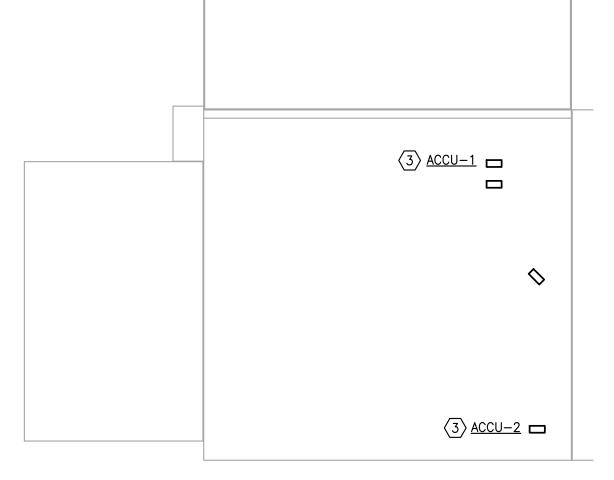




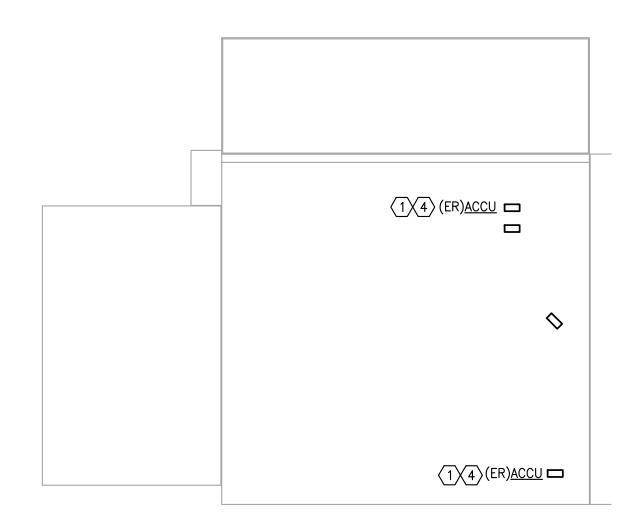












- DETAIL ON SHEET M-500. $\langle 4 \rangle$ demolition limited to the removal of split ac systems serving office 704b AND 705D AS SHOWN ON PLAN. CONTRACTOR TO VERIFY WHICH UNITS SERVE THESE ROOMS BEFORE DEMOLITION AND REPORT DISCREPANCIES TO ENGINEER. CONDENSING
- $\langle 3 \rangle$ ROUTE NEW REFRIGERANT LINES AND WIRING THROUGH EXISTING PENETRATIONS. RESTORE PITCH POCKETS AS REQUIRED. REFER TO ROOF MOUNTED CONDENSING UNIT
- $\langle 1 \rangle$ REMOVE ALL ASSOCIATED ACCESSORIES, WIRING, AND PIPING. VERIFY THE LOCATIONS OF EXISTING PENETRATIONS USED BY THE EXISTING PIPING AND WIRING. $\langle 2 \rangle$ connect to existing condensate drain.

REGISTER, GRILLE, OR DIFFUSER.

UNITS SERVING OTHER AREAS TO REMAIN.

UNLESS NOTED OTHERWISE.

KEY NOTES:

1. THE MECHANICAL DRAWING SHOWS THE SCOPE OF THE EXISTING MECHANICAL DEMOLITION WORK AND DOES NOT SHOW EVERY DEVICE, PIPE, PAD, WIRE, ETC. TO BE REMOVED.

2. RETURN REMOVED CEILING DIFFUSERS, GRILLES, AND REGISTERS BACK TO OWNER.

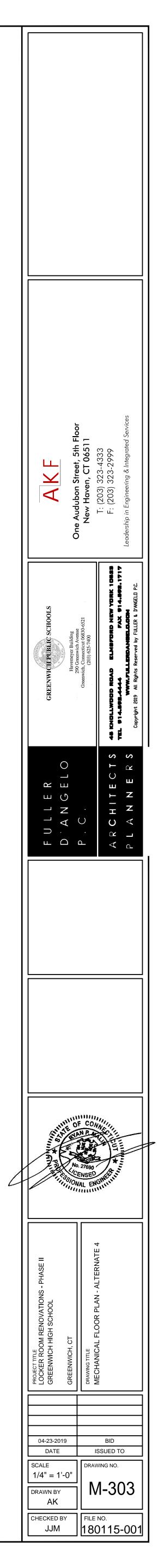
4. EXTEND DUCT AND RESET CEILING REGISTERS, GRILLES, AND DIFFUSERS IN NEW

CEILING. COORDINATE FINAL LOCATION WITH ARCHITECTURAL PLAN.

3. PERFORM PRE-BALANCE TEST TO RECORD EXISTING AIRFLOWS WHEN REMOVING ANY

5. RE-BALANCE NEW REGISTERS, GRILLES, AND DIFFUSERS BACK TO EXISTING AIRFLOWS

DRAWING NOTES:



ALT - 4

| | | | тоти | | | EVAPORATO | R COIL CO | ONDITIONS | | SUPPLY F | N | | ELECTRICAL | DATA | | | UNI | T DIMENSIO | NS | | | | | | | | C | CONDENSING | UNIT | | | | 0010 | UN | IIT DIMENSI | ONS | | |
|--------------------------|-----------------------------------|-------------------------------------|---------------------------|------------------------------|----------------|-------------------|-----------|-------------------------|-------|---------------------------|-------|------|------------|------|------------|------------------------------|----------------|---------------|----------------|-------------------|---------------------------|---------------------------|------------------------------|----------|--------------------------|----------|-------------|---------------|-------------------|------------------------|-----------------|------------------|------|----------------|---------------|----------------|-------------------|---------------|
| AIR HANDLING UNIT No. | LOCATION | SERVICE | TOTAL COOLING (MBH) | SENSIBLE COOLING (MBH) | TOTAL (MBH) | SENSIBLE (MBH) | CFM [| ENT. AIR)B/WB (*F)I | | EXT. SP MC IN. W.G.) H | | ov M | TS PHASE | HZ | AHU FLA | AHU OPER. WEIGHT (LBS) | LENGTH (IN) | WIDTH (IN) | HEIGHT (IN) | MANUF. MODEL # | CONDENSING UNIT No. | TOTAL COOLING (MBH) | SENSIBLE COOLING (MBH) | QUANTITY | COMPRESSOR TYPE LRA/F | LA (EA.) | FAN TYPE | E) CFM (IN | (T. SP . W.G.) | ELECTRICA VOLTS PHA | L DATA SE HZ | COMPRERSS MCA | | LENGTH (IN) | WIDTH (IN) | HEIGHT (IN) | MANUF. MODEL # | REMARKS |
| FCU-1 | PHYSICAL EDUCATION OFFICE 705D | I PHYSICAL EDUCATION OFFICE 705D | 9 | 8.38 | 9 | 8.38 | 338 | 80/67 | 54/53 | - | - - | - 20 | 8 1 | 60 | 0.4 | 18.3 | 32-15/16 | 7-7/16 | 12-1/8 | LG LSN090HSV5 | ACCU-1 | 9 | 8.38 | 1 | - | - | PROP | 1165 | - | 208 1 | 60 | 10 | 74.1 | 30-5/16 | 13-29/32 | 2 21-1/2 | LG LSU090HS\ | 5 SEE NOTES E |
| FCU-2 | INSTRUCTORS' | INSTRUCTORS | 9 | 8.38 | 9 | 8.38 | 338 | 80/67 | 54/53 | _ | | - 20 | 8 1 | 60 | 0.4 | 18.3 | 32-15/16 | 7-7/16 | 12-1/8 | LG LSN090HSV5 | ACCU-2 | 9 | 8.38 | 1 | _ | _ | PROP | 1165 | _ | 208 1 | 60 | 10 | 74.1 | 30-5/16 | 13-29/32 | 2 21 - 1/2 | LG LSU090HS | 5 SEE NOTES E |

RADIANT CEILING PANEL SCHEDULE

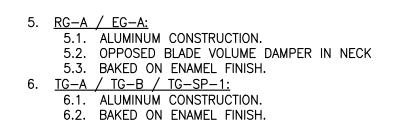
| | | | | | PERFORMAN | ICE DATA | | | | CONSTRUCTION DA | TA | | | |
|------|----------|--------------|-----------|---------|-----------|---------------------------|----------|----------|----------|-----------------|--------|----------------|-----------------|--|
| | ROOM AIR | OUTPUT (BTU) | LENGTH | WIDTH | | WATE | R | | TUBES | | | MANUF. | | |
| TYPE | (*F) DB | SINGLE PANEL | (FT-IN) | (FT-IN) | GPM | PD (FT. H ₂ 0) | EWT (*F) | LWT ('F) | MATERIAL | DIAMETER (IN.) | NUMBER | MODEL # | REMARKS | |
| RP-1 | 70 | 456 | SEE PLANS | 2'-0" | SEE PLANS | - | 180 | 160 | CU | .5" | 8 PASS | AERO TECH RLFM | SEE NOTES BELOW | |
| | | | | | | | | | | | | | | |

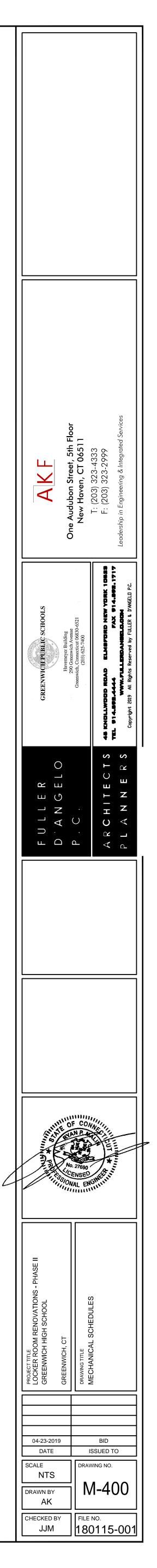
REFER TO PLAN FOR MITER REQUIRED AT CORNER.
 MATCH PANELS TO ACOUSTICAL CEILING TILE. COORDINATE FINISH WITH ARCHITECT.

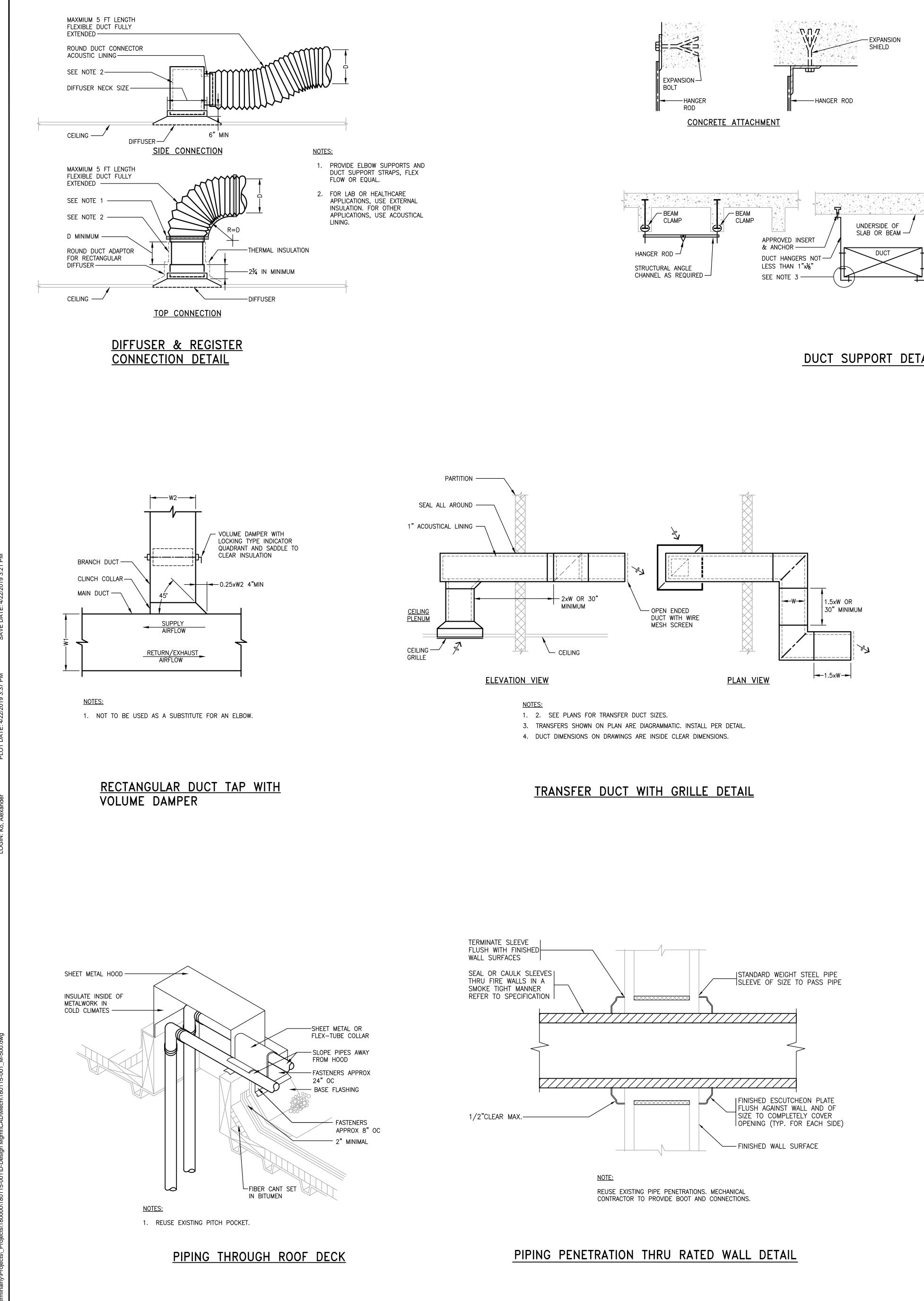
| DESIGNATION | SERVICE | CFM RANGE | MAX NC | TYPE | NECK SIZE (IN.) | NOMINAL OVERALL DIMENSION WxL (IN.) | MANUF. | MODEL | REMARKS |
|-------------|----------|--------------|--------|--------------------|-----------------|--|--------|-------|----------------|
| CD-A | SUPPLY | 0-50 | <10 | CEILING DIFFUSER | 6" DIA. | 24x24 | TITUS | OMNI | SEE NOTES BELO |
| | | 51-175 | <10 | | 8" DIA. | 24x24 | | | |
| | | 176-350 | 16 | | 10" DIA. | 24x24 | | | |
| | | 351-550 | 18 | | 12" DIA. | 24x24 | | | |
| CD-B | SUPPLY | 0-156 | 21 | CEILING DIFFUSER | 6" DIA. | 9x9 | TITUS | OMNI | SEE NOTES BELO |
| | | 157–244 | 24 | | 8" DIA. | 9x9 | | | |
| RG-A | RETURN | 0-95 | <10 | EGG CRATE GRILLE | - | 6x6 | TITUS | 50F | SEE NOTES BELO |
| | | 96-1500 | <10 | | - | 24x24 | | | |
| EG-A | EXHAUST | 0-95 | <10 | LOUVERED GRILLE | - | 6x6 | TITUS | 350FL | SEE NOTES BELO |
| TG-A | TRANSFER | 0-528 | 12 | EGG CRATE GRILLE | _ | 12x12 | TITUS | 50F | SEE NOTES BELO |
| TG-B | TRANSFER | 0-432 | 19 | LOUVERED GRILLE | _ | 12x10 | TITUS | 350FL | SEE NOTES BELO |
| TG-SP-1 | TRANSFER | 0-840 | 16 | SIGHT PROOF GRILLE | _ | 22x22 | TITUS | 45F | SEE NOTES BELO |

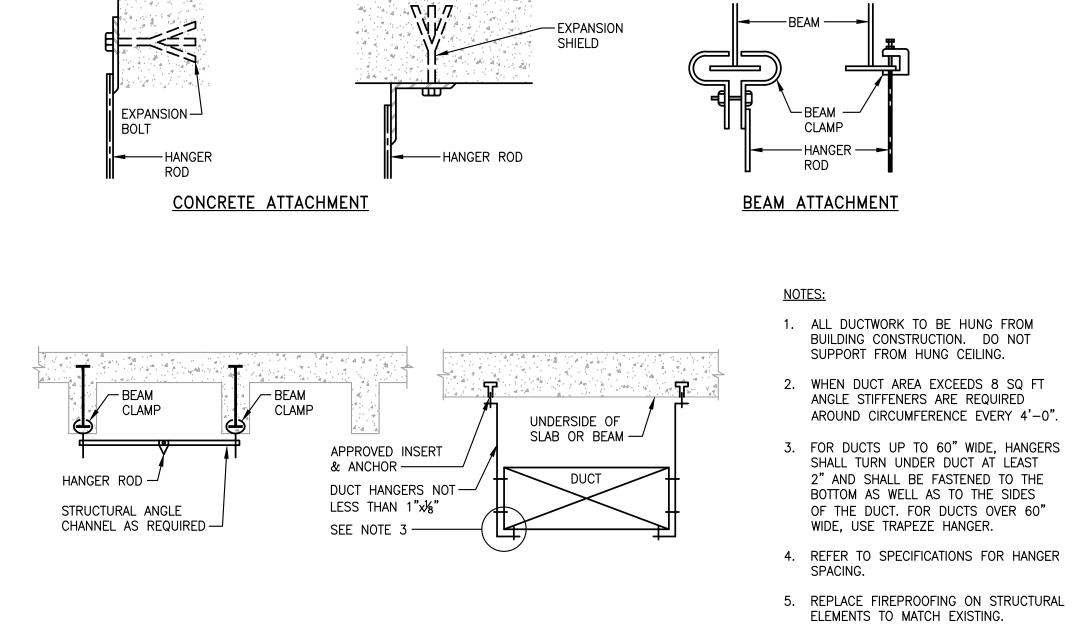
2. ALL FINISH COLORS TO BE SELECTED BY ARCHITECT – SUBMIT COLOR CHART FOR APPROVAL.
 3. LAY-IN BORDER COMPATIBLE WITH CEILING GRID. COORDINATE FINAL MOUNTING WITH ARCHITECT.

4. <u>CD-A / CD-B:</u>
4.1. OPPOSED BLADE VOLUME DAMPER IN NECK.
4.2. BAKED ON ENAMEL FINISH.

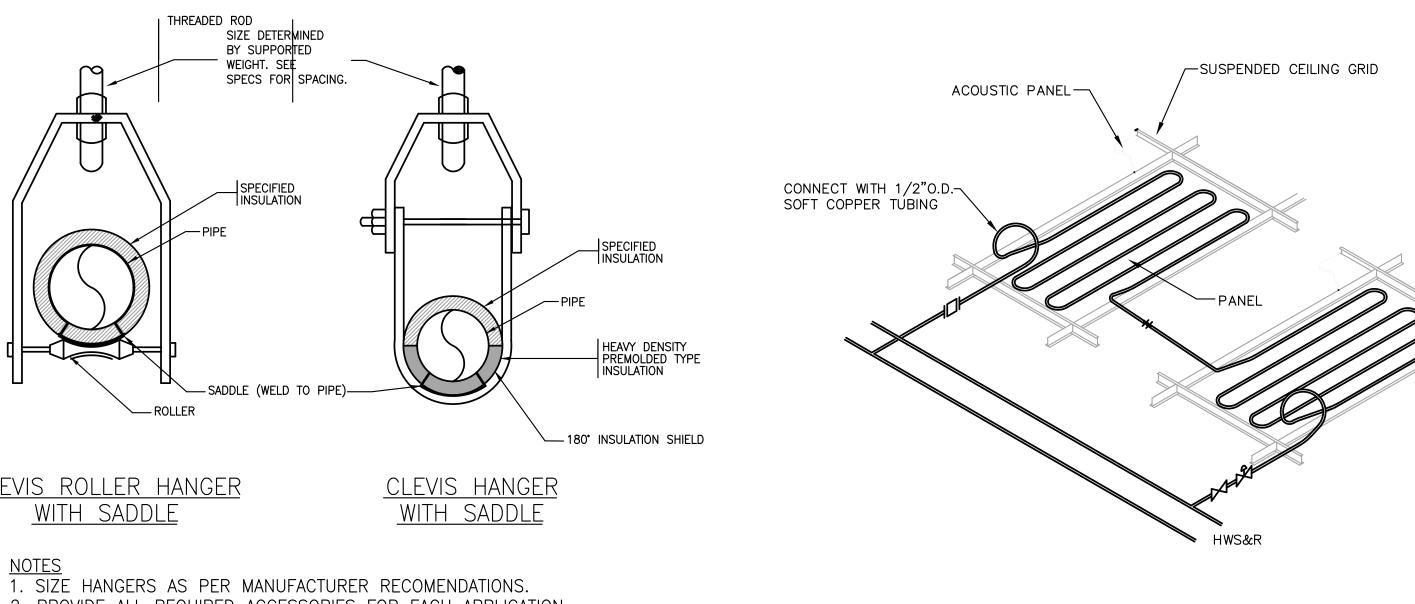








DUCT SUPPORT DETAIL



CLEVIS ROLLER HANGER

2. PROVIDE ALL REQUIRED ACCESSORIES FOR EACH APPLICATION. 3. COMPLY WITH MSS STANDARDS SP-58, SP-69, SP-89, & SP-77.

HVAC PIPE HANGER DETAIL

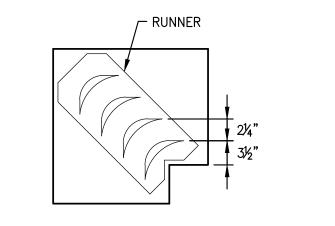
ROOF

EVAPORATOR

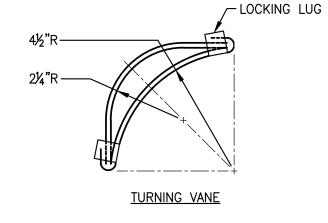
SECTION

NOTES:

-k--



VANED ELBOW

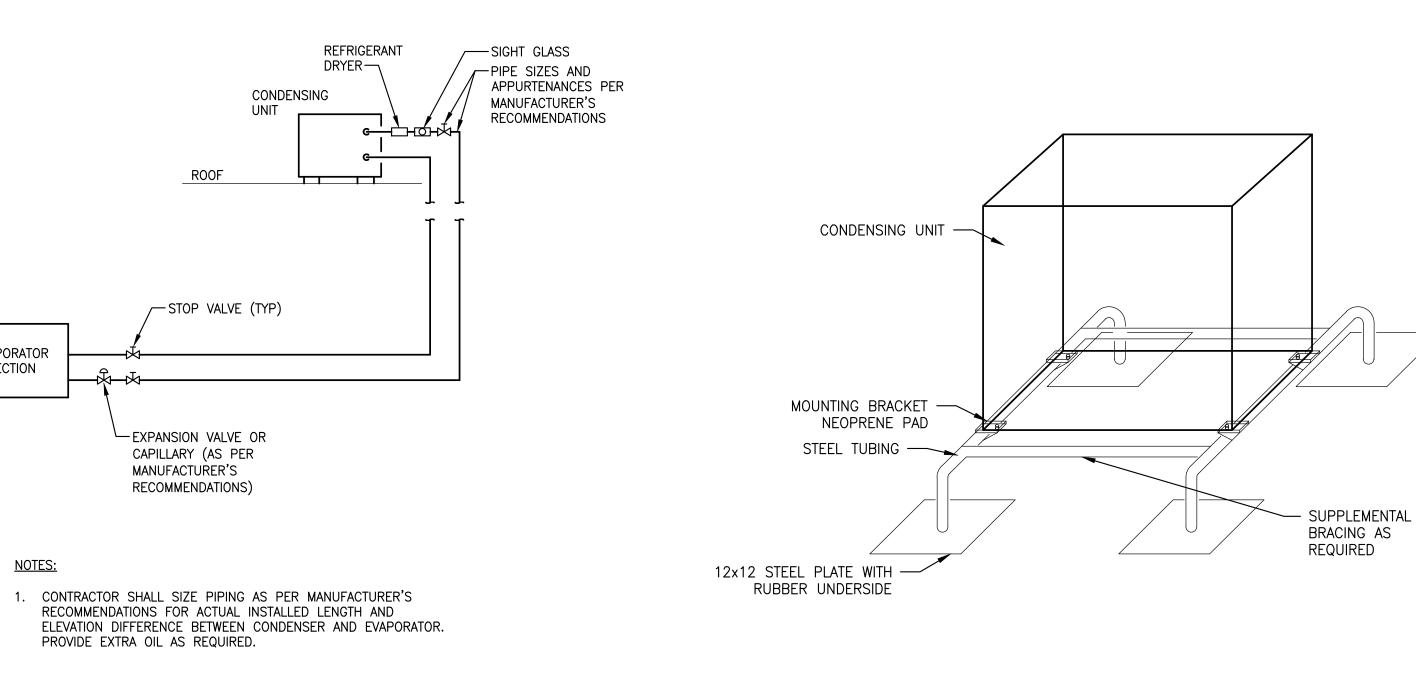


NOTES:

- 1. LOCKING LUGS INTERNAL WITH VANE.
- 2. MAXIMUM UNSUPPORTED VANE LENGTH 48".
- 3. RUNNER BOLTED OR RIVETED TO ELBOW.
- 4. VANES SHALL BE SECURELY FASTENED TO RUNNER.
- 5. VANES AND RUNNER SAME GAUGE AS ELBOW.
- 6. FOR DUCTS WITH EQUAL INLET AND OUTLET DIMENSIONS.

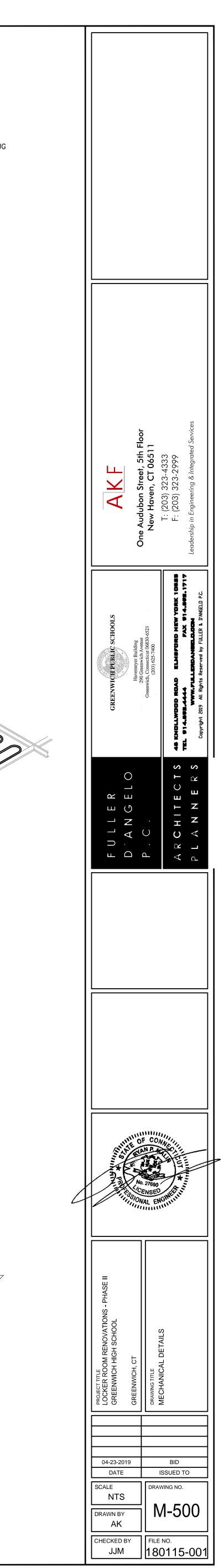
DOUBLE THICKNESS TURNING VANES FOR SQUARE ELBOWS

MODULAR RADIANT PANEL SERIES PIPING



TYPICAL REFRIGERANT PIPING DETAIL

ROOF MOUNTED CONDENSING UNIT



| | CAL SYMBOLS LIST | |
|---|--|----------|
| <u>LIGHTING</u> | | |
| NL ^{'A'} NL ^{'A'} NL 'A' | 2'x4'/2'x2' RECESSED FLUORESCENT CEILING MOUNTED FIXTURE 'A' = FIXTURE TYPE 'a' = CONTROLLED BY SWITCH 'a' NS = NOT SWITCHED NL = NIGHT LIGHT EM = EMERGENCY LIGHT | _ |
| | WALL MOUNTED FLUORESCENT LIGHT FIXTURE 'A' = FIXTURE TYPE 'a' = CONTROLLED BY SWITCH 'a' NL = NIGHT LIGHT | 1 |
| EM 'A' I a | FLUORESCENT STRIP FIXTURE-TYPE AS NOTED 'A' = FIXTURE TYPE 'a' = CONTROLLED BY SWITCH 'a' EM = EMERGENCY BACKUP | |
| `iA' | UNDERCABINET LIGHT FIXTURE 'A' = FIXTURE TYPE | |
| O ^{'A'} | CEILING MOUNTED FIXTURE 'A' = FIXTURE TYPE 'a' = CONTROLLED BY SWITCH 'a' | |
| ۵, A, | SIMILAR TO ABOVE WITH EMERGENCY BACKUP 'A' = FIXTURE TYPE 'a' = CONTROLLED BY SWITCH 'a' | Ē |
| Od _a | WALL MOUNTED LIGHT FIXTURE 'A' = FIXTURE TYPE 'a' = CONTROLLED BY SWITCH 'a' | |
| Â, | SIMILAR TO ABOVE WITH EMERGENCY BACKUP 'A' = FIXTURE TYPE 'a' = CONTROLLED BY SWITCH 'a' | |
| <0 ^{'A'} | ACCENT LIGHT OR WALL WASHER 'A' = FIXTURE TYPE 'a' = CONTROLLED BY SWITCH 'a' | |
| <@` ^{`A`} | SIMILAR TO ABOVE WITH EMERGENCY BACKUP 'A' = FIXTURE TYPE 'a' = CONTROLLED BY SWITCH 'a' | |
| ×, 'X1' | CEILING MOUNTED EXIT LIGHT; TYPE 'X' – DIRECTIONAL ARROWS WHERE INDICATED – SHADED AREAS INDICATE ILLUMINATED FACE/FACES | 0 |
| ∱ € H | WALL MOUNTED EXIT LIGHT; TYPE 'X' – DIRECTIONAL ARROWS WHERE INDICATED – SHADED AREAS INDICATE ILLUMINATED FACE/FACES | _ |
| , _A , | EMERGENCY BATTERY LIGHT UNIT 'A' = FIXTURE TYPE | |
| ⁴₽` 'A' | REMOTE LIGHT HEADS FOR EMERGENCY BATTERY LIGHT UNIT TYPE AS NOTED | <u>S</u> |
| <u>POWER</u> | | |
| Sa | SINGLE POLE SWITCH a = CONTROLLING OUTLET 'a' 2 = DOUBLE POLE 3 = THREE-WAY AD= CALL FOR AID FULL SWITCH D = DOOR K = KEY OPERATED MO = MOMENTARY CONTACT T = TIME SWITCH P = PILOT LIGHT | |
| \$ _T | DISCONNECT SWITCH – TOGGLE TYPE WITH THERMAL OVERLOAD – 277V HP RATED | |
| \$ m | DISCONNECT SWITCH – TOGGLE TYPE MOTOR RATED, 20A, 1P, U.O.N. | |
| os osh T | OCCUPANCY SENSOR, CEILING MOUNTED OCCUPANCY SENSOR, WALL MOUNTED TRANSFORMER 20A, 125V DUPLEX RECEPTACLE – FLUSH WALL MOUNTED | - |
| €a | CONTROLLED FROM WALL SWITCH 'a' 20A, 125V QUADRUPLEX RECEPTACLE – FLUSH WALL | |
| ₩ | MOUNTED 20A, 125V ISOLATED GROUND, DUPLEX RECEPTACLE, FLUSH | • |
| ₩ | FLOOR MOUNTED 20A, 125V DUPLEX RECEPTACLE – FLUSH WALL MOUNTED, | |
| - - - ● | GFI TYPE 20A, 125V EMERGENCY DUPLEX RECEPTACLE – FLUSH WALL MOUNTED | 7 |
| - O | 20A, 125V DUPLEX RECEPTACLE – FLUSH WALL MOUNTED, WITH TWO (2) INTEGRALLY POWERED USB PORTS | |
| -0 | 20A, 125V EMERGENCY DUPLEX RECEPTACLE – FLUSH WALL MOUNTED, WITH TWO (2) INTEGRALLY POWERED USB PORTS | - |
| -⊕ | 20A, 125V QUADRUPLEX RECEPTACLE – FLUSH WALL MOUNTED, WITH FOUR (4) INTEGRALLY POWERED USB PORTS | |

SINGLE RECEPTACLE – FLUSH WALL MOUNTED

FLUSH WALL MOUNTED

MOUNTED

INDICATED

A = TYPE

APPROVED EQUAL.

20A, 125V DUPLEX RECEPTACLE – SURFACE MOUNTED

20A, 125V SURGE SUPRESSION DUPLEX RECEPTACLE -

20A, 125V QUADRUPLEX RECEPTACLE - FLUSH FLOOR

SPECIAL PURPOSE RECEPTACLE – FLUSH WALL MOUNTED

PLUG-IN SURFACE METAL RACEWAY - LETTER INDICATES TYPE – WITH SPECIAL PURPOSE RECEPTACLES WHERE

SIGNALING CFA SERIES, 7007B-N5 OR APPROVED EQUAL.

CALL-FOR-AID PULL CORD SWITCH. CFA SERIES 6537 OR

CALL-FOR-AID STROBE AND BUZZER, BY EDWARDS

20A, 125V DUPLEX RECEPTACLE - FLUSH FLOOR MOUNTED

| | | CONTROL | <u>UNITS (PANELS)</u> |
|-----------------------|--|-----------------|---|
| 1 | HOMERUN-NUMERAL WHERE USED INDICATES CIRCUIT | FACP | FIRE ALARM CONTROL PANEL |
| 5, 1 | NUMBER FOR REFERENCE ONLY. 2#12+1#12G-3/4"C FOR ONE CKT. HOMERUN, U.O.N | | FIRE ALARM DATA GATHERING PANEL |
| | 4#12+1#12G-3/4"C FOR TWO CKT. HOMERUN, U.O.N 6#12+1#12G-3/4"C FOR THREE CKT. HOMERUN, U.O. | ۰. (۲۰۰۰) | FIRE ALARM ANNUNCIATOR |
| → ¹ | HOMERUN – NUMERAL WHERE USED INDICATES CIRCUIT NUMBER FOR REFERENCE ONLY | | |
| ک | UNFUSED DISCONNECT SWITCH SWITCH AMPS/# OF POLES, VOLTAGE RATING AS REQUIR | | NITIATING DEVICE & ACTIVATION |
| ю/з Р | FUSED DISCONNECT SWITCH; SWITCH AMPS/FUSE AMPS/ # OF POLES, VOLTAGE RATING AS REQUIRED | | INTRAINE DEVICE & ACTIVATION |
| 60 | ENCLOSED CIRCUIT BREAKER TRIP AMPS/# OF POLES, VOLTAGE RATING AS REQUIRED NA = NON-AUTOMATIC | , XX | MANUAL STATION – PULL STATION/FIRE ALARM BOX, 'XX' DENOTES TYPE: CO2 = CARBON DIOXIDE |
| | SURFACE MOUNTED LIGHTING PANELBOARD | | DC = DRY CHEMICAL HL = HALON |
| | FLUSH MOUNTED LIGHTING PANELBOARD | | F = FIRE ALARM FO = FOAM |
| 2 | SURFACE MOUNTED POWER PANELBOARD | | WC = WET CHEMICAL CA = CLEAN AGENT |
| | FLUSH MOUNTED POWER PANELBOARD | | WM = WATER MIST DL = DELUGE FIRE SPRINKLER |
| \square | SURFACE MOUNTED POWER DISTRIBUTION PANELBOARD | | PRE = PREACTION |
|) | CEILING MOUNTED JUNCTION BOX | Œ | HEAT DETECTOR/SENSOR (THERMAL DETECTION) ORIENTATION NOT TO BE CHANGED |
| H ' | FLUSH WALL MOUNTED JUNCTION | Έxx | HEAT DETECTOR/SENSOR, 'XX' DENOTES TYPE: |
| | FLUSH FLOOR MOUNTED JUNCTION BOX | | R/F = COMBINATION RATE OF RISE/FIXED TEMPERATURE R/C = RATE COMPENSATION |
| | PULLBOX | | F = FIXED TEMPERATURE R = RATE OF RISE ONLY |
| Р | POWER POLE | a | SMOKE DETECTOR/SENSOR, 'XX' DENOTES TYPE: |
| —— X — | EXISTING CONDUIT TO BE REMOVED | SXX | AS = AIR SAMPLING P = PHOTOELECTRIC |
| | EXISTING CONDUIT/EQUIPMENT TO REMAIN | | I = IONIZATION R = RELAY BASE |
| | NEW CONCEALED CONDUIT | | SS = SINGLE STATION SB = SOUNDER BASE |
| | CONDUIT TURNING UP | | ID = IN DUCT |
| | CONDUIT TURNING DOWN | | |
| 0 | CONDUIT STUB-UP WITH FLEXIBLE EQUIPMENT CONNECTION | <u>NOTIFICA</u> | TION APPLIANCES SYMBOLS |
| - C | FLEXIBLE EQUIPMENT CONNECTION | Xxx | NOTIFICATION APPLIANCE SUBSCRIPTS ('XX') WP = WEATHERPROOF |
| —₃ GLE L | LINE DIAGRAM | | WG = WIRE GUARD H = HIGH AUDIBLE SETTING L = LOW AUDIBLE SETTING C = CEILING MOUNT nW = WATTAGE SETTING (n = SPEAKER TAP) P = PENDENT SL = SIGNAL LIGHT |
| | | | RI = REMOTE INDICATOR |
| | 2460V POWER TRANSFORMER 120/208 VOLTAGES, WINDINGS AND SIZE AS INDICATED | X CD | VISIBLE ONLY (STROBE) – WALL MOUNT CD = CANDELA RATING/SETTING |
| | MOTOR GROUND CONNECTION | X | COMBINATION SPEAKER/VISIBLE CD = CANDELA RATING/SETTING C = CEILING MOUNT |
| 90/3 | | | |
| | 90 AMP TRIP / # OF POLES | <u>RELATED</u> | EQUIPMENT |
| | LT = LONG TIME SETTING ST = SHORT TIME SETTING | DH | DOOR HOLDER |
| | I = INSTANTANEOUS SETTING | 0 | JUNCTION BOX |
| | PANEL-BOARD, 100A, 208/120V, 3PH, 4W | C | |

SI

| 1 | 4#12+1#12G-3/4"C FOR TWO CKT. HOMERUN, U.O.N. 6#12+1#12G-3/4"C FOR THREE CKT. HOMERUN, U.O.N. | FAA | FIRE ALARM ANNUNCIATOR |
|----------------------------------|--|------------------------|--|
| 1 | HOMERUN — NUMERAL WHERE USED INDICATES CIRCUIT NUMBER FOR REFERENCE ONLY | | |
| 50/3 | UNFUSED DISCONNECT SWITCH SWITCH AMPS/# OF POLES, VOLTAGE RATING AS REQUIRED | SIGNAL II | NITIATING DEVICE & ACTIVATION |
| 00/60/3 | FUSED DISCONNECT SWITCH; SWITCH AMPS/FUSE AMPS/ # OF POLES, VOLTAGE RATING AS REQUIRED | <u>SWITCH</u> | ATTATING DEVICE & ACTIVATION |
| 00/60 CB | ENCLOSED CIRCUIT BREAKER TRIP AMPS/# OF POLES, VOLTAGE RATING AS REQUIRED NA = NON-AUTOMATIC | XX | MANUAL STATION – PULL STATION/FIRE ALARM BOX, 'XX' DENOTES TYPE: CO2 = CARBON DIOXIDE |
| | SURFACE MOUNTED LIGHTING PANELBOARD | | DC = DRY CHEMICAL HL = HALON |
| | FLUSH MOUNTED LIGHTING PANELBOARD | | F = FIRE ALARM FO = FOAM |
| | SURFACE MOUNTED POWER PANELBOARD | | WC = WET CHEMICAL CA = CLEAN AGENT WM = WATER MIST |
| | FLUSH MOUNTED POWER PANELBOARD | | MM = WATER MISTDL = DELUGE FIRE SPRINKLERPRE = PREACTION |
| | SURFACE MOUNTED POWER DISTRIBUTION PANELBOARD | _ | HEAT DETECTOR/SENSOR (THERMAL DETECTION) ORIENTATION |
| \bigcirc | CEILING MOUNTED JUNCTION BOX | Æ | NOT TO BE CHANGED |
| Ū ∙Ū | FLUSH WALL MOUNTED JUNCTION | Hxx | HEAT DETECTOR/SENSOR, 'XX' DENOTES TYPE: R/F = COMBINATION RATE OF RISE/FIXED TEMPERATURE |
| | FLUSH FLOOR MOUNTED JUNCTION BOX | | R/C = RATE COMPENSATION F = FIXED TEMPERATURE |
| | PULLBOX POWER POLE | | R = RATE OF RISE ONLY |
| — р — х х - | EXISTING CONDUIT TO BE REMOVED | Sxx | SMOKE DETECTOR/SENSOR, 'XX' DENOTES TYPE: AS = AIR SAMPLING |
| | EXISTING CONDUIT/EQUIPMENT TO REMAIN | | P = PHOTOELECTRIC I = IONIZATION |
| | NEW CONCEALED CONDUIT | | R = RELAY BASE SS = SINGLE STATION |
| | CONDUIT TURNING UP | | SB = SOUNDER BASE ID = IN DUCT |
| | CONDUIT TURNING DOWN | | |
| 2-0 | CONDUIT STUB-UP WITH FLEXIBLE EQUIPMENT CONNECTION | NOTIFICA | TION APPLIANCES SYMBOLS |
| \sim | FLEXIBLE EQUIPMENT CONNECTION | ∇ | NOTIFICATION APPLIANCE SUBSCRIPTS ('XX') |
| 3 | CAPPED CONDUIT | ∑ xx | $ \begin{array}{llllllllllllllllllllllllllllllllllll$ |
| NGLE | LINE DIAGRAM | | SL = SIGNAL LIGHT RI = REMOTE INDICATOR |
| ^և ՃՎ | 120/208 POWER TRANSFORMER 120/208 VOLTAGES, WINDINGS AND SIZE AS INDICATED | X ^{CD} | VISIBLE ONLY (STROBE) – WALL MOUNT CD = CANDELA RATING/SETTING |
| (| MOTOR | X | COMBINATION SPEAKER/VISIBLE |
| — — | GROUND CONNECTION | | CD = CANDELA RATING/SETTING C = CEILING MOUNT |
| 90 | CIRCUIT BREAKER – MOLDED CASE TYPE 90 AMP TRIP / # OF POLES | RELATED | EQUIPMENT |
| | LT = LONG TIME SETTING ST = SHORT TIME SETTING I = INSTANTANEOUS SETTING | DH | DOOR HOLDER |
| | T = INSTANTANEOUS SETTING PANEL-BOARD, 100A, 208/120V, 3PH, 4W | \bigcirc | JUNCTION BOX |

VOICE/DATA/P.A.

| ▼ #/# | VOICE & DATA OUTLET LOCATION WITH $3/4$ " CONDUIT TERMINATED IN A 90 DEG. BEND 6" INTO NEAREST ACCESSIBLE CEILING #/# = # OF VOICE JACKS / $#$ OF DATA JACKS |
|--------------|--|
| ▼# | VOICE OUTLET LOCATION WITH $3/4$ " CONDUIT TERMINAT A 90 DEG. BEND 6" INTO NEAREST ACCESSIBLE CEILIN P = PUBLIC F = FAX W = WALL MOUNTED 48"AFF # = NUMBER OF JACKS |
| ♥# | DATA OUTLET LOCATION WITH $3/4$ " CONDUIT TERMINATE A 90 DEG. BEND 6" INTO NEAREST ACCESSIBLE CEILIN # = NUMBER OF JACKS |
| P/L | COMBINATION CLOCK AND PUBLIC ADDRESS SPEAKER. |

-

-**O**_A

Sad

ABBREVIATIONS

TA JACKS

TERMINATED IN BLE CEILING

TERMINATED IN BLE CEILING

| + | SPECIAL MOUNTING HEIGHT. COORDINATE |
|------------|--|
| т | LOCATION WITH ARCHITECTURAL ELEVATIONS |
| | |
| 1P | SINGLE POLE |
| 2P | TWO POLE |
| | |
| 3P | THREE POLE |
| A | AMPERE |
| | |
| AFF | ABOVE FINISHED FLOOR |
| AIC | AMPERE INTERRUPTING CAPACITY |
| | |
| ATS | AUTOMATIC TRANSFER SWITCH |
| AWG | AMERICAN WIRE GAUGE |
| | |
| BLDG | BUILDING |
| CAB | CABINET |
| 0 | |
| С | CONDUIT |
| СВ | CIRCUIT BREAKER |
| CCTV | CLOSED CIRCUIT TELEVISION |
| CCTV | |
| СКТ | CIRCUIT |
| CLG | CEILING |
| CLG | CLILING |
| CTL | CONTROL |
| CONN | CONNECTED |
| | |
| CONT | CONTINUATION |
| CU | COPPER |
| | |
| DEG | DEGREE |
| •C | DEGREE CELSIUS |
| | |
| •F | DEGREE FAHRENHEIT |
| DIA | DIAMETER |
| | |
| DISC | DISCONNECT |
| DIV | DIVISION |
| | |
| DN | DOWN |
| DP | DISTRIBUTION PANEL BOARD |
| | |
| DWG | DRAWING |
| (E) | EXISTING TO REMAIN |
| | |
| EA | EACH |
| EC | ELECTRICAL CONTRACTOR |
| | |
| ELEC | ELECTRICAL |
| EM | EMERGENCY |
| | |
| EQUIP | EQUIPMENT |
| (ER) | EXISTING TO BE REMOVED |
| | |
| (ERR) | EXISTING TO BE REMOVED & RELOCATED |
| EXIST,EX | EXISTING |
| | FIRE ALARM |
| FA | FIRE ALARM |
| FACP | FIRE ALARM CONTROL PANEL |
| FAP | FIRE ALARM ANNUNCIATOR PANEL |
| I AF | |
| FDR | FEEDER |
| FIXT | FIXTURE |
| | |
| FL | FLOOR |
| FLA | FULL LOAD AMPERES |
| | TOLL LOAD AMILENES |
| FLEX | FLEXIBLE |
| FLUOR | FLUORESCENT |
| FLOOR | |
| G | GROUND |
| GEN | GENERATOR |
| | |
| GFI | GROUND FAULT INTERRUPTER |
| HP | HORSE POWER |
| | |
| HZ | HERTZ |
| IG | ISOLATED GROUND |
| | |
| INCAND | INCANDESCENT |
| JB | JUNCTION BOX |
| | |
| KCMIL | THOUSAND CIRCULAR MILS |
| κv | KILOVOLT |
| | |
| KVA | KILOVOLT AMPERE |
| KW | KILOWATT |
| | |
| KWH | KILOWATT HOUR |
| LTG | LIGHTING |
| | |
| МСВ | MAIN CIRCUIT BREAKER |
| МСС | MOTOR CONTROL CENTER |
| MDP | MAIN DISTRIBUTION PANEL |
| | |
| MH | MANHOLE |
| MLO | MAIN LUG ONLY |
| | |
| MTD | MOUNTED |
| N | NEUTRAL |
| | |
| NC | NORMALLY CLOSED |
| NIC | NOT IN CONTRACT |
| | |
| NO | NORMALLY OPEN |
| NTS | NOT TO SCALE |
| Р | POLE |
| | |
| PB | PULL BOX |
| ø | PHASE |
| | |
| PNL | PANEL |
| PWR | POWER |
| | |
| (RE) | RELOCATED EXISTING |
| RECEPT,REC | RECEPTACLE |
| | |
| (RRO) | EXISTING TO BE REMOVED AND RETURN |
| | TO OWNER |
| SCHED,SCH | SCHEDULE |
| | |
| | SPECIFICATION |
| SPKR | SPEAKER |
| SW | SWITCH |
| | |
| SYS | SYSTEMS |
| | TRANSFORMER |
| , | |
| | |
| UON | UNLESS OTHERWISE NOTED |
| | UNLESS OTHERWISE NOTED |
| UON V | |
| | UNLESS OTHERWISE NOTED |

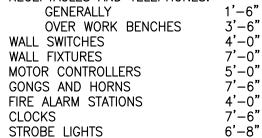
ELECTRICAL DEMOLITION NOTES

- THE CONTRACTOR SHALL INCLUDE IN THEIR BID ALL COSTS ASSOCIATED WITH REMOVALS AND RELOCATIONS OF ELECTRICAL WORK AS DESCRIBED IN THE SPECIFICATIONS WITH ALLOWANCES FOR EXPECTED OR UNFORESEEN DIFFICULTIES WHEN CONCEALED WORK HAS BEEN OPENED. NO CLAIMS FOR ADDITIONAL WORK ASSOCIATED WITH DEMOLITION WILL BE ACCEPTED, EXCEPT IN CERTAIN CASES CONSIDERED JUSTIFIABLE BY THE ARCHITECT.
- 2. THE CONTRACTOR SHALL REMOVE AND/OR RELOCATE ALL EXISTING ELECTRICAL WORK WHICH INTERFERES WITH THE NEW ARCHITECTURAL AND ELECTRICAL LAYOUTS IN FULL COORDINATION WITH THE ARCHITECT'S DEMOLITION PLANS. ALL SYSTEMS WHICH ARE NO LONGER REQUIRED TO FUNCTION SHALL BE DE-ENERGIZED AND DISCONNECTED AT THE SOURCE OF POWER SUPPLY.
- THE CONTRACTOR SHALL PERFORM DEMOLITION AND REMOVAL WORK WITH MINIMUM INTERFERENCE WITH FUNCTIONING ELECTRICAL SYSTEMS. ALL AFFECTED SYSTEMS SHALL BE RECONNECTED AND RESTORED.
- 4. DEMOLITION AND REMOVAL WORK SHALL BE PERFORMED IN A NEAT AND WORKMANLIKE MANNER. THE CONTRACTOR SHALL PATCH, REPAIR OR OTHERWISE RESTORE ANY DAMAGED INTERIOR OR EXTERIOR BUILDING SURFACE TO ITS ORIGINAL CONDITION.
- 5. THE CONTRACTOR SHALL REMOVE ALL ELECTRICAL OUTLETS, SWITCHES AND OTHER DEVICES, COMPLETE WITH ASSOCIATED WIRING, CONDUITS, ETC., FROM PARTITIONS THAT ARE TO BE REMOVED. WHERE THE REMOVAL OF THESE ITEMS DISRUPTS EXISTING WIRING THAT IS TO REMAIN, THE CONTRACTOR SHALL INSTALL JUNCTION BOXES AND OTHER DEVICES AND PROVIDE BYPASS CONNECTIONS NECESSARY TO MAKE CIRCUITS AFFECTED CONTINUOUS AND READY FOR OPERATION. OTHERWISE, WIRING SHALL BE REMOVED BACK TO THE NEAREST ELECTRICAL JUNCTION BOX THAT IS TO REMAIN OR TO PANELBOARD.
- 6. ALL RACEWAYS WHICH BECOME EXPOSED DURING THE ALTERATION WORK SHALL BE REMOVED AND REROUTED CONCEALED BEHIND FINISHED SURFACES.
- 7. ALL UNUSED OUTLET BOXES OR CAPPED FLOOR OUTLETS SHALL BE PROVIDED WITH MATCHING BLANK COVERS.
- 8. EXISTING PANEL DIRECTORIES AFFECTED BY THE ALTERATION WORK SHALL BE MODIFIED TO REFLECT THE BRANCH CIRCUIT WIRING CHANGES.
- 9. PORTIONS OF FEEDER RUNS TO BE REMOVED OR ABANDONED AS A RESULT OF DEMOLITION WORK, BUT WHICH ARE REQUIRED TO REMAIN ENERGIZED, SHALL BE CUT AT CONVENIENT LOCATIONS, REROUTED AND RECONNECTED, NEW FEEDER EXTENSIONS SHALL MATCH EXISTING ONES IN ALL RESPECTS, CABLE TYPE, CONDUCTOR AMPACITY, CONDUIT SIZES, ETC.
- 10. THE CONTRACTOR SHALL NOTIFY THE OWNER AT THE APPROPRIATE TIME OF THE PROJECTED DEMOLITION AND PHASING SCHEDULE SO THAT REMOVAL OR RELOCATION OF AFFECTED UTILITIES MAY BE CARRIED OUT IN COORDINATION WITH THE PROJECT REQUIREMENTS. THE CONTRACTOR SHALL FOLLOW CLOSELY THE ARCHITECT'S DEMOLITION AND PHASING SCHEDULE AND PROCEED IN THE SPECIFIED SEQUENCE.
- 11. ALL EXISTING MATERIAL AND EQUIPMENT IN USABLE CONDITION, WHICH IS TO BE REMOVED UNDER THIS CONTRACT, SHALL REMAIN THE PROPERTY OF THE OWNER OR SHALL BE DISPOSED OF BY THE ELECTRICAL CONTRACTOR, AS DIRECTED BY THE OWNER.
- 12. ARRANGE TO WORK CONTINUOUSLY, INCLUDING OVER TIME, IF REQUIRED, TO ASSURE THAT SYSTEMS WILL BE SHUT DOWN ONLY DURING THE TIME ACTUALLY REQUIRED TO MAKE THE NECESSARY CONNECTIONS TO THE EXISTING SYSTEMS.
- 13. THE SHUTDOWN OF EXISTING BUILDING ELECTRICAL SERVICES SHALL BE COORDINATED WITH THE OWNER. MAKE ARRANGEMENTS AT LEAST 5 BUSINESS DAYS PRIOR TO A SHUTDOWN.

ELECTRICAL GENERAL NOTES

- 1. GENERAL NOTES, SYMBOL LIST AND DETAILS ARE APPLICABLE TO ALL ELECTRICAL DRAWINGS.
- 2. ALL WORK IS NEW UNLESS OTHERWISE NOTED.
- AND WORK. FOLLOW DRAWINGS IN LAYING OUT WORK AND CHECK DRAWINGS OF OTHER TRADES TO VERIFY SPACE CONDITIONS. MAINTAIN HEADROOM AND SPACE CONDITIONS.
- 4. SECURE ALL SUPPORTS TO BUILDING STRUCTURE UTILIZING TOGGLE BOLTS (HOLLOW MASONRY), EXPANSION SHIELDS OR INSERTS (CONCRETE AND BRICK), MACHINE SCREWS (METAL), BEAM CLAMPS (FRAMEWORK), WOOD SCREWS (WOOD) OR PAN THRU STRAPS (METAL DECK). NAILS, RAWL PLUGS AND WOOD PLUGS ARE NOT PERMITTED. WHERE REQUIRED BY STRUCTURE, PROVIDE THRU BOLTS AND FISH PLATES. SUPPORT HORIZONTAL RUNS OF METALLIC RACEWAYS NOT MORE THAN 10 FT APART. SUPPORT RACEWAY RISERS AT EACH FLOOR LEVEL. RUN EXPOSED RACEWAYS PARALLEL WITH OR AT RIGHT ANGLES TO WALLS.
- 5. PASS RACEWAYS OVER WATER, STEAM OR OTHER PIPING WHEN PULL BOXES ARE NOT REQUIRED. NO RACEWAY WITHIN 3 INCHES OF STEAM OR HOT WATER PIPES OR APPLIANCES (EXCEPT PIPE CROSSINGS WHERE RACEWAY SHALL BE AT LEAST 1 INCH FROM PIPE COVERS).
- 6. CUT CONDUIT ENDS SQUARE. REAM SMOOTH. PAINT MALE THREAD OF FIELD THREADED RACEWAYS WITH GRAPHITE BASE PIPE COMPOUND. DRAW UP TIGHT WITH RACEWAY COUPLING.
- 7. HORIZONTAL OR CROSS RUNS IN PARTITIONS AND WALLS ARE NOT PERMITTED. DO NOT RUN CONDUIT IN PRECAST ROOF SLABS, IN 2 INCH SLABS OR IN TERRAZZO FLOOR FINISH.
- 8. LEAVE WIRES WITH SUFFICIENT SLACK TO PERMIT MAKING FINAL CONNECTIONS. RACEWAYS OVER 10 FT LONG IN WHICH WIRING IS NOT INSTALLED: FURNISH FISH WIRF
- 9. SET BOXES SQUARE AND TRUE WITH BUILDING FINISH. ERECT WALL AND SWITCH OUTLETS IN ADVANCE OF FURRING AND FIREPROOFING. SECURE TO BUILDING STRUCTURE BY ADJUSTABLE STRAP IRONS.
- 10. VERIFY LOCATIONS OF OUTLETS AND SWITCHES IN FINISHED ROOMS WITH ARCHITECTURAL DRAWINGS OF INTERIOR DETAILS AND FINISH. IN CENTERING OUTLETS AND LOCATING BOXES AND OUTLETS, ALLOW FOR OVERHEAD PIPES, DUCTS AND MECHANICAL EQUIPMENT, VARIATIONS IN FIREPROOFING AND PLASTERING, WINDOW AND DOOR TRIM, PANELING, HUNG CEILINGS AND THE LIKE. CORRECT ANY INACCURACY RESULTING FROM FAILURE TO DO SO WITHOUT EXPENSE TO OWNER.
- 11. LOCATIONS INDICATED FOR LOCAL WALL SWITCHES ARE SUBJECT TO MODIFICATIONS AT OR NEAR DOORS. COORDINATE WITH ARCHITECT AND INSTALL SWITCH ON SIDE OPPOSITE HINGE. VERIFY FINAL HINGE LOCATIONS IN FIELD PRIOR TO SWITCH OUTLET INSTALLATION.
- 12. COVERS OF JUNCTION AND PULLBOXES SHALL BE READILY ACCESSIBLE. 13. PROVIDE PULLBOXES WHERE INDICATED, WHERE REQUIRED BY CODE AND WHEREVER NECESSARY TO FACILITATE PULLING OF WIRE. COORDINATE PULLBOX LOCATIONS WITH OTHER TRADES.
- 14. EMPTY RACEWAY RUNS: PROVIDE PULLBOXES EVERY 100 FT AND AS INDICATED. COORDINATE LOCATIONS WITH OTHER TRADES.
- 15. JUNCTION AND PULLBOXES: LOCATE GENERALLY NOT EXPOSED IN FINISHED SPACES. WHERE NECESSARY, REROUTE RACEWAYS OR MAKE OTHER ARRANGEMENTS FOR
- 16. SUPPORT PANEL, JUNCTION AND PULLBOXES INDEPENDENTLY TO BUILDING
- STRUCTURE WITH NO WEIGHT BEARING ON RACEWAYS. 17. ALL ACCESS DOOR LOCATIONS SHALL BE REVIEWED BY ARCHITECT PRIOR TO
- 18. CONNECT CONDUIT TO MOTOR CONDUIT TERMINAL BOXES WITH FLEXIBLE CONDUIT (MINIMUM 18 IN. LENGTH AND 50% SLACK). DO NOT TERMINATE IN OR FASTEN
- RACEWAYS TO MOTOR FOUNDATION. 19. PROVIDE 2#14 INDICATING PILOT LIGHT WIRES FROM PILOT LIGHT IN CONTROLLER TO LOAD SIDE OF DISCONNECT SWITCH. RUN WIRES IN BRANCH CIRCUIT CONDUIT AND INCREASE CONDUIT SIZE AS REQUIRED.
- 20. PULL NO THERMOPLASTIC WIRES AT TEMPERATURES LOWER THAN 32°F (OC). PROVIDE CABLE SUPPORTS FOR WIRE IN RISER CONDUITS AS REQUIRED BY CODE.
- 21. PROVIDE SEPARATE RACEWAYS FOR CONDUCTORS OF NORMAL AND EMERGENCY CIRCUITS. COMMON BOXES: PROVIDE BARRIERS BETWEEN EMERGENCY AND NORMAL WIRING.

22. HEIGHTS OF OUTLETS FROM FINISHED FLOOR TO CENTERLINE OF OUTLET: RECEPTACLES AND TELEPHONES: 1'-6"



CONCEALMENT.

INSTALLATION.

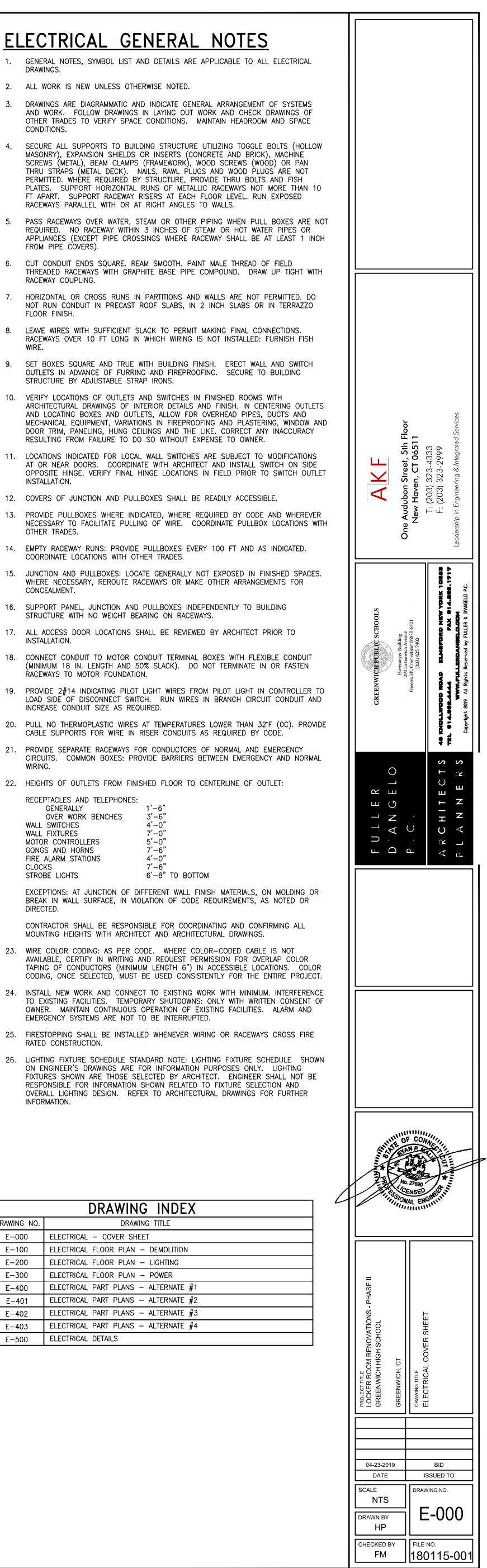
| 0 0 | | |
|-------|----|--------|
| 4'-0" | | |
| 7'-0" | | |
| 5'-0" | | |
| 7'-6" | | |
| 4'-0" | | |
| 7'-6" | | |
| 6'-8" | то | BOTTOM |
| ~ 0 | 10 | DOTION |

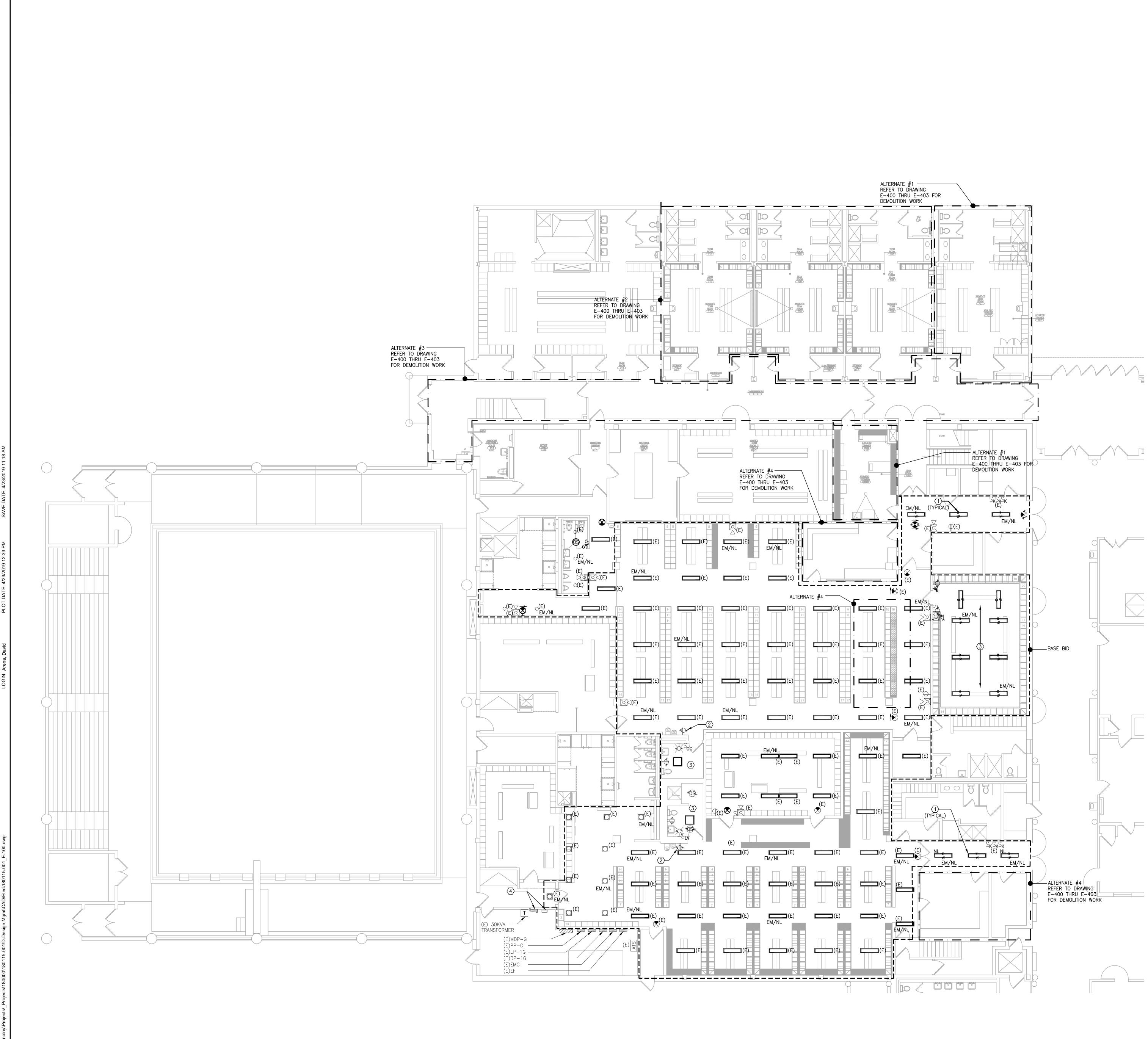
EXCEPTIONS: AT JUNCTION OF DIFFERENT WALL FINISH MATERIALS, ON MOLDING OR BREAK IN WALL SURFACE, IN VIOLATION OF CODE REQUIREMENTS, AS NOTED OR DIRECTED.

CONTRACTOR SHALL BE RESPONSIBLE FOR COORDINATING AND CONFIRMING ALL MOUNTING HEIGHTS WITH ARCHITECT AND ARCHITECTURAL DRAWINGS.

- 23. WIRE COLOR CODING: AS PER CODE. WHERE COLOR-CODED CABLE IS NOT AVAILABLE, CERTIFY IN WRITING AND REQUEST PERMISSION FOR OVERLAP COLOR TAPING OF CONDUCTORS (MINIMUM LENGTH 6") IN ACCESSIBLE LOCATIONS. COLOR CODING, ONCE SELECTED, MUST BE USED CONSISTENTLY FOR THE ENTIRE PROJECT.
- 24. INSTALL NEW WORK AND CONNECT TO EXISTING WORK WITH MINIMUM. INTERFERENCE TO EXISTING FACILITIES. TEMPORARY SHUTDOWNS: ONLY WITH WRITTEN CONSENT OF OWNER. MAINTAIN CONTINUOUS OPERATION OF EXISTING FACILITIES. ALARM AND EMERGENCY SYSTEMS ARE NOT TO BE INTERRUPTED.
- 25. FIRESTOPPING SHALL BE INSTALLED WHENEVER WIRING OR RACEWAYS CROSS FIRE RATED CONSTRUCTION. 26. LIGHTING FIXTURE SCHEDULE STANDARD NOTE: LIGHTING FIXTURE SCHEDULE SHOWN
- ON ENGINEER'S DRAWINGS ARE FOR INFORMATION PURPOSES ONLY. LIGHTING FIXTURES SHOWN ARE THOSE SELECTED BY ARCHITECT. ENGINEER SHALL NOT BE RESPONSIBLE FOR INFORMATION SHOWN RELATED TO FIXTURE SELECTION AND OVERALL LIGHTING DESIGN. REFER TO ARCHITECTURAL DRAWINGS FOR FURTHER INFORMATION.

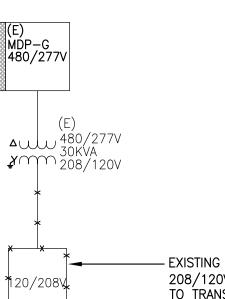
| | DRAWING INDEX |
|-------------|--------------------------------------|
| DRAWING NO. | DRAWING TITLE |
| E-000 | ELECTRICAL – COVER SHEET |
| E-100 | ELECTRICAL FLOOR PLAN - DEMOLITION |
| E-200 | ELECTRICAL FLOOR PLAN - LIGHTING |
| E-300 | ELECTRICAL FLOOR PLAN – POWER |
| E-400 | ELECTRICAL PART PLANS – ALTERNATE #1 |
| E-401 | ELECTRICAL PART PLANS – ALTERNATE #2 |
| E-402 | ELECTRICAL PART PLANS – ALTERNATE #3 |
| E-403 | ELECTRICAL PART PLANS – ALTERNATE #4 |
| E-500 | ELECTRICAL DETAILS |

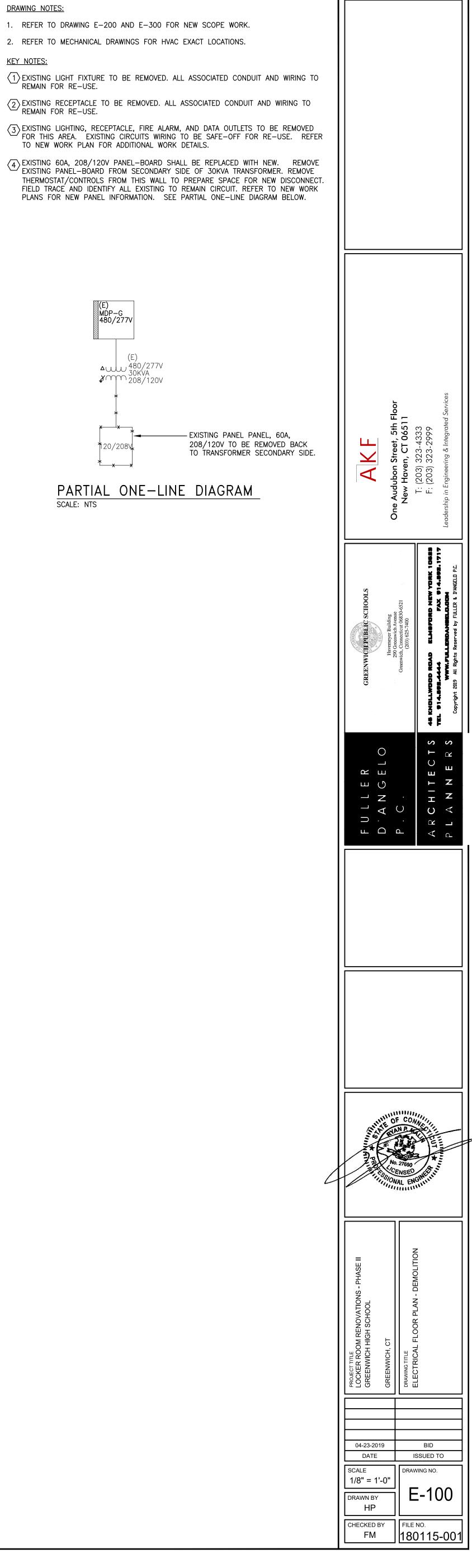


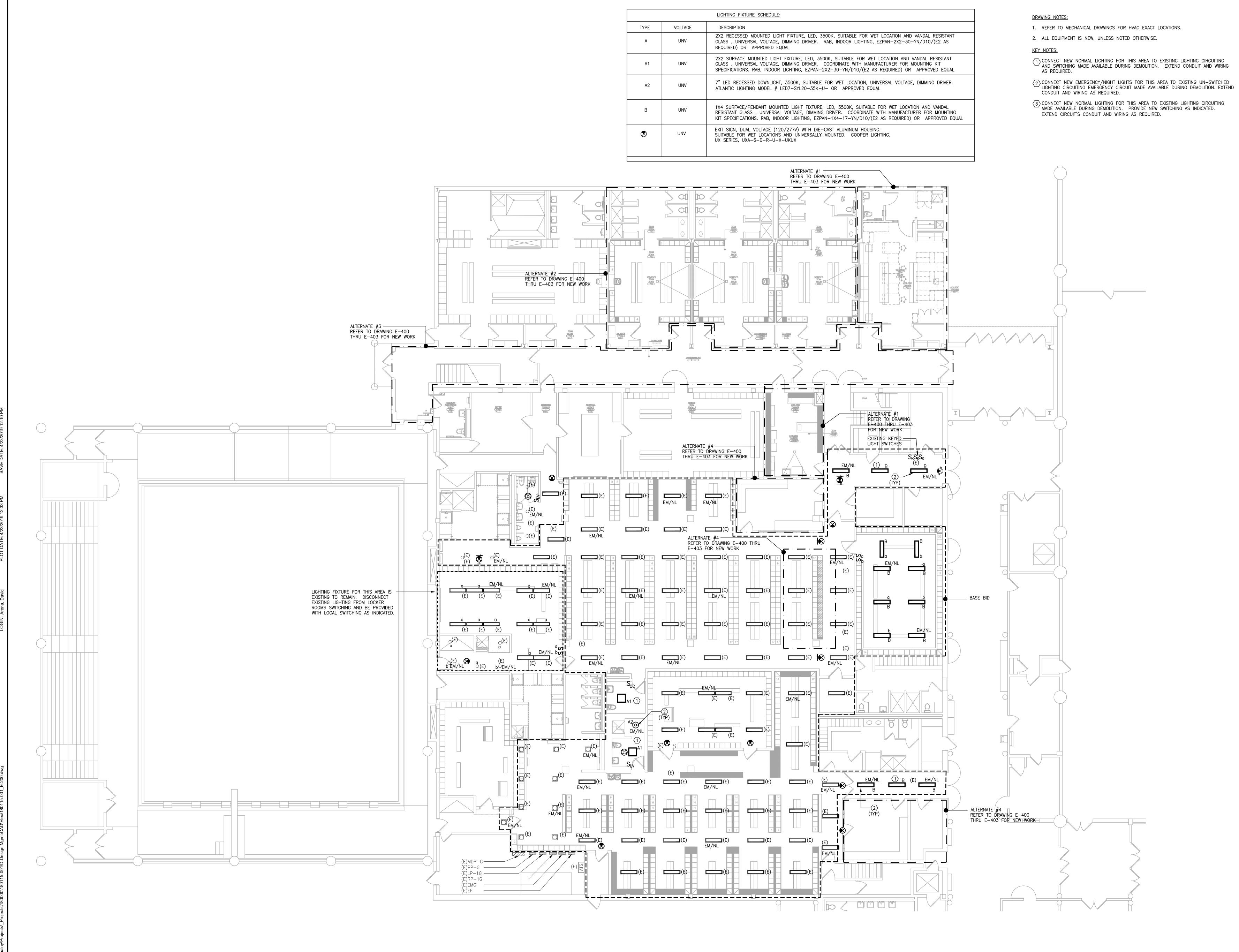


DRAWING NOTES:

- 1. REFER TO DRAWING E-200 AND E-300 FOR NEW SCOPE WORK. 2. REFER TO MECHANICAL DRAWINGS FOR HVAC EXACT LOCATIONS.
- KEY NOTES:
- ~ REMAIN FOR RE-USE.
- TO NEW WORK PLAN FOR ADDITIONAL WORK DETAILS.

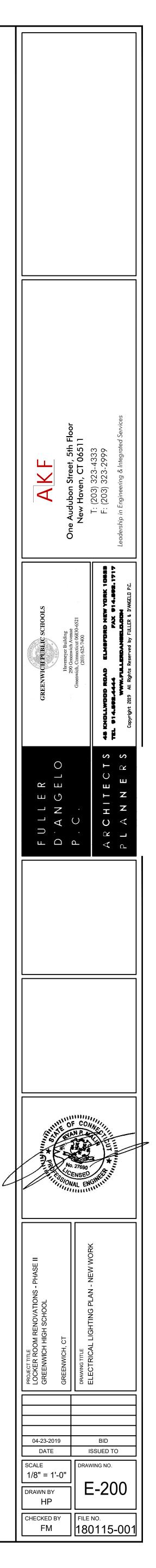






| LIGHTING | FIXTURE | SCHEDULE: |
|----------|---------|-----------|

| TYPE | VOLTAGE | DESCRIPTION |
|--------------|---------|---|
| A | UNV | 2X2 RECESSED MOUNTED LIGHT FIXT GLASS , UNIVERSAL VOLTAGE, DIMMI REQUIRED) OR APPROVED EQUAL |
| A1 | UNV | 2X2 SURFACE MOUNTED LIGHT FIXTU GLASS , UNIVERSAL VOLTAGE, DIMMI SPECIFICATIONS. RAB, INDOOR LIGHT |
| A2 | UNV | 7"LED RECESSED DOWNLIGHT, 3500 ATLANTIC LIGHTING MODEL # LED7-5 |
| В | UNV | 1X4 SURFACE/PENDANT MOUNTED LI RESISTANT GLASS , UNIVERSAL VOLT. KIT SPECIFICATIONS. RAB, INDOOR LI |
| \bigotimes | UNV | EXIT SIGN, DUAL VOLTAGE (120/277 SUITABLE FOR WET LOCATIONS AND UX SERIES, UXA-6-D-R-U-X-UKU〉 |
| | | |



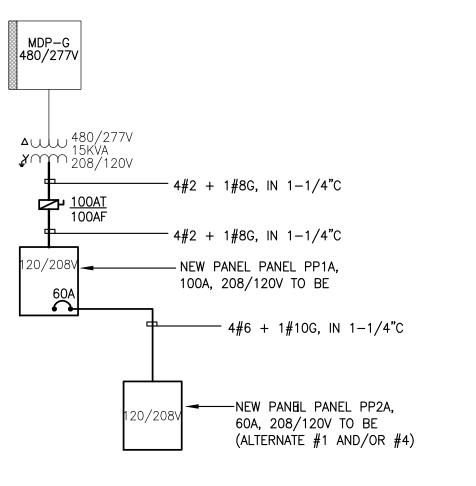


CIRCUIT ABBREVIATION:

PA#1 = ELECTRICAL PANEL PP1A#1

DRAWING NOTES:

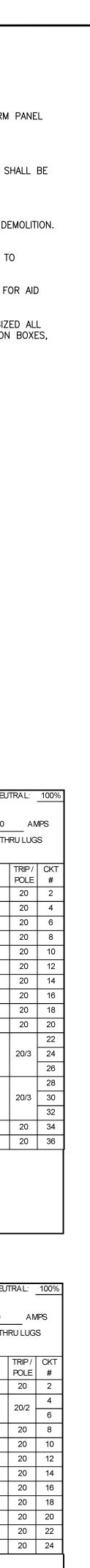
- 1. REFER TO MECHANICAL DRAWINGS FOR HVAC EXACT LOCATIONS.
- 2. EXISTING FIRE ALARM SYSTEM IS BY NOTIFIER. MODIFY EXISTING FIRE ALARM PANEL AS REQUIRED TO ACCOMMODATE NEW FIRE ALARM DEVICES.
- 3. ALL EQUIPMENT IS NEW, UNLESS NOTED OTHERWISE.
- 4. ALL NEW CONDUITS SHALL BE LOCATED IN WALL CAVITY. NO NEW CONDUIT SHALL BE EXPOSED OVER TILED AREAS
- <u>KEY NOTES:</u> (1) NEW RECEPTACLE. CONNECT TO EXISTING CIRCUIT MADE AVAILABLE AFTER DEMOLITION. EXTEND CONDUIT AND WIRING AS REQUIRED.
- $\langle 2 \rangle$ NEW FIRE ALARM DEVICE TO MATCH EXISTING BUILDING SYSTEM. CONNECT TO NEAREST FIRE ALARM CIRCUIT.
- 3 NEW CALL-FOR-AID SYSTEM BY EDWARDS SIGNALING, CFA SERIES. CALL FOR AID SHALL INCLUDE PULL CORD SWITCH AND BUZZER/STROBE.
- 4 PROVIDE NEW ELECTRICAL PANEL SAME LOCATION OF EXISTING. RE-ENERGIZED ALL EXISTING TO REMAIN CIRCUITS FROM NEW PANEL BOARD. PROVIDE JUNCTION BOXES, CONDUIT, AND WIRING AS REQUIRED.

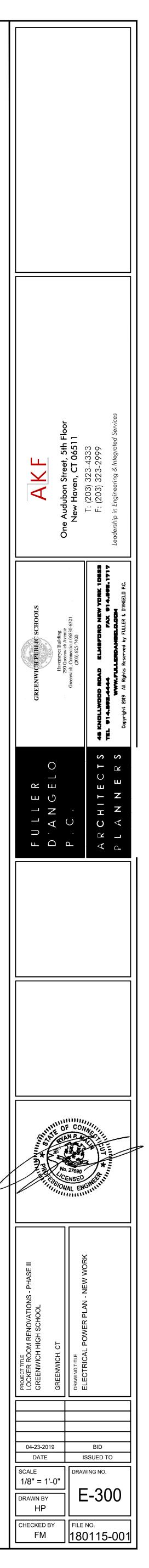


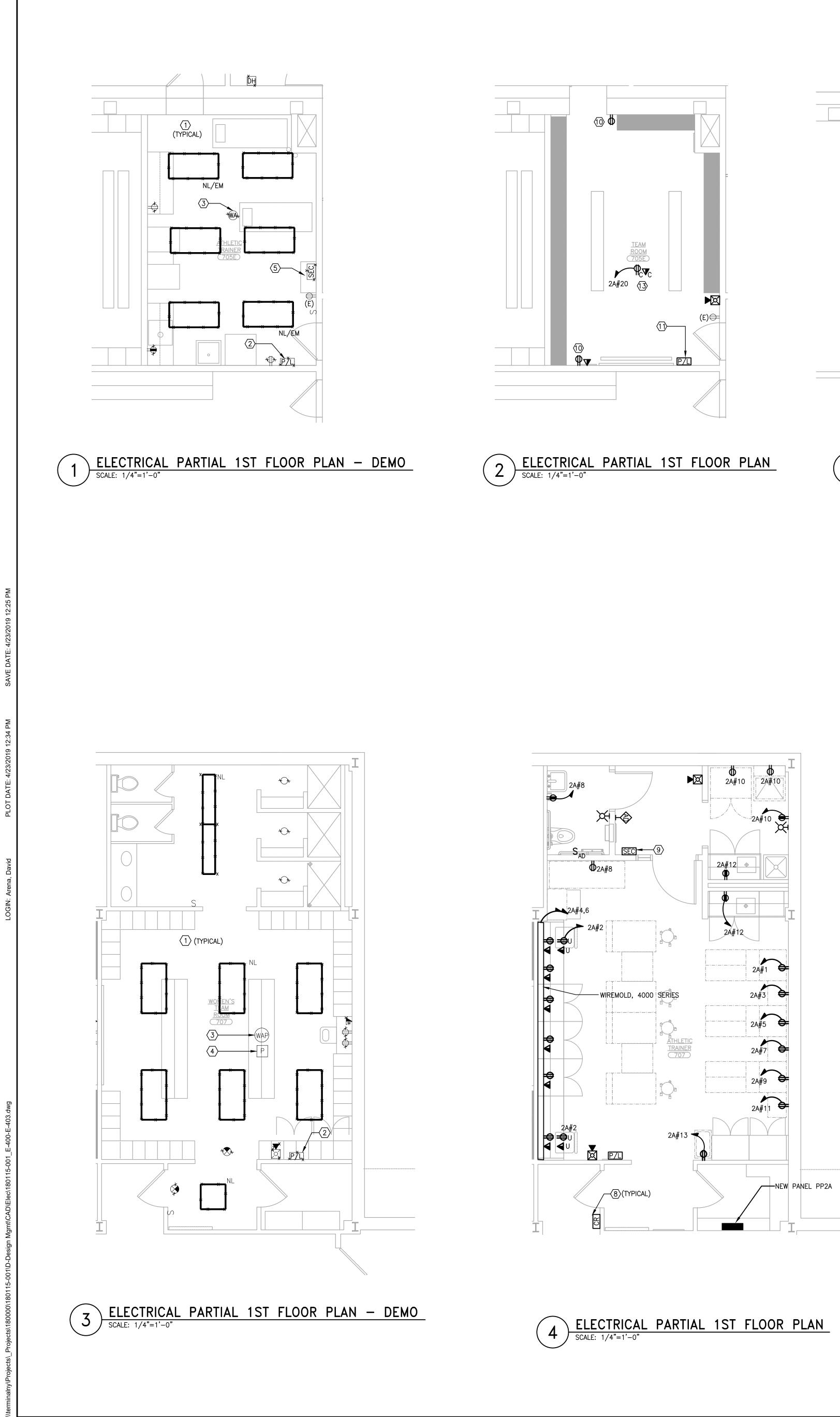
PARTIAL ONE-LINE DIAGRAM

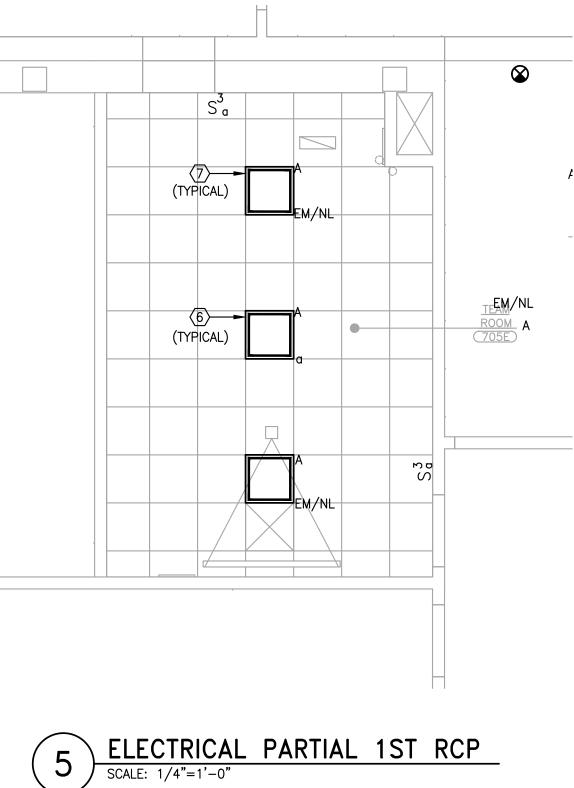
| | PANEL: PP1A | | 208 / 120 VOLTS, 3 | | 3 | PHASE | 4 | WRE | MAIN BUS: 100 AMPS NEU | TF | | |
|-------------|-------------|---------------------------|--------------------|----------------|------|-----------------|-----------|--------------------|------------------------|------------------------------------|-----|--|
| LOCATION | | CLOSET | | MOUNTING: | | SURFACE | | FLUSH | | MAIN LUGS ONLY | | |
| BUILDING | | | | BUS: | | COPPER | | | | MAIN BKR: 100 | | |
| FED FROM | | SEE SINGLE LINE DIA GRAM | | GROUND BUS: | | | | | | PROVIDE WITH FEED-TH | IRI | |
| FEEDER SIZE | | SEE SINGLE LINE DIA GRAM | | ISOL.GND. BUS: | | | | * SHUNT TRIP BRKR. | | AIC: 22000 AMPS | | |
| СКТ | TRIP/ | DESCRIPTION OF LOAD | WIRE & | LOAD PE | | ERPHASE(VA) | | LOAD | WRE & | DESCRIPTION OF LOAD | | |
| # | POLE | | COND SIZE | (VA) | A | В | C | (VA) | COND SIZE | DESCRIPTION OF LOAD | F | |
| 1 | 20 | EXISTING CIRCUIT | | 800 | 1300 | | | 500 | | EXISTING CIRCUIT | | |
| 3 | 20 | EXISTING CIRCUIT | | 800 | | 1600 | | 800 | | EXISTING CIRCUIT | | |
| 5 | 20 | EXISTING CIRCUIT | | 800 | | | 1300 | 500 | | EXISTING CIRCUIT | | |
| 7 | 20 | EXISTING CIRCUIT | | 800 | 1600 | | | 800 | | EXISTING CIRCUIT | | |
| 9 | 20 | EXISTING CIRCUIT | | 800 | | 1600 | | 800 | | EXISTING CIRCUIT | | |
| 11 | 20 | EXISTING CIRCUIT | | 800 | | | 1600 | 800 | | EXISTING CIRCUIT | | |
| 13 | 20 | EXISTING CIRCUIT | | 800 | 1600 | | | 800 | | EXISTING CIRCUIT | | |
| 15 | 20 | EXISTING CIRCUIT | | 800 | | 1600 | | 800 | | EXISTING CIRCUIT | | |
| 17 | 20 | EXISTING CIRCUIT | | 800 | | | 1300 | 500 | | EXISTING CIRCUIT | | |
| 19 | 20 | EXISTING CIRCUIT | | 800 | 1300 | | | 500 | | NEW RECEPT | | |
| 21 | 20 | NEW RECEPT | | 500 | | 1000 | | 500 | | | | |
| 23 | 20 | SPARE | | 0 | | | 500 | 500 | | NEW RECEPT 4#12 + 1#12G, IN 3/4 | | |
| 25 | 20 | SPARE | | 0 | 500 | | | 500 | | -m12 + 1m120, 1110/- | | |
| 27 | 20 | SPARE | | 0 | | 500 | | 500 | | | F | |
| 29 | 20 | SPARE | | 0 | | | 500 | 500 | | NEW RECEPT 4#12 + 1#12G, IN 3/4 | | |
| 31 | 4 | | | 0 | 0 | | | 0 | | -m12 + 1m120, 1110/- | | |
| 33 | 3P-60A | PF2A | | 0 | | 0 | | 0 | | SPARE | F | |
| 35 | | | | 0 | | | 0 | 0 | | SPARE | F | |
| | | | TOTA | L BY PHASE | 6300 | 6300 | 5200 | | | <u>.</u> | L | |
| | | ** = GFCI CIRCUIT BREAKER | | | | | SPARE =0% | | | | | |
| | | TOTAL CONNECTED LOAD = | 17800 | VA | | | | TOTAL E | DEMAND LC | DAD = <u>13900</u> VA | | |
| | | TOTAL CONNECTED AMPS = | 49 | AMPS | | | | TOTALI | DEMAND AN | $MPS = \underline{39} AMPS$ | | |
| | | | | | | | | | | | | |

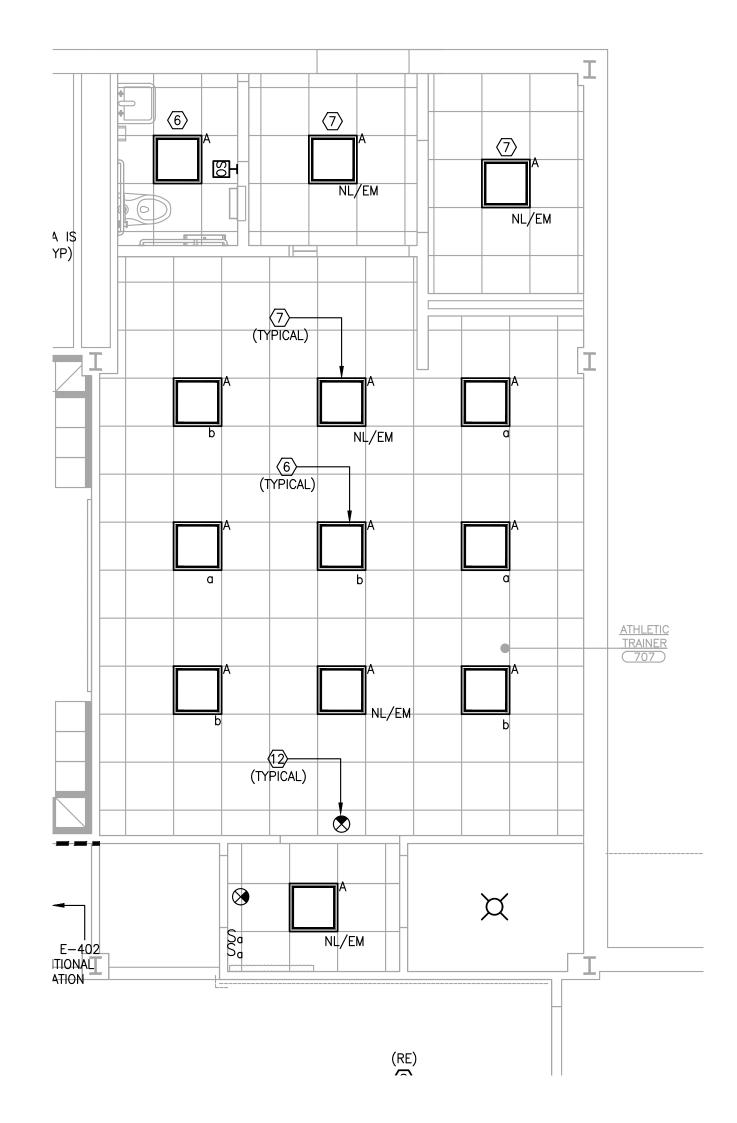
| PANEL: | | PP2A (ALT 1 AND/OR 4) | | 208 / 120 VOLTS, | | 3 PHASE | | 4WRE | | MAIN BUS: 100 AMPS NEUT | ſ | |
|------------------------|-----------------------------|---------------------------|------------|------------------|------|------------|-----------|--------------------|-------------------------------------|-------------------------|---|--|
| LOCATION: | | CLOSET | | MOUNTING: | | SURFACE | | FLUSH | | MAIN LUGS ONLY | | |
| BUILDING: | | | | BUS: | | COPPER | | | | MAIN BKR: 60 | | |
| FED FROM: | | SEE SINGLE LINE DIA GRAM | | GROUND BUS: | | | | | | PROVIDE WITH FEED-THE | R | |
| FEEDER SIZE | | SEE SINGLE LINE DIAGRAM | | ISOL.GND. BUS: | | | | * SHUNT TRIP BRKR. | | AIC: 22000 AMPS | | |
| CKT TRIP/ | | DESCRIPTION OF LOAD | WRE& | LOAD | PE | RPHASE(VA) | | LOAD | WIRE & | DESCRIPTION OF LOAD | | |
| # | POLE | DESCRIPTION OF LOAD | COND SIZE | (VA) | A | В | С | (VA) | COND SIZE | | | |
| 1 | 20 | EQUIPMENT RECEPT | | 500 | 1000 | | | 500 | | UNDERCOUNTE RECEPT | | |
| 3 | 20 | EQUIPMENT RECEPT | | 600 | | 1100 | | 500 | | WREMOLD 4000 RECEPT | | |
| 5 | 20 | EQUIPMENT RECEPT | | 500 | | | 1000 | 500 | | | | |
| 7 | 20 | EQUIPMENT RECEPT | | 600 | 1200 | | | 600 | | GFI RECEPT | | |
| 9 | 20 | EQUIPMENT RECEPT | | 600 | | 1200 | | 600 | | GENERAL RECEPT | | |
| 11 | 20 | EQUIPMENT RECEPT | | 500 | | | 1100 | 600 | | GFI RECEPT | | |
| 13 | 20 | EQUIPMENT RECEPT | | 600 | 1800 | | | 1200 | | COMP RECEPT | | |
| 15 | 20 | COMP RECEPT | | 1200 | | 2000 | | 800 | | COMP RECEPT | | |
| 17 | 20 | COMP RECEPT | | 800 | | | 2000 | 1200 | | COMP RECEPT | | |
| 19 | 20 | PRINTER | | 700 | 1200 | | | 500 | | PROJECTOR RECEPTACLE | | |
| 21 | 20 | SPARE | | 0 | | 0 | | 0 | | SPARE | | |
| 23 | 20 | SPARE | | 0 | | | 0 | 0 | | SPARE | | |
| | | | L BY PHASE | 5200 | 4300 | 4100 | | | | | | |
| | | ** = GFCI CIRCUIT BREAKER | | | | | SPARE =0% | | | | | |
| | TOTAL CONNECTED LOAD =13600 | | | | VA | | | | TOTAL DEMAND LOAD = <u>11800</u> VA | | | |
| TOTAL CONNECTED AMPS = | | | AMPS | | | | TOTAL | DEMAND A | $MPS = \underline{33} AMPS$ | | | |









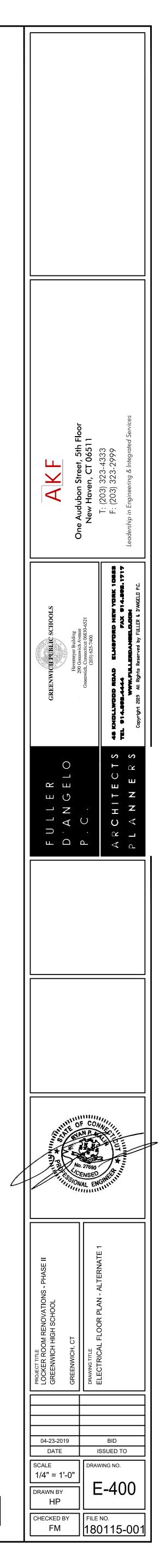


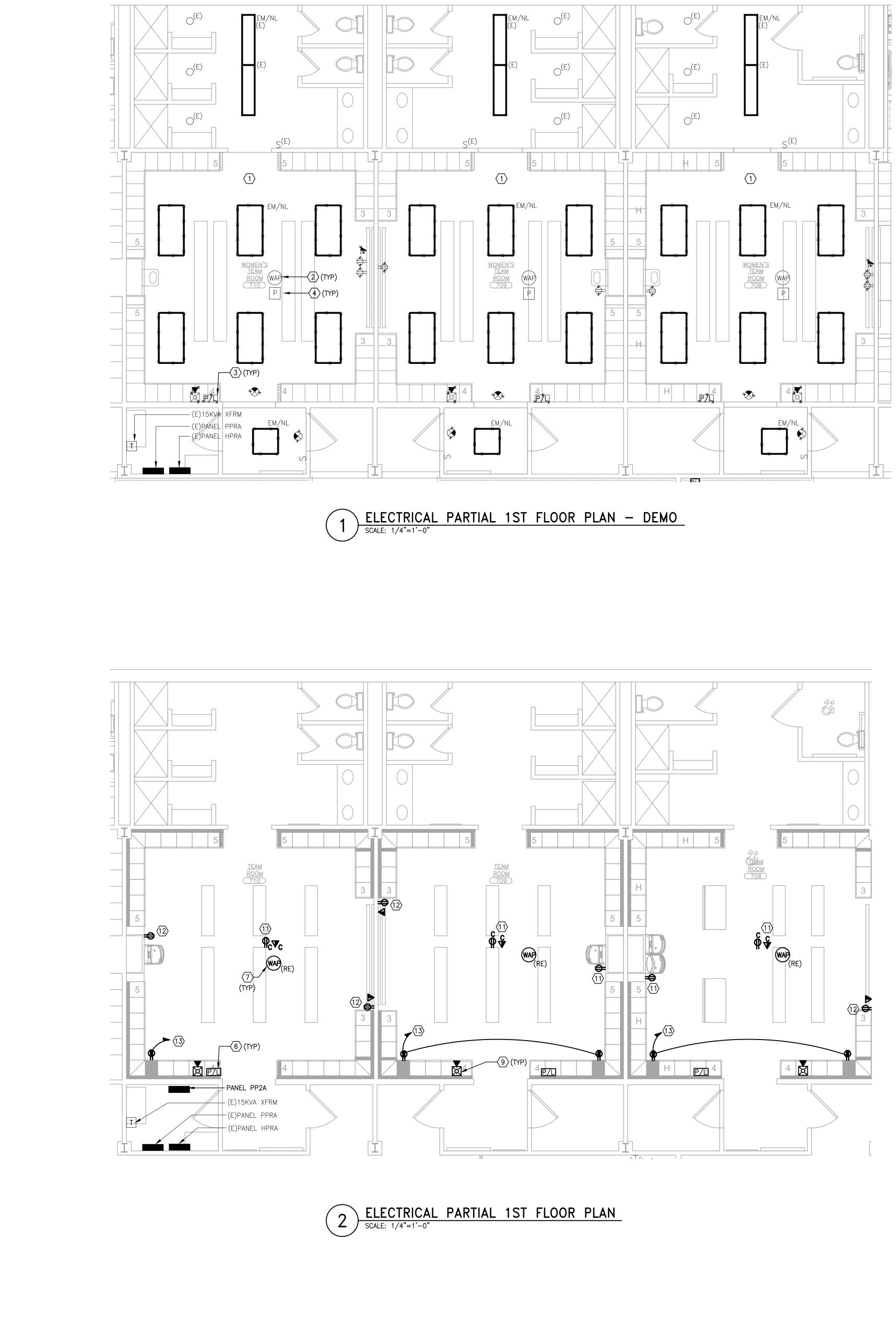


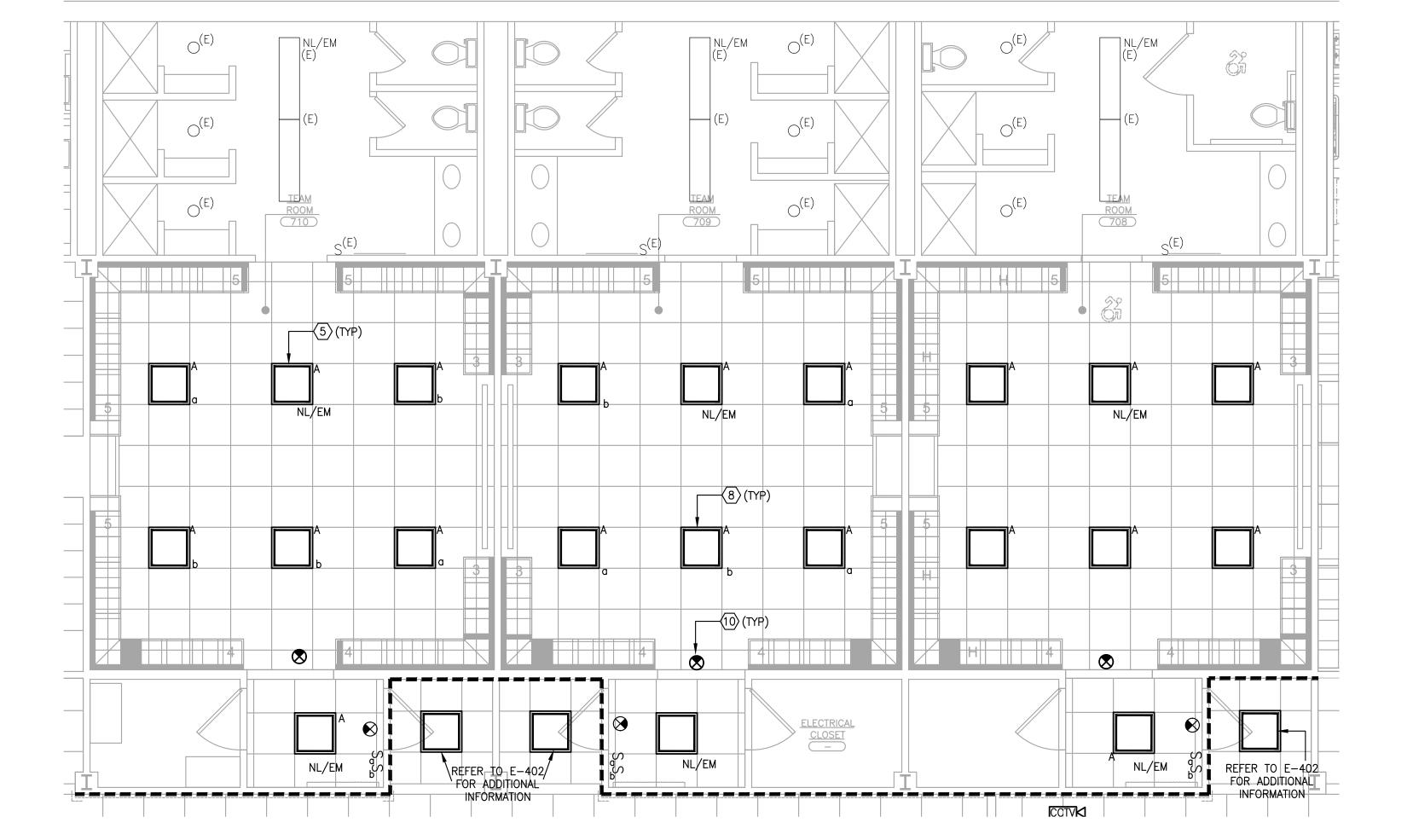
- 1. REFER TO MECHANICAL DRAWINGS FOR HVAC EXACT LOCATIONS.
- 2. ALL EQUIPMENT IS NEW, UNLESS NOTED OTHERWISE.
- 3. MODIFY EXISTING FIRE ALARM SYSTEM AS REQUIRED TO ACCOMMODATE NEW DEVICES.
- 4. REFER TO DRAWING E-300 FOR PANEL PP2A SCHEDULE AND LOCATION.
- 5. ALL NEW CONDUITS SHALL BE LOCATED IN WALL CAVITY. NO NEW CONDUIT SHALL BE EXPOSED OVER TILED AREAS KEY NOTES:
- 1 UNLESS NOTED OTHERWISE, EXISTING LIGHTING, RECEPTACLE, FIRE ALARM, AND DATA OUTLETS TO BE REMOVED FOR THIS AREA. EXISTING CIRCUITS WIRING TO BE
- SAFE-OFF FOR RE-USE. REFER TO NEW WORK PLAN FOR ADDITIONAL WORK DETAILS. (2) REMOVE PUBLIC ADDRESS SPEAKER AND CLOCK. EXISTING WIRING TO REMAIN FOR RE-USE.
- $\overline{(3)}$ REMOVE EXISTING WIRELESS ACCESS POINT AND SAVE FOR RE-USE. EXISTING WIRING TO REMAIN FOR RE-USE.
- (4) REMOVE EXISTING PROJECTOR AND RETURN TO OWNER. PROJECTOR'S MOUNTING BRACKETS TO REMAIN.
- $\overline{(5)}$ EXISTING SECURITY KEYPAD TO BE REMOVED FOR RELOCATION TO NEW ATHLETIC TRAINER ROOM 707. REFER TO NEW ATHLETIC ROOM PART-PLAN FOR NEW LOCATION.
- 6 CONNECT NEW NORMAL LIGHTING FOR THIS AREA TO EXISTING LIGHTING CIRCUITS MADE AVAILABLE DURING DEMOLITION. PROVIDE NEW SWITCHING AS INDICATED. EXTEND CIRCUIT'S CONDUIT AND WIRING AS REQUIRED.
- CONNECT NEW EMERGENCY/NIGHT LIGHTS FOR THIS AREA TO EXISTING UN-SWITCHED LIGHTING CIRCUITING EMERGENCY CIRCUIT MADE AVAILABLE DURING DEMOLITION. EXTEND CONDUIT AND WIRING AS REQUIRED.
- (8) NEW CARD READER. PROVIDE SINGLE-GAND BACK-BOX AND 1-1/4"C CONDUIT UP TO CEILING.
- 9 SECURITY KEYPAD RELOCATED FROM OLD ATHLETIC TRAINER ROOM. PROVIDE ADDITIONAL CONDUIT AND WIRING AS REQUIRED BY VENDOR. COORDINATE EXACT LOCATIONS WITH OWNER/VENDOR.
- (10) connect new receptacle to existing circuit made available during demolition. (11) NEW CLOCK/PA SPEAKER TO MATCH EXISTING SYSTEM. CONNECT TO EXISTING CLOCK/PA WIRING MADE AVAILABLE DURING DEMOLITION.
- 12 NEW EXIT SIGN, CONNECT TO EXISTING EXIT SIGN CIRCUIT MADE AVAILABLE DURING DEMOLITION.
- (13) NEW CEILING MOUNTED RECEPTACLE AND DATA PORT FOR FUTURE PROJECTOR. PROVIDE (1) 1-1/4" CONDUIT FOR FUTURE A/V WIRING TO WHITE BOARD LOCATION. COORDINATE EXACT LOCATIONS WITH OWNER/ARCHITECT.

CIRCUIT ABBREVIATION:

A2#1 = PANEL PP2A#1









12 NEW RECEPTACLES, CONNECT TO EXISTING RECEPTACLE CIRCUIT MADE AVAILABLE DURING DEMOLITION. NEW RECEPTACLES. CONNECT TO NEW 1P-20A CIRCUIT BREAKER AT PANEL PPRA. PROVIDE 1P-20A CIRCUIT BREAKER AS REQUIRED. PROVIDE 2#12 + 1#12G, IN 3/4"C.

 $\langle 4 \rangle$ REMOVE EXISTING PROJECTOR AND RETURN TO OWNER. PROJECTOR'S MOUNTING BRACKETS TO REMAIN.

 $\langle 2 \rangle$ REMOVE EXISTING WIRELESS ACCESS POINT AND SAVE FOR RE-USE. EXISTING WIRING TO REMAIN FOR RE-USE.

 $\langle 3 \rangle$ REMOVE EXISTING PUBLIC ADDRESS (PA) SPEAKER AND CLOCK. EXISTING WRING TO REMAIN FOR RE-USE.

- $\langle 5 \rangle$ connect new light fixtures to un-switched emergency lighting circuit made available during demolition.
- 6 NEW CLOCK/PA SPEAKER TO MATCH EXISTING SYSTEM. CONNECT TO EXISTING CLOCK/PA WIRING MADE AVAILABLE DURING DEMOLITION.

- $\langle 7 \rangle$ UPON NEW CEILING INSTALLATION, INSTALL RELOCATED WIRELESS ACCESS POINT AND CONNECT TO EXISTING WIRING MADE AVAILABLE DURING DEMOLITION.
- (8) CONNECT NEW NORMAL LIGHTING FOR THIS AREA TO EXISTING LIGHTING CIRCUITS MADE AVAILABLE DURING DEMOLITION. PROVIDE NEW SWITCHING AS INDICATED. EXTEND CIRCUIT'S CONDUIT AND

- WIRING AS REQUIRED.
- $\langle 9 \rangle$ NEW FIRE ALARM DEVICE. CONNECT TO EXISTING FIRE ALARM SYSTEM MADE AVAILABLE DURING DEMOLITION. PROVIDE NEW CONDUIT AND WIRING AS REQUIRED. $\overline{(10)}$ NEW EXIT SIGN, CONNECT TO EXISTING EXIT SIGN CIRCUIT MADE AVAILABLE DURING DEMOLITION.

NEW CEILING MOUNTED RECEPTACLE AND DATA PORT FOR FUTURE PROJECTOR. CONNECT RECEPTACLE TO EXISTING CIRCUIT MADE AVAILABLE DURING DEMOLITION. PROVIDE (1) 1-1/4"

CONDUIT FOR FUTURE A/V WIRING TO WHITE BOARD LOCATION. COORDINATE EXACT LOCATIONS

- EXPOSED OVER TILED AREAS
- 1 UNLESS NOTED OTHERWISE, EXISTING LIGHTING, RECEPTACLE, FIRE ALARM, AND DATA OUTLETS TO BE REMOVED FOR THIS AREA. EXISTING CIRCUITS WIRING TO BE SAFE-OFF FOR RE-USE. REFER
- <u>KEY NOTES:</u>
- 4. ALL NEW CONDUITS SHALL BE LOCATED IN WALL CAVITY. NO NEW CONDUIT SHALL BE

3. MODIFY EXISTING FIRE ALARM SYSTEM AS REQUIRED TO ACCOMMODATE NEW DEVICES.

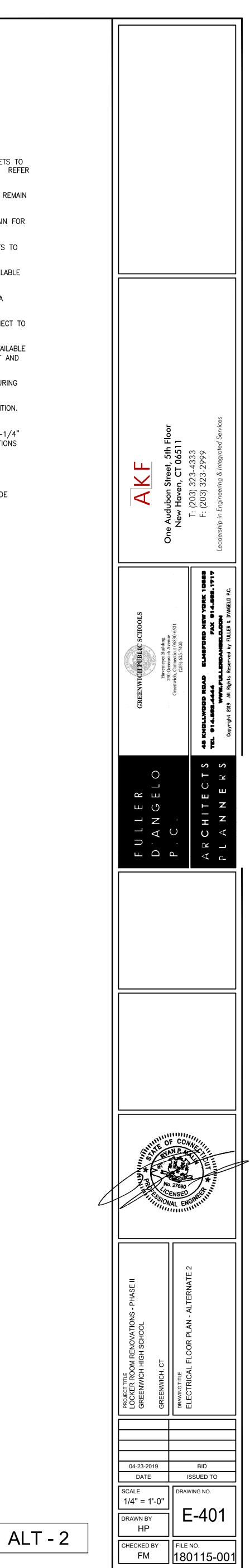
1. REFER TO MECHANICAL DRAWINGS FOR HVAC EXACT LOCATIONS.

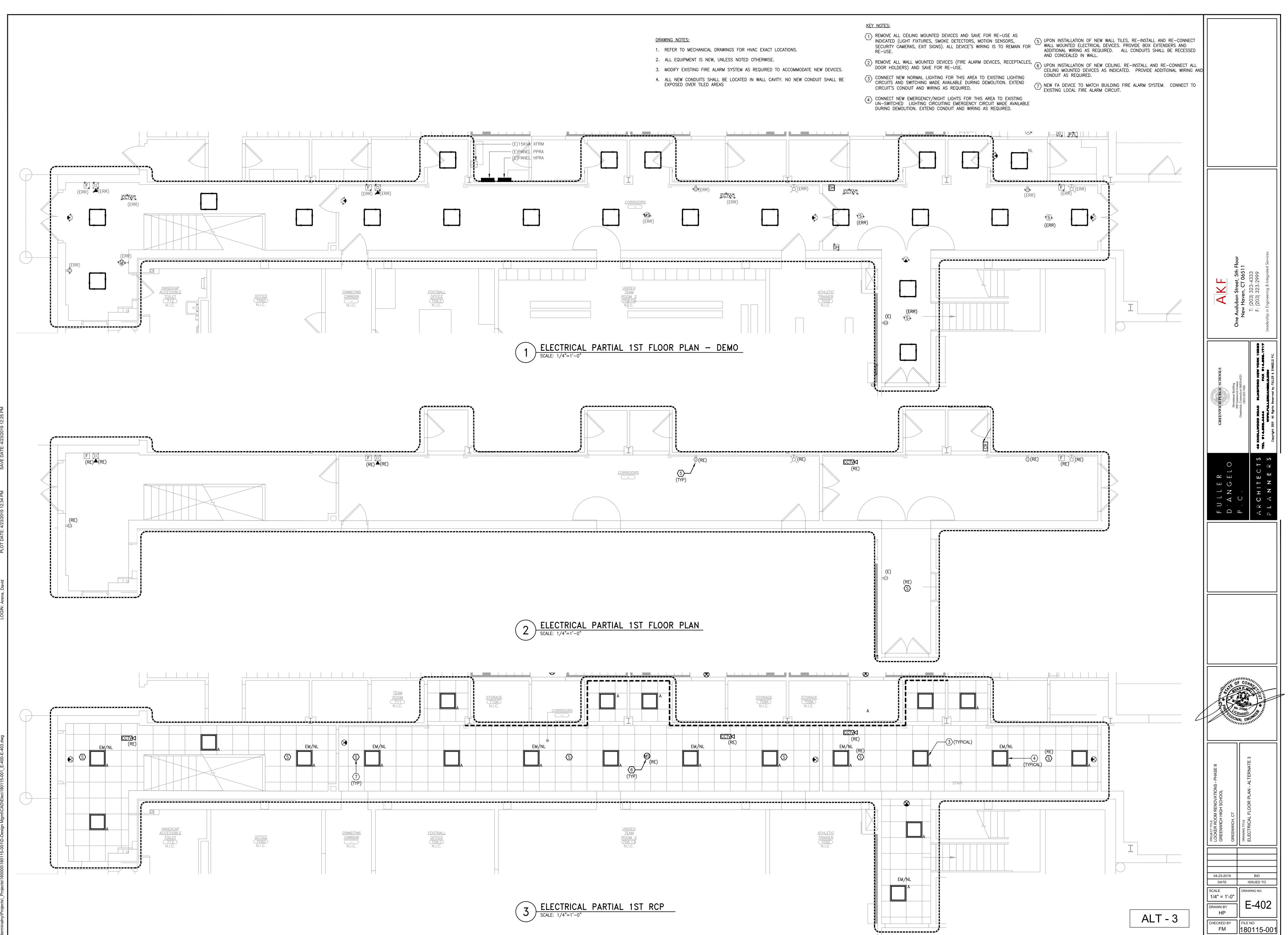
2. ALL EQUIPMENT IS NEW, UNLESS NOTED OTHERWISE.

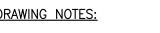
TO NEW WORK PLAN FOR ADDITIONAL WORK DETAILS.

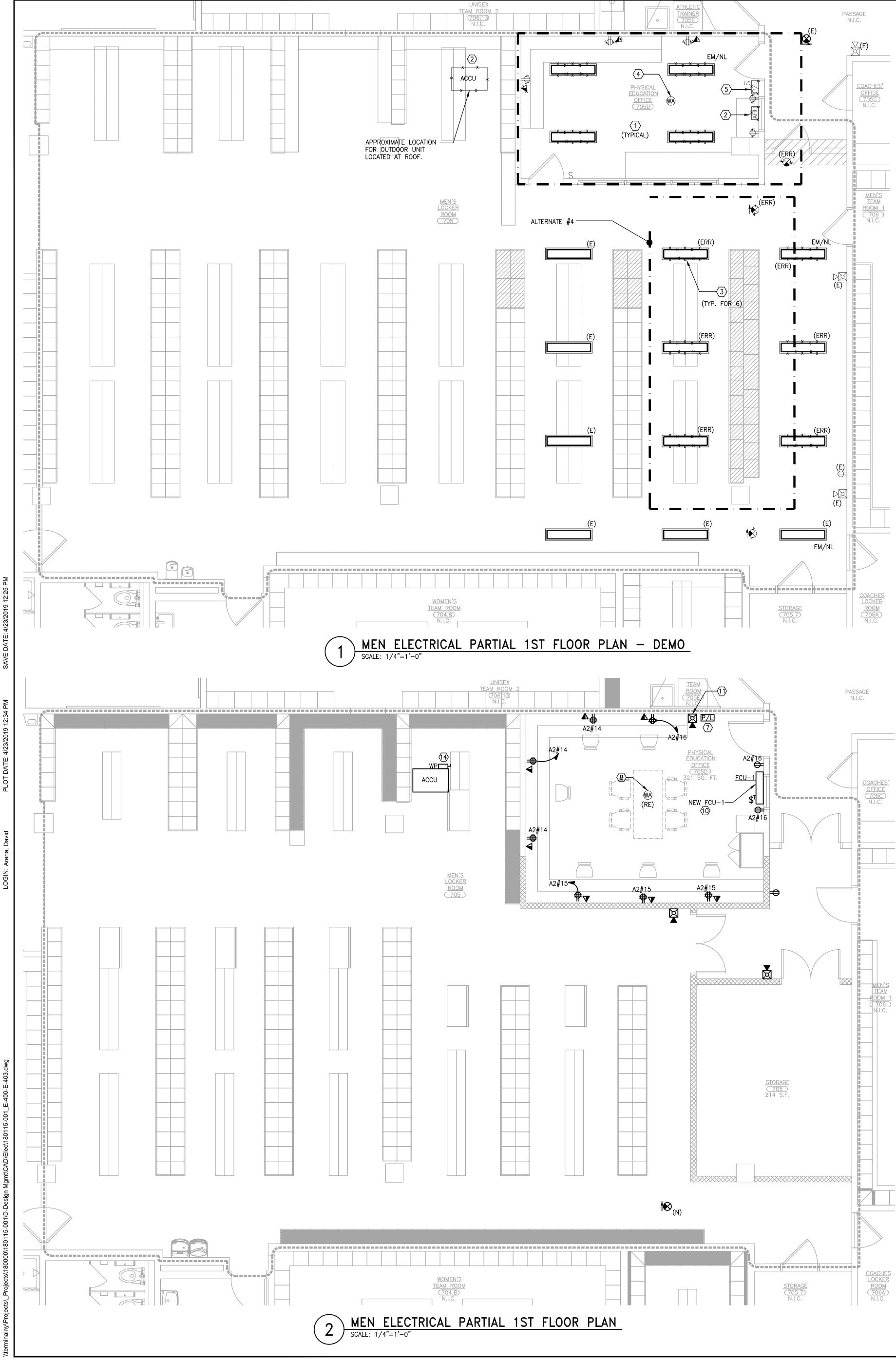
WITH OWNER/ARCHITECT.

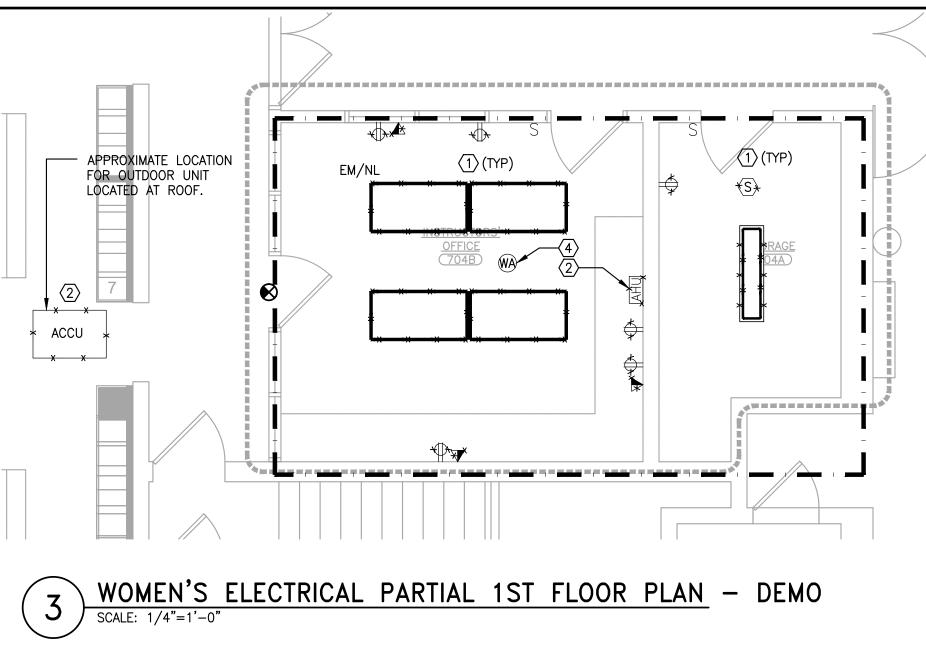
DRAWING NOTES:

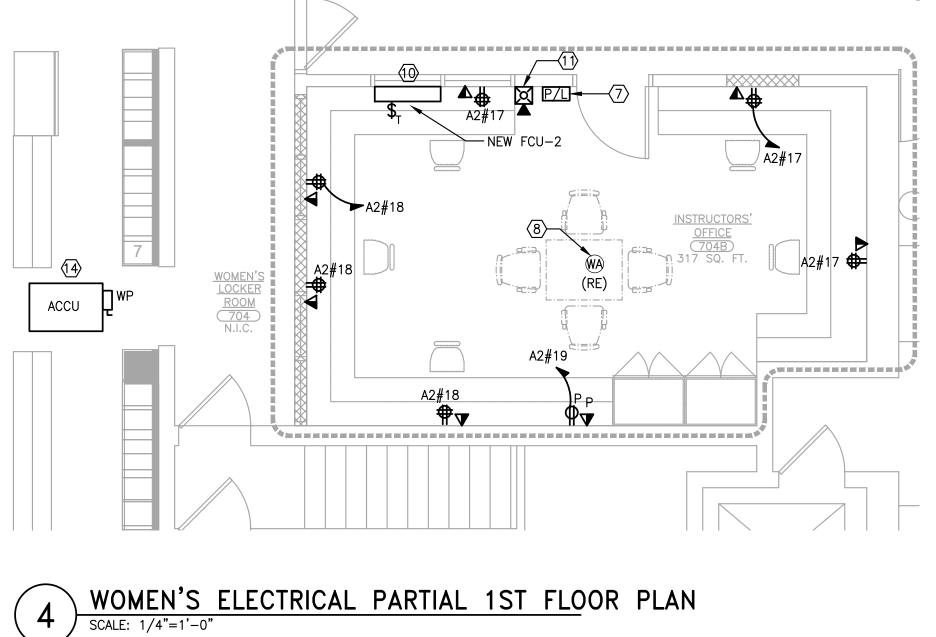


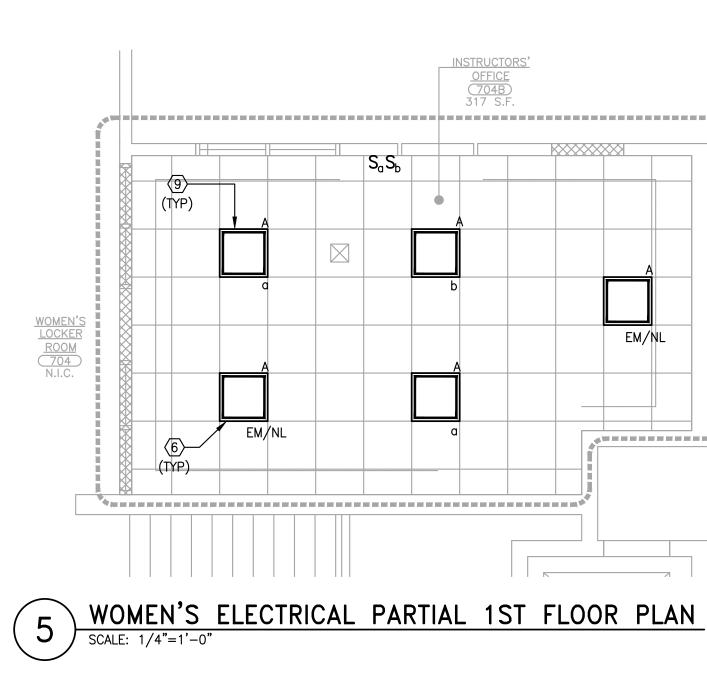




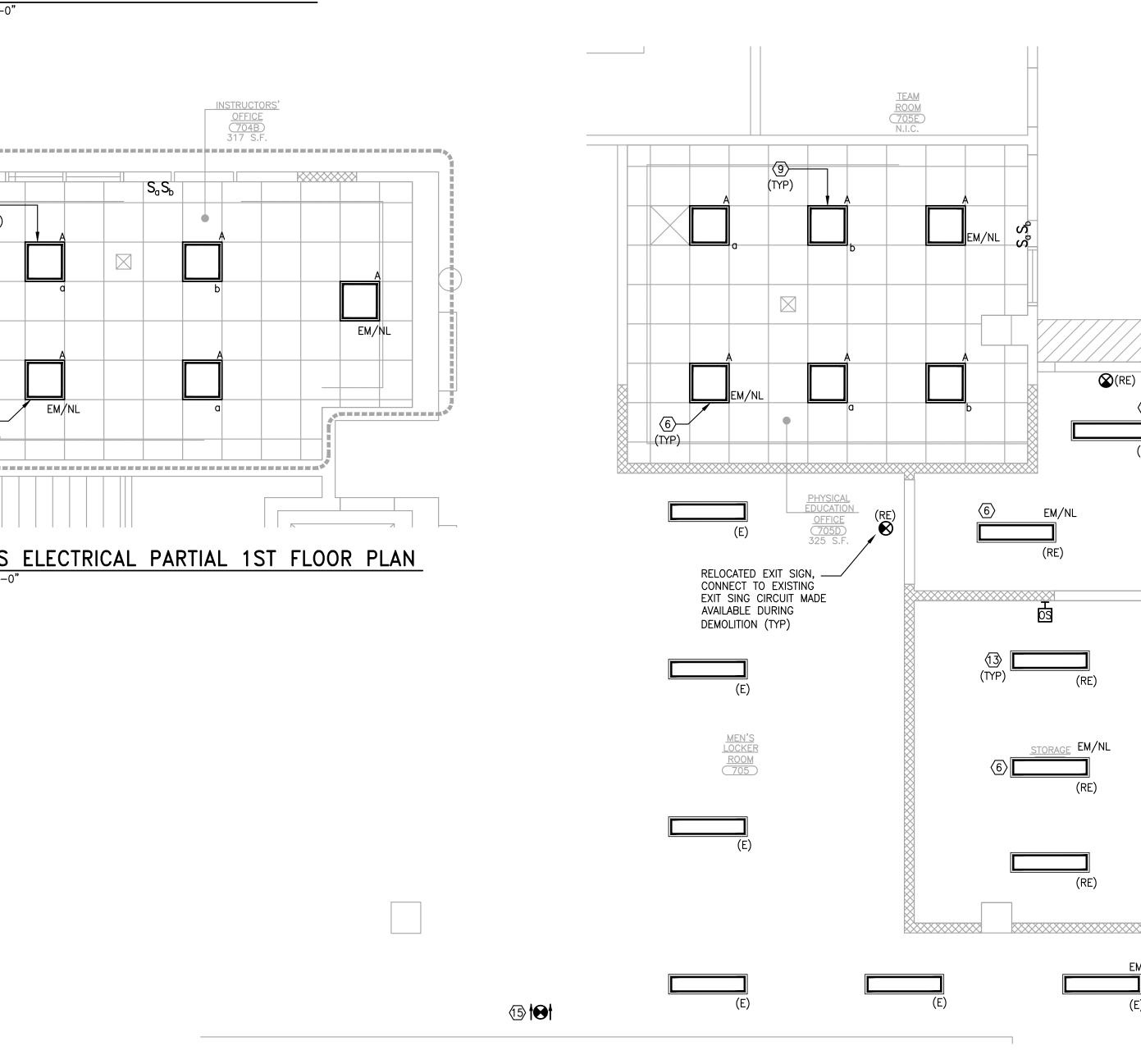








6 MEN'S ELECTRICAL PARTIAL 1ST RCP SCALE: 1/4"=1'-0"



(9) CONNECT NEW NORMAL LIGHTING FOR THIS AREA TO EXISTING LIGHTING CIRCUITS MADE AVAILABLE DURING DEMOLITION. PROVIDE NEW SWITCHING AS INDICATED. EXTEND CIRCUIT'S CONDUIT AND WIRING AS REQUIRED.

AND ADDITIONAL WIRING/CONDUIT AS REQUIRED.

CIRCUIT ABBREVIATION:

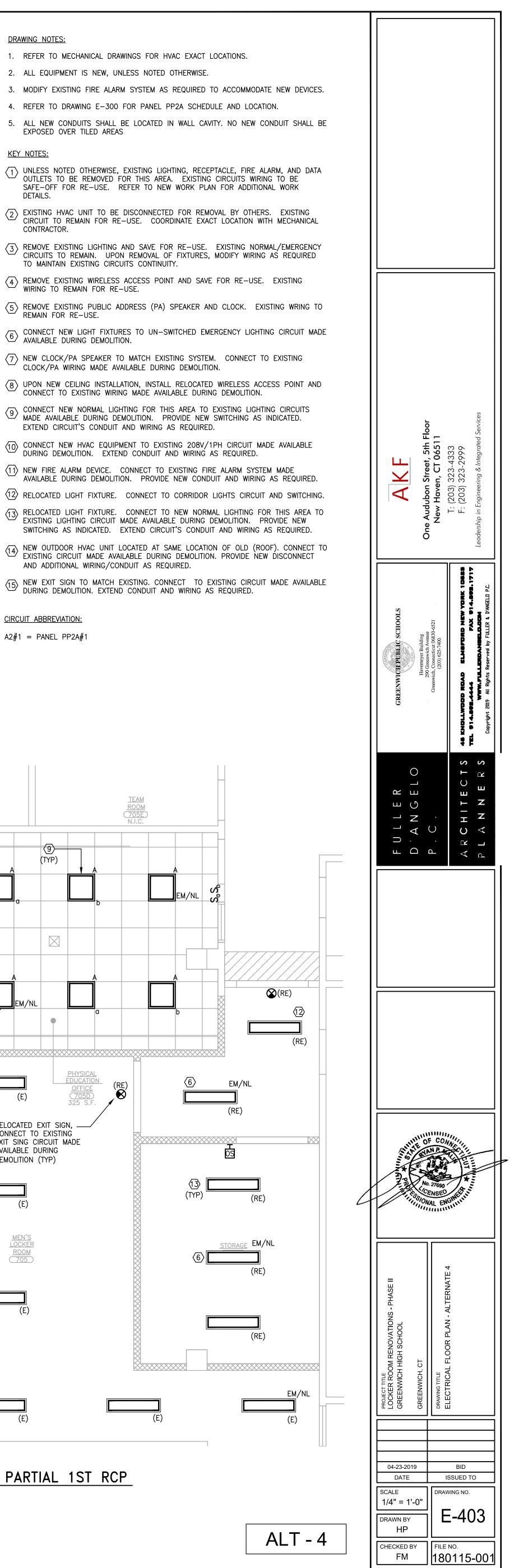
A2#1 = PANEL PP2A#1

- (8) UPON NEW CEILING INSTALLATION, INSTALL RELOCATED WIRELESS ACCESS POINT AND CONNECT TO EXISTING WIRING MADE AVAILABLE DURING DEMOLITION.
- $\langle 7 \rangle$ NEW CLOCK/PA SPEAKER TO MATCH EXISTING SYSTEM. CONNECT TO EXISTING CLOCK/PA WIRING MADE AVAILABLE DURING DEMOLITION.
- \bigcirc CONNECT NEW LIGHT FIXTURES TO UN-SWITCHED EMERGENCY LIGHTING CIRCUIT MADE AVAILABLE DURING DEMOLITION.

- REMAIN FOR RE-USE.
- $\langle 5 \rangle$ REMOVE EXISTING PUBLIC ADDRESS (PA) SPEAKER AND CLOCK. EXISTING WRING TO
- WIRING TO REMAIN FOR RE-USE.
- TO MAINTAIN EXISTING CIRCUITS CONTINUITY. $\langle 4 \rangle$ REMOVE EXISTING WIRELESS ACCESS POINT AND SAVE FOR RE-USE. EXISTING

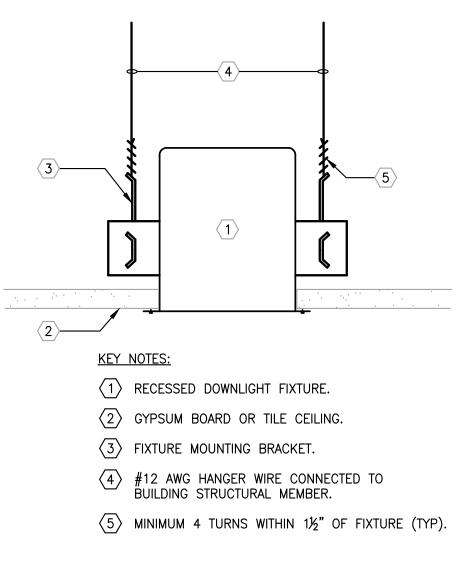
- 3 REMOVE EXISTING LIGHTING AND SAVE FOR RE-USE. EXISTING NORMAL/EMERGENCY CIRCUITS TO REMAIN. UPON REMOVAL OF FIXTURES, MODIFY WIRING AS REQUIRED
- CONTRACTOR.
- \bigcirc EXISTING HVAC UNIT TO BE DISCONNECTED FOR REMOVAL BY OTHERS. EXISTING CIRCUIT TO REMAIN FOR RE-USE. COORDINATE EXACT LOCATION WITH MECHANICAL
- SAFE-OFF FOR RE-USE. REFER TO NEW WORK PLAN FOR ADDITIONAL WORK DETAILS.
- OUTLETS TO BE REMOVED FOR THIS AREA. EXISTING CIRCUITS WIRING TO BE
- KEY NOTES: UNLESS NOTED OTHERWISE, EXISTING LIGHTING, RECEPTACLE, FIRE ALARM, AND DATA
- 5. ALL NEW CONDUITS SHALL BE LOCATED IN WALL CAVITY. NO NEW CONDUIT SHALL BE EXPOSED OVER TILED AREAS
- 4. REFER TO DRAWING E-300 FOR PANEL PP2A SCHEDULE AND LOCATION.
- 2. ALL EQUIPMENT IS NEW, UNLESS NOTED OTHERWISE. 3. MODIFY EXISTING FIRE ALARM SYSTEM AS REQUIRED TO ACCOMMODATE NEW DEVICES.
- 1. REFER TO MECHANICAL DRAWINGS FOR HVAC EXACT LOCATIONS.

DRAWING NOTES:

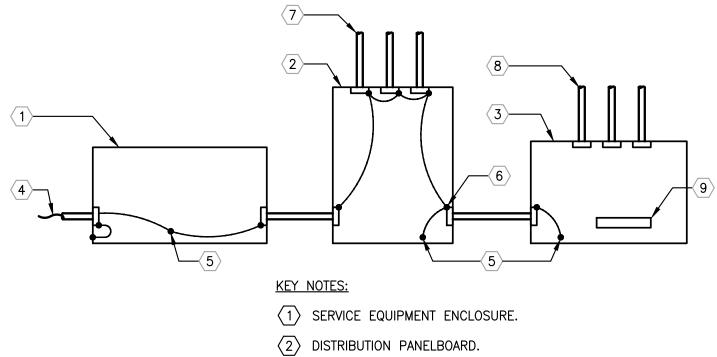


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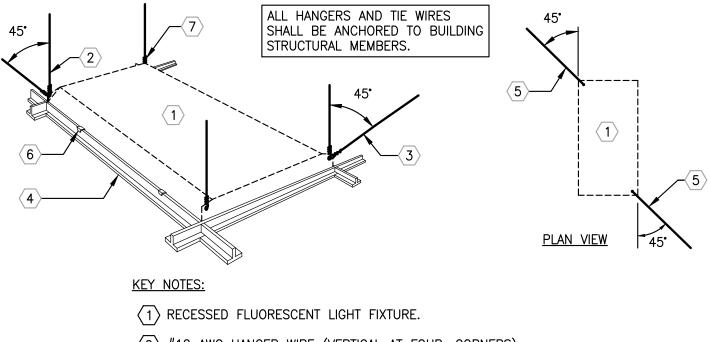


RECESSED DOWNLIGHT FIXTURE SEISMIC BRACING



- 2 DISTRIBUTION FANELBOARD.
- (3) LIGHTING/APPLIANCE PANELBOARD.
- $\langle 4 \rangle$ System grounding electrode conductor.
- $\langle 5 \rangle$ ground lug (typical).
- $\langle 6 \rangle$ grounding bushing (typical).
- $\langle 7 \rangle$ Feeder conduit (typical).
- $\langle 8 \rangle$ branch circuit conduit (typical).
- $\langle 9 \rangle$ EQ GROUND BUS WHERE PROVIDED, BONDED TO ENCLOSURE.

RACEWAY EQUIPMENT GROUNDING SYSTEM



 $\langle 2 \rangle$ #12 AWG HANGER WIRE (VERTICAL AT FOUR CORNERS).

 $\langle 3 \rangle$ #12 AWG TIE WIRE (45° DIAGONAL AT OPPOSITE CORNERS).

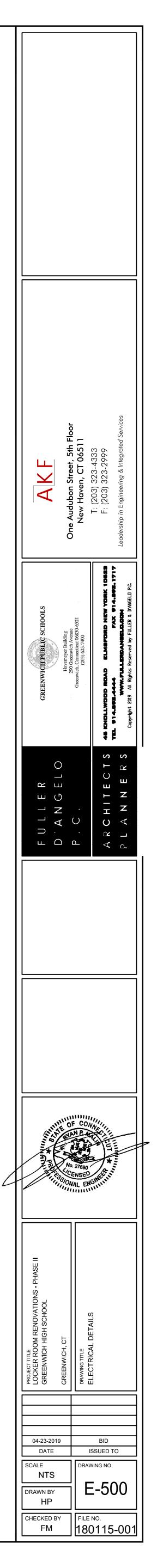
 $\langle 4 \rangle$ T–BAR GRID (TYP).

 $\langle 5 \rangle$ TIE WIRE.

 $\langle 6 \rangle$ CADDY T-BAR CLIP FOR SECURING FIXTURE TO T-BAR GRID (4/FIXT). (CAPACITY EACH CLIP=100% FIXTURE WEIGHT ACTING ANY DIRECTION).

 $\langle \overline{7} \rangle$ minimum 4 turns within first 1½" (vertical).

RECESSED LAY-IN FIXTURE SEISMIC BRACING



PLUMBING SYMBOL LIST

BASIC SYMBOLS

| BASIC SYM | BOLS |
|---------------|---------------------------------|
| | EXISTING PIPING |
| <u> </u> | EXISTING PIPING TO BE REMOVED |
| | PIPING TO BE ABANDONED |
| | NEW SOIL, WASTE OR SANITARY PIF |
| | VENT PIPING (SANITARY) |
| | PIPING BELOW SLAB |
| | DOMESTIC COLD WATER PIPING |
| | DOMESTIC HOT WATER PIPING (120 |
| | DOMESTIC HOT WATER CIRCULATION |
| \bullet | DISCONNECT FROM EXISTING |
| \bullet | CONNECT TO EXISTING |
| ı | CLEAN OUT/PLUGGED OUTLET |
| E | CAPPED OUTLET |
| • | CLEAN-OUT DECK PLATE |
| œ <u> </u> | P-TRAP |
| C | PIPE DOWN/DROP |
| 0 | PIPE RISE/UP |
| \oplus | FLOOR DRAIN |
| O | ROOF DRAIN |
| | VENT THRU ROOF |
| \sim | TRAP |
| \bowtie | BALL VALVE |
| \bowtie | GATE VALVE |
| \bowtie_{+} | GLOBE VALVE |
| | OUTSIDE SCREW & YOKE (OS & Y) |
| | CHECK VALVE |

| PIPING TO BE ABANDONED |
|---------------------------------------|
| NEW SOIL, WASTE OR SANITARY PIPING |
| VENT PIPING (SANITARY) |
| PIPING BELOW SLAB |
| DOMESTIC COLD WATER PIPING |
| DOMESTIC HOT WATER PIPING (120°) |
| DOMESTIC HOT WATER CIRCULATION PIPING |
| DISCONNECT FROM EXISTING |
| CONNECT TO EXISTING |
| CLEAN OUT/PLUGGED OUTLET |
| CAPPED OUTLET |
| CLEAN-OUT DECK PLATE |
| P-TRAP |
| PIPE DOWN/DROP |
| PIPE RISE/UP |
| FLOOR DRAIN |
| ROOF DRAIN |
| VENT THRU ROOF |
| TRAP |
| BALL VALVE |
| GATE VALVE |
| GLOBE VALVE |
| OUTSIDE SCREW & YOKE (OS & Y) VALVE |
| CHECK VALVE |
| |

ABBREVIATIONS

| <u>ABBRE</u> | EVIATIONS |
|--------------|---|
| AD | AREA DRAIN |
| AFF | ABOVE FINISHED FLOOR |
| BLDG | BUILDING |
| BOP | BOTTOM OF PIPE |
| CO CODP | CLEANOUT CLEANOUT DECK PLATE |
| СМ | COFFEE MAKER |
| CV | CHECK VALVE |
| CVO | CAPPED AND VALVED OUTLET |
| CW | COLD WATER |
| CLG CONN | CEILING CONNECT |
| CONT | CONTINUATION |
| DF | DRINKING FOUNTAIN |
| DIA | DIAMETER |
| DN | DOWN (PENETRATES FLOOR SLAB) |
| DR | DRAIN |
| DWG | DRAWING |
| DWH (E) | DOMESTIC WATER HEATER EXISTING TO REMAIN |
| (E) (ER) | EXISTING TO BE REMOVED |
| (ERR) | EXISTING TO BE REMOVED & RELOCATE |
| EL | ELEVATION |
| EWC | ELECTRIC WATER COOLER |
| FAI | FRESH AIR INLET |
| FD | FLOOR DRAIN |
| FS | FLOOR SINK |
| FU FL | FIXTURE UNIT FLOOR |
| FL H | FLOOR HYDRANT |
| FT | FEET |
| GC | GENERAL CONTRACTOR |
| GAL | GALLONS |
| GPM | GALLONS PER MINUTE |
| GV HB | GATE VALVE HOSE BIBB |
| HW | HOT WATER |
| HWCP | HOT WATER CIRCULATION PUMP |
| HWR | HOT WATER RETURN |
| ID | INSIDE DIAMETER |
| IW IN | INDIRECT WASTE INCH |
| JS | JANITOR'S SINK |
| LV | LAVATORY |
| MAX | MAXIMUM |
| MIN | MINIMUM |
| MR | MOP RECEPTOR |
| NC | NORMALLY CLOSED |
| NIC NO | NOT IN THIS CONTRACT NORMALLY OPEN |
| NTS | NOT TO SCALE |
| OD | OUTSIDE DIAMETER |
| OF | OVERFLOW |
| OS&Y | OUTSIDE SCREW & YOKE GATE VALVE |
| PC PD | PLUMBING CONTRACTOR PUMP DISCHARGE |
| PRV | PRESSURE REDUCING VALVE |
| PSI | POUNDS PER SQUARE INCH (GAUGE) |
| RD | ROOF DRAIN |
| SA | SHOCK ARRESTOR |
| SAN | SANITARY |
| SH SK | SHOWER SINK |
| SQ FT | SQUARE FOOT |
| ST | STORM |
| TYP | TYPICAL |
| UON | UNLESS OTHERWISE NOTED |
| UP | UP (PENETRATES FLOOR SLAB) |
| UR | URINAL |
| V VB | VENT VACUUM BREAKER |
| W W | WASTE |
| WC | WATER CLOSET |
| WD | WATER DISPENSER |
| WCO | WALL CLEANOUT |
| WH | WALL HYDRANT |

DEMOLITION NOTES

- 1. THE CONTRACTOR SHALL INCLUDE IN HIS PRICE ALL COSTS ASSOCIATED WITH REMOVALS AND RELOCATIONS OF EXISTING SYSTEMS AS DESCRIBED ON THE DRAWINGS AND IN THE SPECIFICATIONS WITH ALLOWANCES FOR EXPECTED OR UNFORESEEN DIFFICULTIES WHEN CONCEALED WORK HAS BEEN OPENED. NO CLAIMS FOR ADDITIONAL WORK ASSOCIATED WITH DEMOLITION WILL BE ACCEPTED, EXCEPT IN CERTAIN CASES CONSIDERED JUSTIFIABLE BY THE OWNER.
- 2. CONTRACTOR SHALL CAREFULLY EXAMINE EXISTING CONDITIONS BEFORE STARTING ANY WORK.
- 3. CONTRACTOR SHALL NOTIFY ARCHITECT/ENGINEER BEFORE REMOVING OR RELOCATING ANY EXISTING PIPING NOT INDICATED ON DRAWINGS.
- 4. THE CONTRACTOR SHALL REMOVE AND/OR RELOCATE ALL EXISTING PIPING/SYSTEMS WHICH INTERFERE WITH THE NEW ARCHITECTURAL LAYOUTS. ALL ABANDONED PIPING/SYSTEMS WHICH ARE NO LONGER REQUIRED TO FUNCTION SHALL BE REMOVED BACK TO ACTIVE LINES/MAINS/RISERS AS REQUIRED.
- 5. THE CONTRACTOR SHALL PERFORM DEMOLITION AND REMOVAL WORK WITH MINIMUM INTERFERENCE WITH EXISTING FUNCTIONING SYSTEMS. ALL AFFECTED SYSTEMS SHALL BE RECONNECTED AND RESTORED AS REQUIRED.
- 6. MAKE ANY NECESSARY TEMPORARY CONNECTIONS BETWEEN EXISTING AND NEW WORK TO MAINTAIN CONTINUOUS SERVICE OF ALL EXISTING SYSTEMS. MINIMIZE SHUTDOWNS. OBTAIN WRITTEN APPROVAL FROM OWNER FOR SHUTDOWNS. LOCAL SHUT-DOWNS REQUIRE A REQUEST TO THE OWNER A MINIMUM OF 48 HOURS PRIOR TO WORK. SHUTDOWNS OF EXISTING BUILDING SERVICES, BEYOND AREA OF WORK, REQUIRE A REQUEST TO THE OWNER A MINIMUM OF 5 BUSINESS DAYS PRIOR TO WORK. SHUTDOWNS SHALL ALSO DONE DURING NON-OCCUPIED HOURS, UNLESS OTHERWISE NOTED.
- 7. THE CONTRACTOR SHALL NOTIFY THE OWNER AT THE APPROPRIATE TIME OF THE PROJECTED DEMOLITION AND PHASING SCHEDULE SO THAT REMOVAL OR RELOCATION OF AFFECTED UTILITIES MAY BE CARRIED OUT IN COORDINATION WITH THE PROJECT REQUIREMENTS.
- 8. ARRANGE TO WORK CONTINUOUSLY, INCLUDING PREMIUM TIME, IF REQUIRED, TO ASSURE THAT SYSTEMS WILL BE SHUT DOWN ONLY DURING THE TIME ACTUALLY REQUIRED TO MAKE THE NECESSARY CONNECTIONS TO THE EXISTING SYSTEMS.
- 9. DEMOLITION AND REMOVAL WORK SHALL BE PERFORMED IN A NEAT AND WORKMANLIKE MANNER. THE CONTRACTOR SHALL PATCH, REPAIR OR OTHERWISE RESTORE ANY DAMAGED INTERIOR OR EXTERIOR BUILDING SURFACE TO ITS ORIGINAL CONDITION.
- 10. ALL PIPING WHICH BECOMES EXPOSED DURING THE ALTERATION WORK SHALL BE REMOVED AND REROUTED CONCEALED BEHIND FINISHED SURFACES.
- 11. ALL EXISTING MATERIAL AND EQUIPMENT IN USABLE CONDITION, WHICH IS TO BE REMOVED UNDER THIS CONTRACT, SHALL REMAIN THE PROPERTY OF THE OWNER OR SHALL BE DISPOSED OF BY THE CONTRACTOR, AS DIRECTED BY THE OWNER.

GENERAL NOTES

- 1. GENERAL NOTES, SYMBOLS LIST AND DETAILS ARE APPLICABLE TO ALL DRAWINGS MARKED P.
- 2. DRAWINGS ARE DIAGRAMMATIC: DETERMINE LOCATIONS OF SYSTEMS AND COMPONENTS IN FIELD.
- 3. NEITHER ACCURACY NOR COMPLETION OF UTILITY LOCATIONS SHOWN ON DRAWINGS IS GUARANTEED. DETERMINE EXACT LOCATIONS OF EXISTING UTILITIES IN FIELD, WHETHER OR NOT SHOWN ON DRAWINGS. EXERCISE CAUTION AND IDENTIFY LOCATIONS OF UNMARKED UTILITY LINES AS NECESSARY TO PERFORM WORK OF THIS SECTION.
- 4. ALL PLUMBING WORK SHALL BE IN ACCORDANCE WITH THE CURRENT PLUMBING CODE AND ALL APPLICABLE LOCAL CODES AND AGENCIES HAVING JURISDICTION.
- 5. IT SHALL BE THE RESPONSIBILITY OF THIS CONTRACTOR TO COORDINATE HIS WORK WITH THAT OF ALL OTHER TRADES, INCLUDING (BUT NOT LIMITED TO), ELECTRICAL, HVAC PROCESS PIPING, SPRINKLER, PLUMBING STRUCTURAL AND GENERAL ARCHITECTURE.
- 6. ANY INTERFERENCE SHALL BE BROUGHT TO THE ATTENTION OF THE CONSTRUCTION MANAGER AND THE OWNER'S REPRESENTATIVE, AND SHALL BE RESOLVED PRIOR TO THE INSTALLATION OF THE WORK INVOLVED.
- 7. NO WORK SHALL BE INSTALLED IN VIOLATION OF ANY GOVERNING CODES. ANY WORK SHOWN ON THE DRAWINGS WHICH IS IN VIOLATION OF SUCH CODES SHALL BE BROUGHT TO THE ATTENTION OF THE CONSTRUCTION MANAGER AND THE OWNER'S REPRESENTATIVE AND SHALL BE RESOLVED PRIOR TO THE INSTALLATION OF THE WORK INVOLVED.
- 8. ALL PIPING PENETRATING CEILING AND WALLS SHALL BE INSTALLED WITH CHROME (STAINLESS WHERE NOTED) PLATED ESCUTCHEONS AT THE PENETRATION. ALL PIPING PENETRÁTING EXTERIOR WALLS AND ROOFS SHALL BE FLASHED IN AN APPROVED MANNER AND SHALL BE SEALED WEATHER TIGHT. PIPING PENETRATING RATED PARTITIONS SHALL BE PROTECTED AS REQUIRED BY LOCAL CODE AUTHORITY. (SEE DETAILS)
- MANUFACTURER'S MODEL NUMBERS ARE SPECIFIED SOLELY TO ESTABLISH STANDARDS OF QUALITY FOR PERFORMANCE AND MATERIALS.
- 10. PRODUCT INSTALLATION SHALL ADHERE TO MANUFACTURERS' RECOMMENDATIONS.
- 11. PROVIDE ACCESS PANELS FOR EQUIPMENT THAT REQUIRES PERIODIC SERVICE.
- 12. TOPS OF ALL FLOOR DRAINS SHALL BE SET FLUSH WITH FINISHED FLOOR. ALL PIPING ABOVE GRADE SHALL BE PROPERLY SUPPORTED BY THE BUILDING STRUCTURE AND SHALL NOT REST ON CEILING TILES OR CEILING STRUCTURE.
- REQUIREMENTS OF ALL PLUMBING EQUIPMENT WITH THE ELECTRICAL DRAWINGS AND SHALL FURNISH EQUIPMENT WIRED FOR THE VOLTAGES SHOWN HEREIN.
- ALL SUPPLIES TO INDIVIDUAL FIXTURES AND EQUIPMENT. PROVIDE BALL VALVES ON ALL WATER MAIN BRANCHES IN CORRIDORS AND WHERE INDICATED ON DRAWINGS. ALL VALVES SHALL BE ACCESSIBLE.
- CONCRETE FLOORS AND WALLS SHALL BE BY THIS CONTRACTOR. 16. CONCRETE PADS AND PLATFORMS FOR WORK OF THIS SECTION WILL BE
- AS NECESSARY TO COORDINATE WORK.
- FIRE-PROOFING WORK.
- FLASHING REQUIREMENTS.
- 19. RUN PIPING CONCEALED, UNLESS SPECIFIED OTHERWISE, AND CLEAR OF CEILING INSERTS.
- 20. PROVIDE CLAMPS, OFFSETS, EXPANSION JOINTS, ANCHORS AND GUIDES AS NECESSARY TO PREVENT STRESS ON PIPING.
- LOW POINTS.
- AND RETURN BRANCHES AND AT PUMP INLETS AND OUTLETS. 23. VERIFY EXACT SIZES, LOCATIONS, INVERTS AND ELEVATIONS PRIOR TO RUNNING ANY PIPING. REFER TO ARCHITECTURAL DRAWINGS FOR EXACT LOCATIONS OF ALL FIXTURES AND EQUIPMENT.
- 24. PIPING SHALL NOT RUN OVER ELECTRICAL PANELS AND SHALL BE COORDINATED WITH WORK OF OTHER TRADES.

13. CONTRACTOR SHALL COORDINATE ELECTRICAL CHARACTERISTICS AND 14. PROVIDE SHUTOFF VALVES ON ALL BRANCH PIPING AND FIXTURE STOPS ON

15. ALL SLEEVES THROUGH CONCRETE FLOORS AND ALL CORE DRILLING OF

PROVIDED BY GENERAL CONTRACTOR. PROVIDE INFORMATION AND HARDWARE

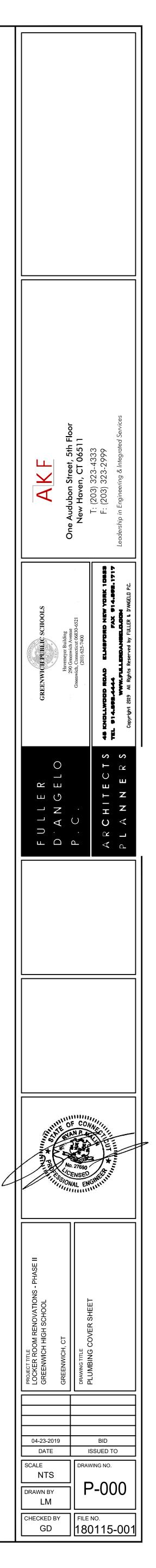
17. SCHEDULE WORK OF THIS SECTION TO AVOID INTERFERENCES WITH

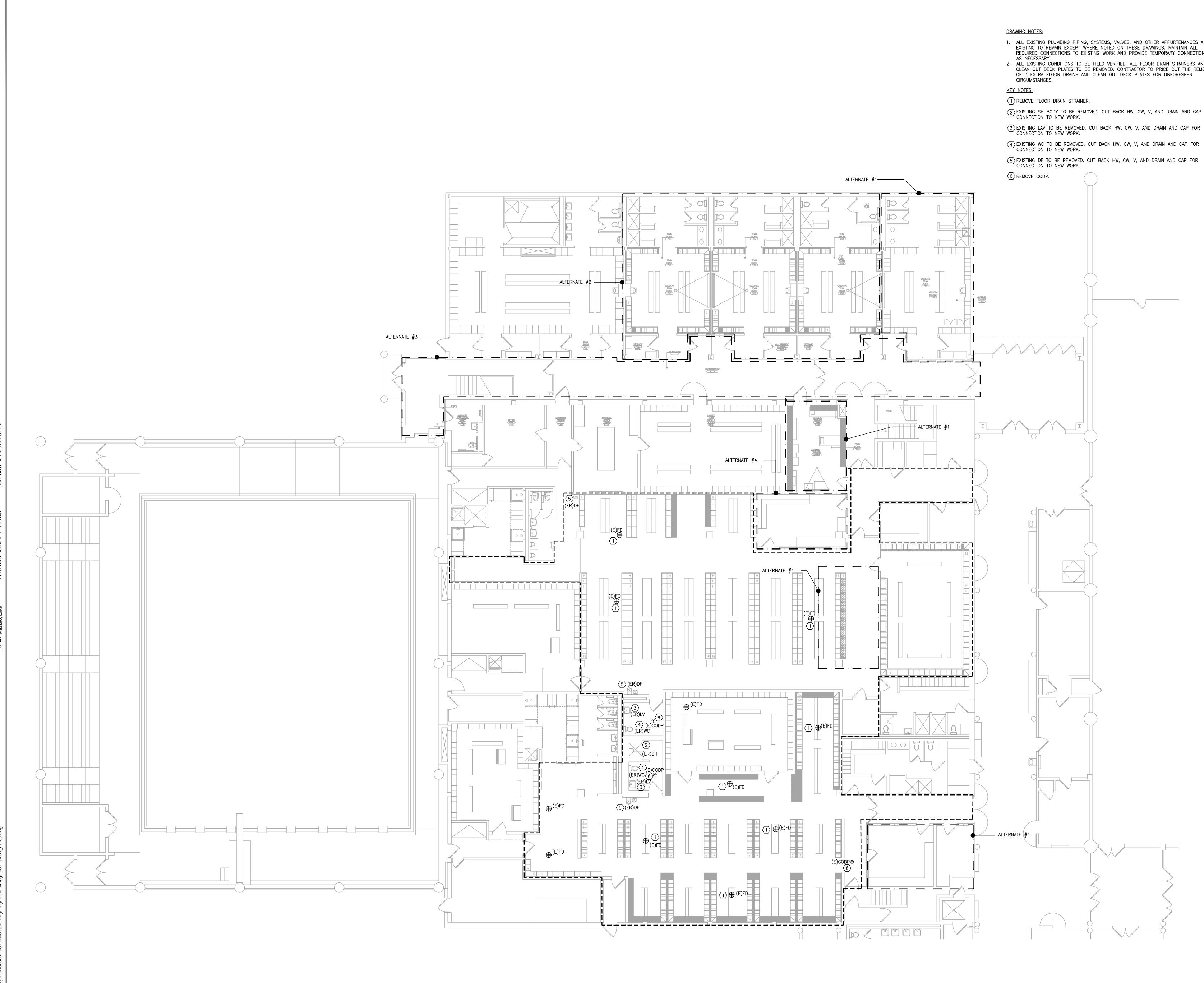
18. COORDINATE ROOF PENETRATIONS WITH WORK OF OTHER SECTIONS AND WITH

21. PROVIDE VENTS AT HIGH POINTS IN PIPING SYSTEMS AND DRAIN VALVES AT

22. PROVIDE GAUGE FITTINGS AND THERMOMETER WELLS AT HOT WATER SUPPLY

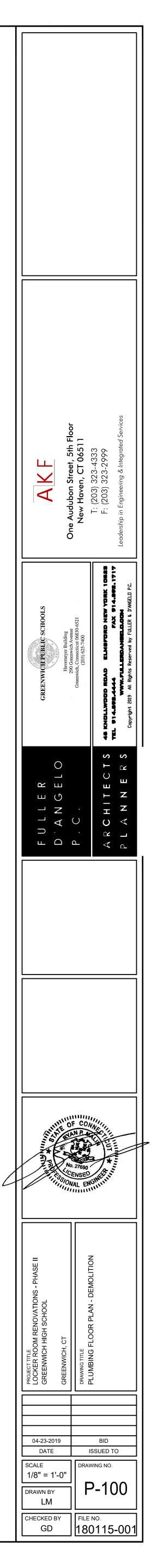
DRAWING INDEX DRAWING TITLE DRAWING NO. P-000 PLUMBING COVER SHEET P-100 PLUMBING FLOOR PLAN - DEMOLITION P-200 PLUMBING FLOOR PLAN P-300 PLUMBING FLOOR PLAN-ALTERNATE 1 P-301 PLUMBING FLOOR PLAN-ALTERNATE 3 P-302 PLUMBING FLOOR PLAN-ALTERNATE 4 P-400 PLUMBING SCHEDULES P-500 PLUMBING DETAILS

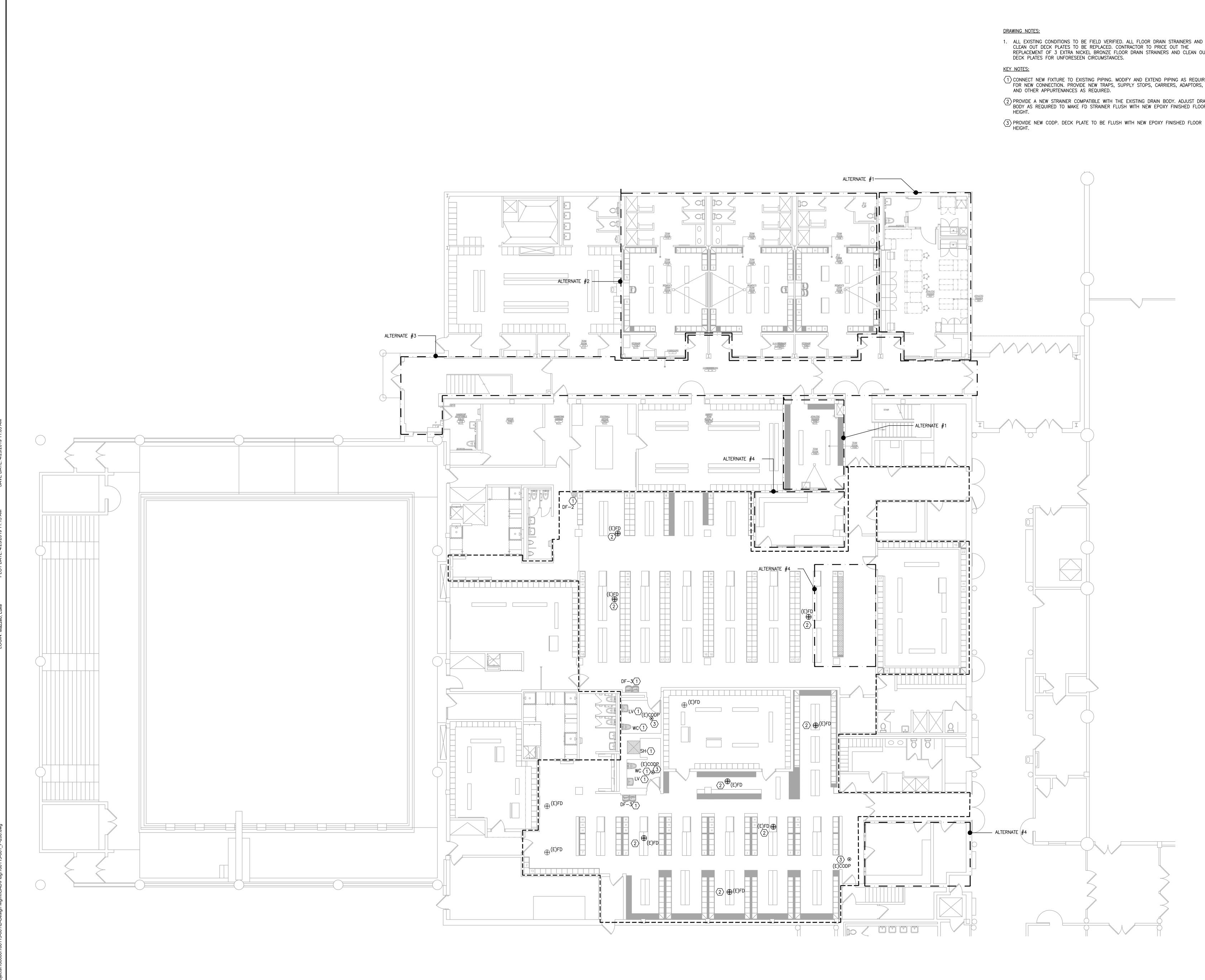




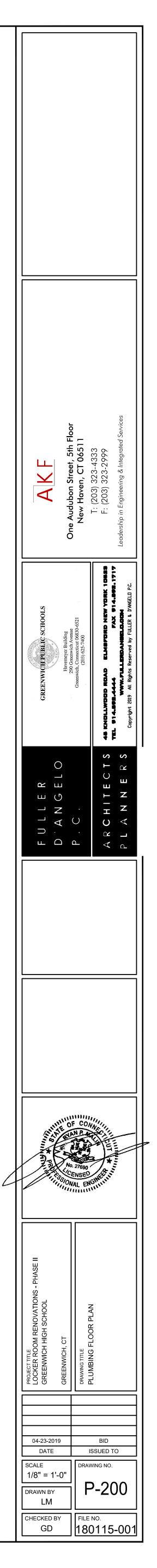
 $\langle 2 \rangle$ EXISTING SH BODY TO BE REMOVED. CUT BACK HW, CW, V, AND DRAIN AND CAP FOR CONNECTION TO NEW WORK. $\overline{(3)}$ EXISTING LAV TO BE REMOVED. CUT BACK HW, CW, V, AND DRAIN AND CAP FOR CONNECTION TO NEW WORK. EXISTING WC TO BE REMOVED. CUT BACK HW, CW, V, AND DRAIN AND CAP FOR CONNECTION TO NEW WORK.

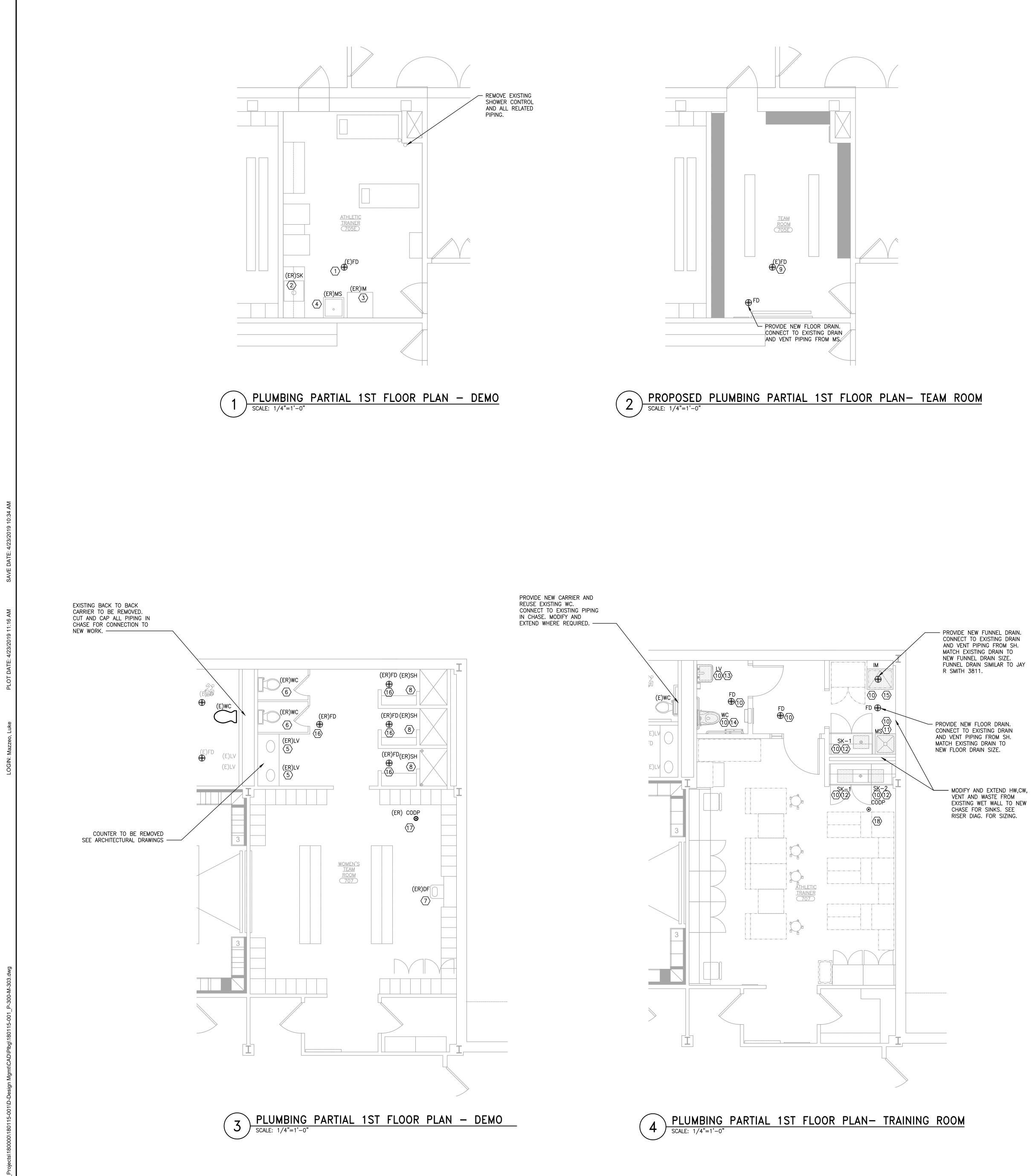
1. ALL EXISTING PLUMBING PIPING, SYSTEMS, VALVES, AND OTHER APPURTENANCES ARE EXISTING TO REMAIN EXCEPT WHERE NOTED ON THESE DRAWINGS. MAINTAIN ALL REQUIRED CONNECTIONS TO EXISTING WORK AND PROVIDE TEMPORARY CONNECTIONS AS NECESSARY. 2. ALL EXISTING CONDITIONS TO BE FIELD VERIFIED. ALL FLOOR DRAIN STRAINERS AND CLEAN OUT DECK PLATES TO BE REMOVED. CONTRACTOR TO PRICE OUT THE REMOVAL





- 2 provide a New Strainer compatible with the existing drain body. Adjust drain body as required to make FD strainer flush with New EPOXY finished floor
- (1) CONNECT NEW FIXTURE TO EXISTING PIPING. MODIFY AND EXTEND PIPING AS REQUIRED FOR NEW CONNECTION. PROVIDE NEW TRAPS, SUPPLY STOPS, CARRIERS, ADAPTORS, AND OTHER APPURTENANCES AS REQUIRED.
- 1. ALL EXISTING CONDITIONS TO BE FIELD VERIFIED. ALL FLOOR DRAIN STRAINERS AND CLEAN OUT DECK PLATES TO BE REPLACED. CONTRACTOR TO PRICE OUT THE REPLACEMENT OF 3 EXTRA NICKEL BRONZE FLOOR DRAIN STRAINERS AND CLEAN OUT





- 1. ALL EXISTING PLUMBING PIPING, SYSTEMS, VALVES, AND OTHER APPURTENANCES ARE EXISTING TO REMAIN EXCEPT WHERE NOTED ON THESE DRAWINGS. MAINTAIN ALL REQUIRED CONNECTIONS TO EXISTING WORK AND PROVIDE TEMPORARY CONNECTIONS AS NECESSARY.
- 2. ALL CUTTING AND PATCHING OF EXISTING FLOORING AND WALLS REQUIRED TO COMPLETE DEMOLITION WORK IS TO BE COORDINATED WITH GC.
- 3. ALL EXISTING CONDITIONS TO BE FIELD VERIFIED. ALL FLOOR DRAIN STRAINERS AND CLEAN OUT DECK PLATES TO BE REMOVED AND REPLACED. CONTRACTOR TO PRICE OUT THE REMOVAL AND REPLACEMENT OF 3 EXTRA BASE BIDKEL BRONZE FLOOR
- DRAIN STRAINERS AND CLEAN OUT DECK PLATES FOR UNFORESEEN CIRCUMSTANCES. 4. PROVIDE TRAP PRIMER FOR ALL NEW FUNNEL DRAINS AND FD.

KEY NOTES:

1 REMOVE FLOOR DRAIN STRAINER

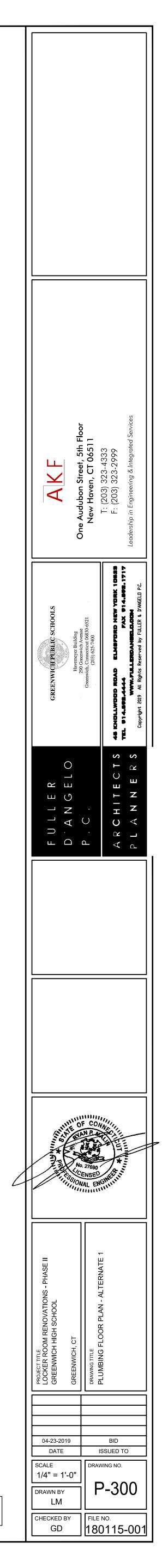
- $\langle 2 \rangle$ EXISTING SK TO BE REMOVED. REMOVE ALL EXISTING HW, CW, V, AND DRAIN. ALL EXISTING PIPING TO BE CUT BACK TO ACTIVE LINES AND CAPPED. WORK TO INCLUDE ALL REQUIRED CUTTING AND PATCHING OF FLOOR OR CEILING CONSTRUCTION. COORDINATE WITH GC.
- $\overline{(3)}$ EXISTING IM TO BE REMOVED. REMOVE ALL EXISTING HW, CW, AND DRAIN. ALL EXISTING PIPING TO BE CUT BACK TO ACTIVE LINES AND CAPPED. WORK TO INCLUDE ALL REQUIRED CUTTING AND PATCHING OF FLOOR OR CEILING CONSTRUCTION. COORDINATE WITH GC.
- (4) EXISTING MS TO BE REMOVED. WORK TO INCLUDE ALL REQUIRED CUTTING AND PATCHING OF FLOOR OR CEILING CONSTRUCTION. COORDINATE WITH GC. LEAVE WASTE AND VENT PIPING FOR CONNECTION TO NEW WORK FLOOR DRAIN.
- $\langle 5 \rangle$ EXISTING LAV TO BE REMOVED. CUT BACK HW, CW, V, AND DRAIN AND CAP FOR CONNECTION TO NEW WORK.
- 6 EXISTING WC AND CARRIER TO BE REMOVED. CUT BACK HW, CW, V, AND DRAIN AND CAP FOR CONNECTION TO NEW WORK.
- T EXISTING DF TO BE REMOVED. CUT BACK HW, CW, V, AND DRAIN AND CAP FOR CONNECTION TO NEW WORK.

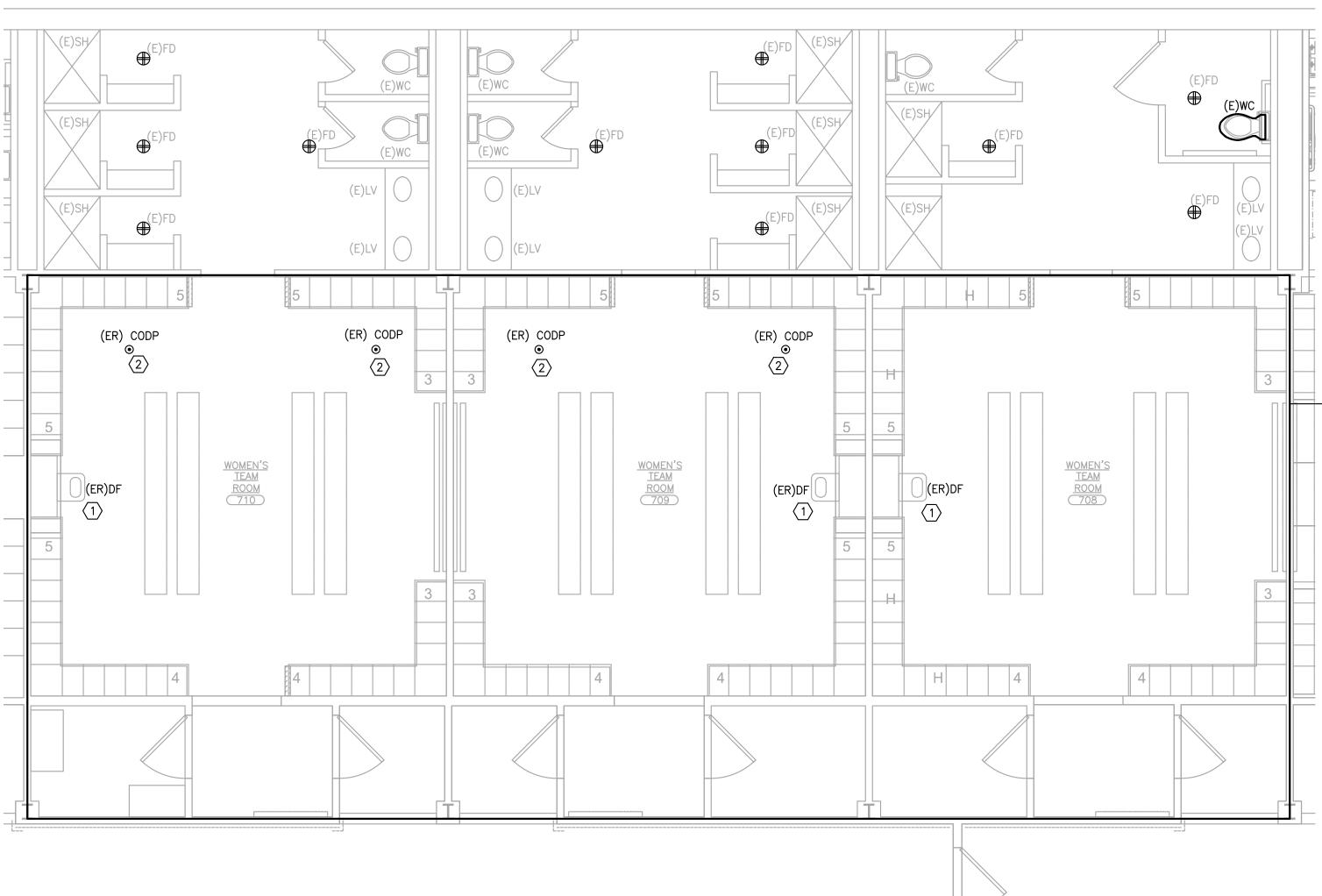
8 EXISTING SH TO BE REMOVED. CUT BACK HW, CW, V, AND DRAIN AND CAP FOR CONNECTION TO NEW WORK.

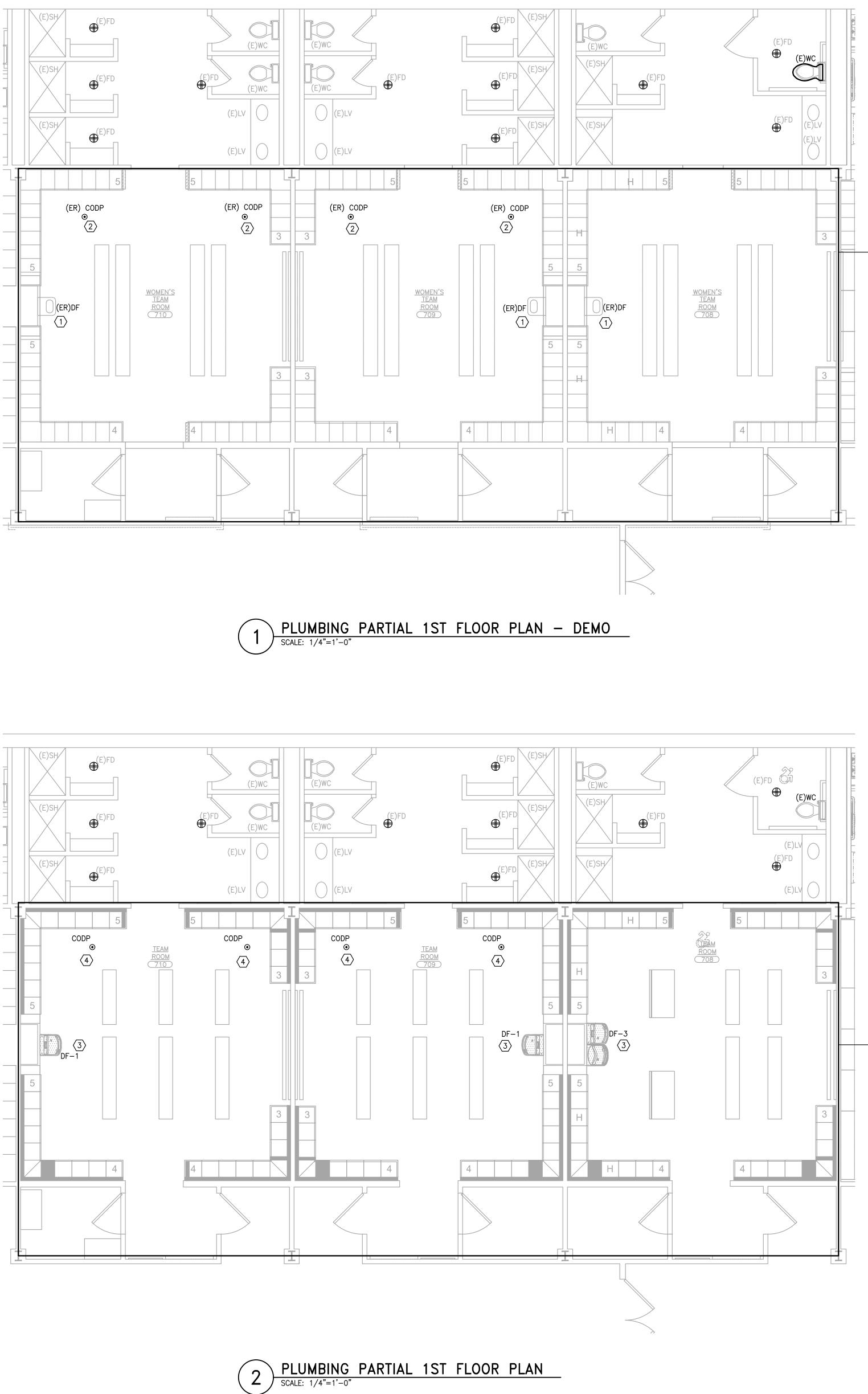
- $\overline{(9)}$ provide a new strainer compatible with the existing drain body.
- (10) CONNECT NEW FIXTURE TO EXISTING PIPING. MODIFY AND EXTEND PIPING AS REQUIRED FOR NEW CONNECTION. PROVIDE NEW TRAPS, SUPPLY STOPS, CARRIERS, ADAPTORS, AND OTHER APPURTENANCES AS REQUIRED.
- $\langle 11 \rangle$ EXTEND $\frac{3}{4}$ " HW&CW, 2" DRAIN, 1½" VENT TO NEW MS.
- (12) EXTEND $\frac{3}{4}$ " HW&CW, 2" DRAIN, 1½" VENT TO NEW SK-1& SK-2.
- (13) EXTEND 34" HW&CW, 2" DRAIN, $1\frac{1}{2}$ " VENT TO NEW LV.
- $\langle 14 \rangle$ EXTEND 1" CW, 4" DRAIN, 2" VENT TO NEW WC.
- (15) EXTEND 34" CW TO NEW IM. 2" IW TO FUNNEL DRAIN.
- (16) REMOVE EXISTING FLOOR DRAIN. REMOVE ALL EXISTING DRAIN AND VENT. ALL EXISTING PIPING TO BE CUT BACK TO ACTUVE LINES AND CAPPED. WORK TO INCLUDE ALL REQUIRED CUTTING AND PATCHING OF FLOOR OR CEILING CONSTRUCTION. COORDINATE WITH GC

(17) REMOVE CODP.

 $\overline{(18)}$ PROVIDE NEW CODP. DECK PLATE TO BE FLUSH WITH FINISHED FLOOR HEIGHT.







1. ALL EXISTING CONDITIONS TO BE FIELD VERIFIED. ALL FLOOR DRAIN STRAINERS AND CLEAN OUT DECK PLATES TO BE REMOVED AND REPLACED. CONTRACTOR TO PRICE OUT THE REMOVAL AND REPLACEMENT OF 3 EXTRA BASE BIDKEL BRONZE FLOOR DRAIN STRAINERS AND CLEAN OUT DECK PLATES FOR UNFORESEEN CIRCUMSTANCES.

KEY NOTES:

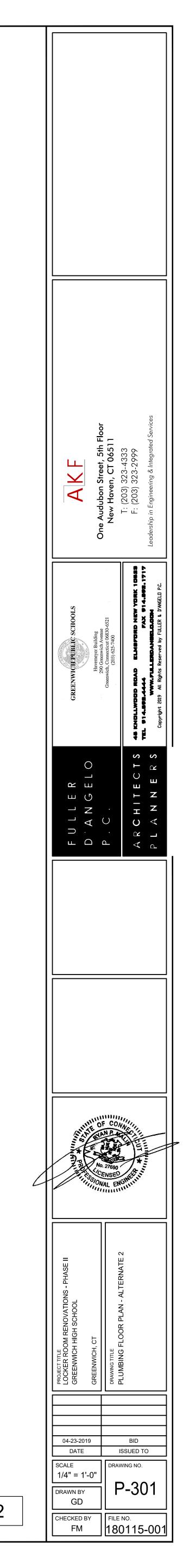
1 existing DF to be removed. Cut back hw, cw, v, and drain and cap for connection to new work. 2 REMOVE CODP.

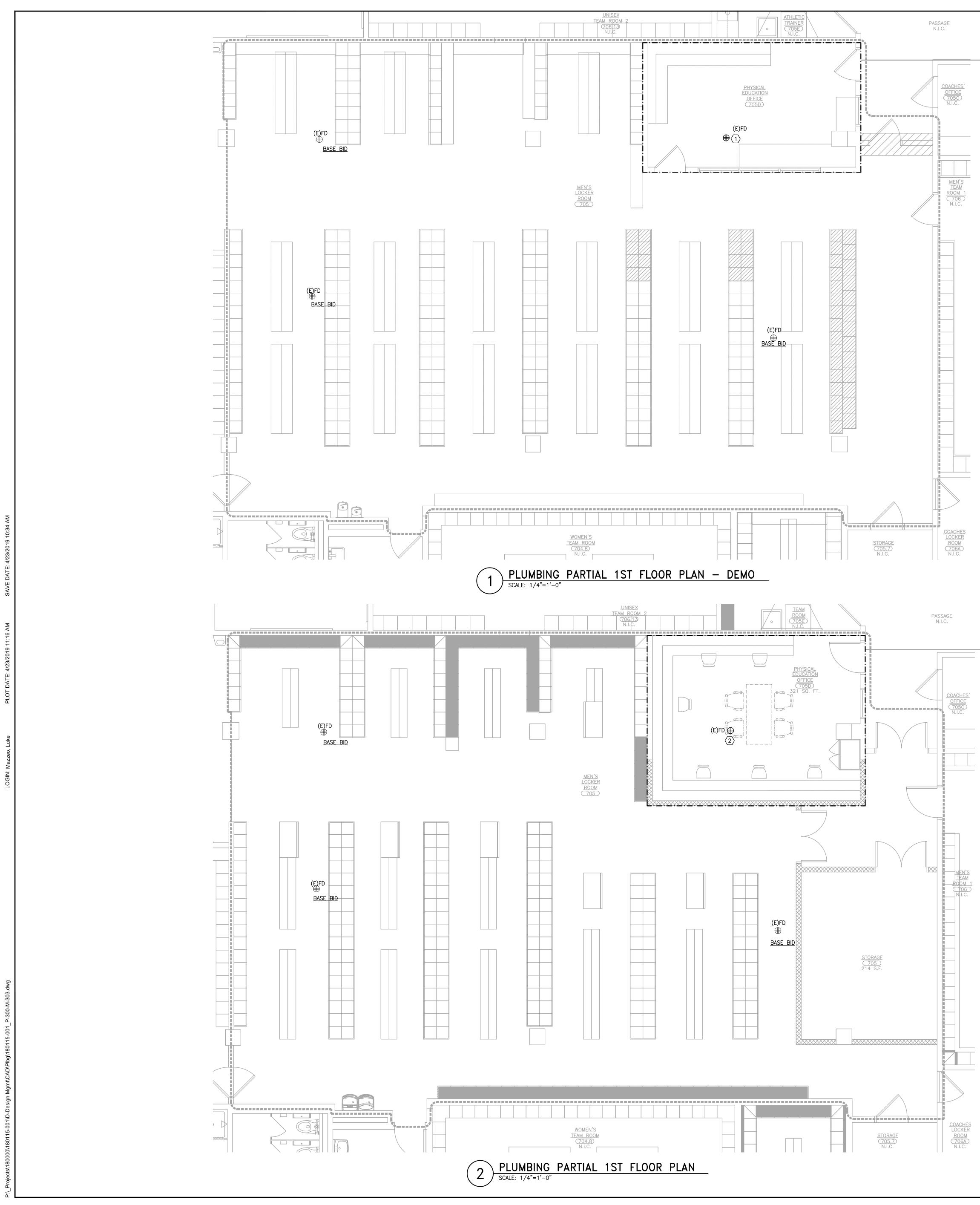
3 CONNECT NEW FIXTURE TO EXISTING PIPING. MODIFY AND EXTEND PIPING AS REQUIRED FOR NEW CONNECTION. PROVIDE NEW TRAPS, SUPPLY STOPS, CARRIERS, ADAPTORS, AND OTHER APPURTENANCES AS REQUIRED.

 $\overline{4}$ provide New Codp. Deck plate to be flush with finished floor height.

- AREA OF WORK

- AREA OF WORK





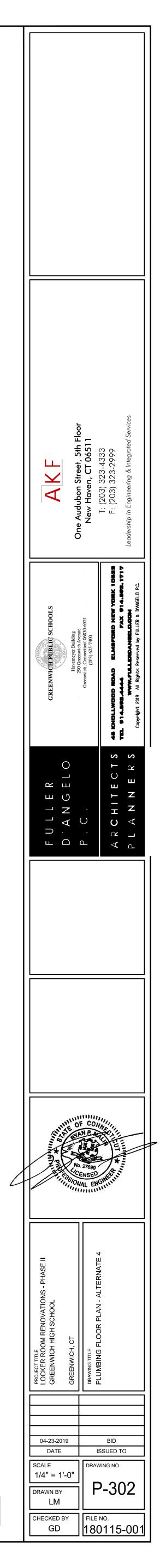
1. ALL EXISTING CONDITIONS TO BE FIELD VERIFIED. ALL FLOOR DRAIN STRAINERS AND CLEAN OUT DECK PLATES TO BE REMOVED AND REPLACED. CONTRACTOR TO PRICE OUT THE REMOVAL AND REPLACEMENT OF 3 EXTRA BASE BIDKEL BRONZE FLOOR DRAIN STRAINERS AND CLEAN OUT DECK PLATES FOR UNFORESEEN CIRCUMSTANCES.

KEY NOTES:

(1) REMOVE FLOOR DRAIN STRAINER

 $\langle 2 \rangle$ provide a new strainer compatible with the existing drain body.

- AREA OF WORK



| | | FI | ΧΤΙ | JRE | S | CHE | EDL | ILE | |
|-------------|----------------------------|--------------------------------------|--------|------|--------------|--------------|------|-----|--|
| | | SER | VICE (| ONNE | CTION | | | | |
| FIXTURE NO. | FIXTURE | MFR. AND MODEL NO. | S | W | V | CW | НW | TW | REMARKS |
| | WATER CLOSET | KOHLER K-4325 | | | | | | | 1.28GPF TOP SPUD ADA WALL MTD |
| | SEAT ELONGATED | CHURCH 9500CT | . " | | | 4.77 | | | - |
| WC | FLUSH VALVE | SLOAN 111-1.28 | 4" | - | 2" | 1" | - | _ | 1.28GPF TOP SPUD EXPOSED MANUAL |
| | CARRIER | ZURN 1200 SERIES | | | | | | | ADJUSTABLE CLOSET CARRIER |
| | LAVATORY | KOHLER K-2032 | | | | | | | ADA WALL-HUNG 4 INCH CENTER-SET VIT CHINA |
| LV | FAUCET | CHICAGO 857-E2805-665PSHAB | _ | 2" | 1½" | ½" | ½" | ½" | SELF-METERING ADA 0.5 GPM |
| | DRAIN | MCGUIRE MFG PRODRAINWC | | | | | | | OFF-SET GRID STRAINER |
| | CARRIER | ZURN Z1231 | | | | | | | CONCEALED ARM WALL CARRIER |
| | SHOWER | FIELD-FABRICATED | | | | | | | CONSTRUCTION PER ARCHITECTURAL DRAWINGS |
| SH | SHOWER SUPPLY | BRADLEY HN200 | _ | 2" | 1½" | 3⁄4" | 3⁄4" | _ | SELF-METERING WALL-MTD SS SHOWER UNIT 1.5GPN W\ ASSE 1016 SAFETY VALVE SET TO 110°F |
| | DRAIN | KOHLER K-9132 | | | ⁻ | | | | WITH COLLAR, CLAMP AND NB STRAINER |
| | ACCESORIES | COORDINATE W\ GC | | | | | | | MEMBRANE/FLASHING/LINER AS REQUIRED |
| | SINK | ADVANCED TABCO 1014B-05 | | | | | | | CONSTRUCTION PER ARCHITECTURAL DRAWINGS |
| SK-1 | FAUCET | CHICAGO FAUCETS 895–317E73–RGD2AB | _ | 2" | 1½" | 3⁄4" | 3⁄4" | _ | ASSE 1016 SAFETY VALVE SET TO 110°F |
| | DRAIN | ADVANCED TABCO K-410 | 1 | _ | " 2 | /4 | /* | | INSTALL PER MFR INSTALLATION INSTRUCTIONS |
| | CARRIER | UNDER MOUNT | | | | | | | INSTALL PER MFR INSTALLATION INSTRUCTIONS |
| | SINK | ADVANCED TABCO 2020A-14 | | | | | | | CONSTRUCTION PER ARCHITECTURAL DRAWINGS |
| SK-2 | FAUCET | CHICAGO FAUCETS 895–317E73–RGD2AB | _ | 3" | 1½" | 3⁄4" | 3⁄4" | _ | ASSE 1016 SAFETY VALVE SET TO 110°F |
| 011 2 | DRAIN | ADVANCED TABCO K-410 | | Ŭ | 1 ″2 | /4 | /4 | | INSTALL PER MFR INSTALLATION INSTRUCTIONS |
| | CARRIER | UNDER MOUNT | | | | | | | INSTALL PER MFR INSTALLATION INSTRUCTIONS |
| DF-1 | DRINKING FOUNTAIN DRAIN | | _ | 3" | 1½" | <i>3</i> ∕4" | _ | _ | BOTTLE FILLING STATION & ADA COOLER; HIGH EFFICIENCY |
| | ACCESORIES | COORDINATE W\ GC | | | | | | | INSTALL PER MFR INSTALLATION INSTRUCTIONS |
| DF-2 | DRINKING FOUNTAIN DRAIN | ELKAY EDFP19C | _ | 2" | 1½" | 3⁄4" | _ | _ | SEMI-RECESSED FOUNTAIN, NON-FILTERED NON-REFRIGERATED STAINLESS |
| DI -2 | ACCESORIES | COORDINATE W\ GC | | | | | | | INSTALL PER MFR INSTALLATION INSTRUCTIONS |
| DF-3 | DRINKING FOUNTAIN DRAIN | ELKAY EZSTLG8WSSK | _ | 2" | 1½" | 3⁄4" | _ | _ | DOUBLE FOUNTAIN WITH BOTTLE FILLER AND COOLER |
| | ACCESORIES | COORDINATE W\ GC | | | | | | | INSTALL PER MFR INSTALLATION INSTRUCTIONS |
| | SINK | TERRAZZO TSH-24-KF24 | | Ī | 1 | Ī | | | |
| MS | FAUCET | T&S BRASS B–0665–BSTR | _ | 2" | 1½" | 3⁄4" | 3⁄4" | _ | 8" WALL MOUNTED SERVICE SINK FAUCET/ MOP HANGER BRACKET |
| | DRAIN | INCLUDED | | | | | | | |
| | CARRIER | FLOOR MOUNTED | | | | | | | |
| IM | ICE MACHINE | PRODIGY PLUS C0530 | - | 2" | - | <i>3</i> ⁄4" | - | _ | INDIRECT WASTE CONNECTION |
| FD | FLOOR DRAIN | JR SMITH 2005 | _ | 3" | 1½" | _ | _ | _ | STRAINER TO BE NICKEL BRONZE |

NOTES:

1. THE EXACT LOCATION AND MOUNTING HEIGHTS OF ALL PLUMBING FIXTURES SHALL BE AS PER THE ARCHITECTURAL DRAWINGS. ALL FIXTURE FINISHES ARE TO BE AS SELECTED AND APPROVED BY ARCHITECT.

2. ALL SINKS AND LAVATORIES THAT ARE HANDICAPPED ACCESSIBLE SHALL BE PROVIDED WITH THERMAL AND IMPACT INSULATION/SHIELDING KITS ON SUPPLIES, TRAPS, TAILPIECES AND WASTE OUTLETS.

3. PROVIDE TMV FOR ALL LAVATORY FAUCETS W\ OUTLET TEMP SET AT 90°F, SIMILAR TO WATTS MODEL LFMMV. INSTALL SUPPLY STOPS ON H&CW

SUPPLY TO TMV.

4. PROVIDE LEAD-FREE SUPPLY STOPS FOR ALL LAVATORIES, MCGUIRE MFG LF SERIES.

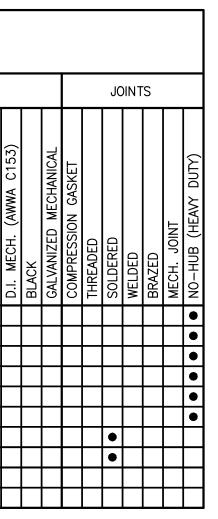
5. PROVIDE TUBULAR CPB TRAPS FOR ALL LAVATORIES, AS MANUFACTURED BY MCGUIRE MFG.

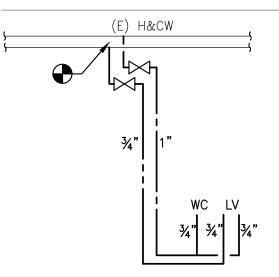
6. PROVIDE TSP FOR ALL NEW FLOOR AND FUNNEL DRAINS WHERE ONE ISN'T AVAILABLE FROM AN OLD FD. TSP SIMILAR TO MIFAB MI-TSP.

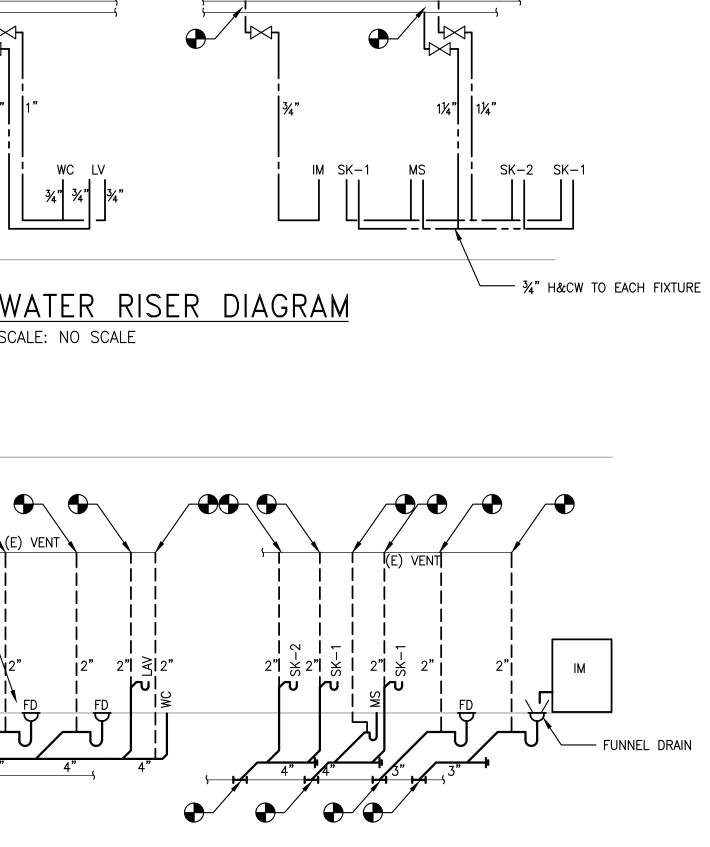
| | | | | | Ρ | Ll | JN | ٨B | BIN | ١G | ; | M | A1 | Ē | RI | A | L | S | C | HI | EC |)U | | - | | |
|----------------------------|----------|-----------|---------------|---------------|-------------|------------|-----------------|-----------------------|----------------------|---------------|-----------------|-----------------|------------------|----------------|--------------------|---------------------|-------------------------|--------------------------|----------------------|--------------------------|-------------------------|-------------------------|------------------|-----------------|--------------------|------------------------|
| SYSTEMS | | | | | | PIPI | Ξ | | | | | | | | | | | | | FIT | TING | S | | | | |
| | REQUIRED | CAST IRON | STL. SCHED.40 | STL. SCHED.80 | BLACK STEEL | GALVANIZED | COPPER TUBE "L" | EXTRA HEAVY CAST IRON | CAST IRON WASTE PIPE | THREADED PIPE | D.I. WATER PIPE | COPPER TUBE "K" | CAST IRON NO-HUB | CAST IRON SOIL | CAST IRON DRAINAGE | STD. C.I175# W.W.P. | EX. H. C.I. 400# W.W.P. | STD. C.I. FLG175# W.W.P. | STD. MALL300# W.W.P. | WROUGHT STEEL GALVANIZED | CAST BRONZE-175# W.W.P. | CAST BRONZE-400# W.W.P. | CAST STEEL FLGD. | SOLDER FITTINGS | BRAZED FITTINGS | D.L. MFCH. (AWWA C153) |
| SAN&ST DRAINAGE (BURIED) | ٠ | | | | | | | | • | | | | • | | | | | | | | | | | | | |
| VENTS (BURIED) | • | | | | | | | | • | | | | • | | | | | | | | | | | | | |
| SANITARY STACKS | • | | | | | | | | • | | | | • | | | | | | | | | | | | $\left - \right $ | ┝ |
| SANITARY BRANCHES VENTS | • | - | | | | | | | | _ | | | • | | | | | | | - | | - | | \vdash | ┝─┦ | - |
| STORM STACKS AND BRANCHES | • | ┝ | - | | | - | | | | - | | | | | | | | | | ┝ | | ┝ | - | | ┝─┦ | - |
| C.W. | • | | \vdash | | | | • | | F | - | | | ┢ | | | | | | \vdash | ┢ | | ┢ | ┢ | • | $\left - \right $ | ⊢ |
| H.W. & H.W.R. | • | | | | | | • | | | | | | | | | | | | | | | | | • | $\left \right $ | - |
| | | | | | | | | | | | | | | | | | | | | | | | | | \square | |
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NOTES:

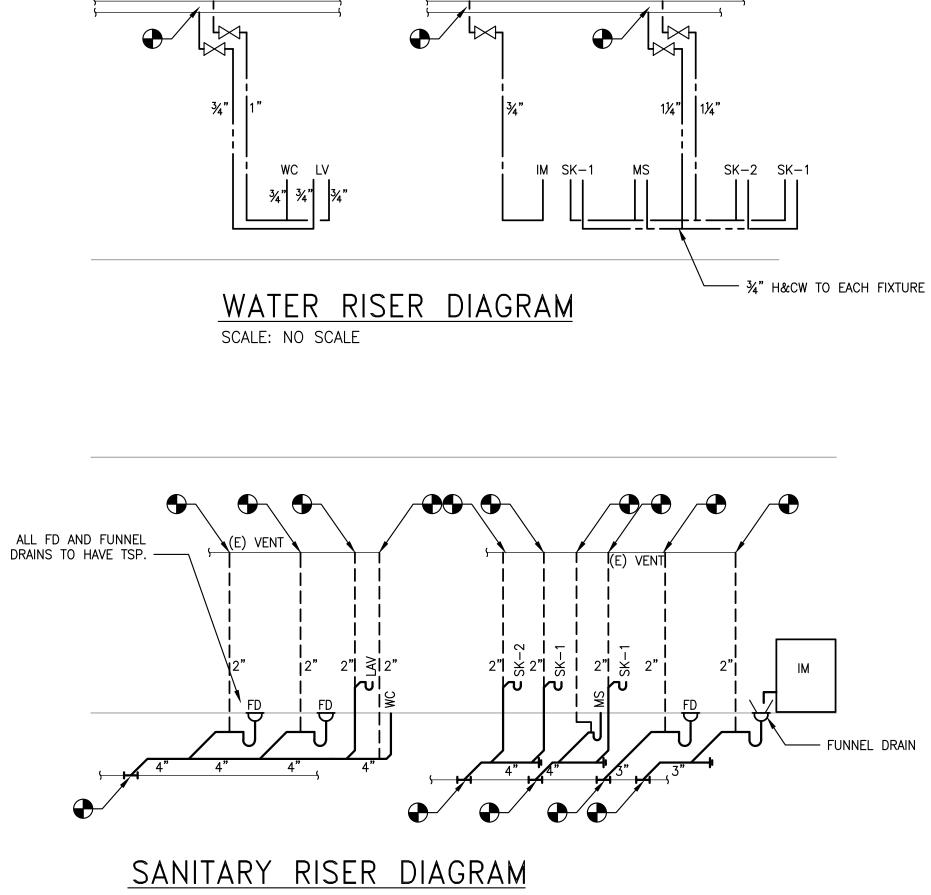
ALL NO-HUB PIPING 6" AND LARGER SHALL BE PROVIDED WITH MECHANICAL RESTRAINTS AT ALL JOINTS, FITTINGS AND CHANGES OF DIRECTION, DESCRIBED IN THE CISPI CAST IRON SOIL PIPE AND FITTINGS HANDBOOK.



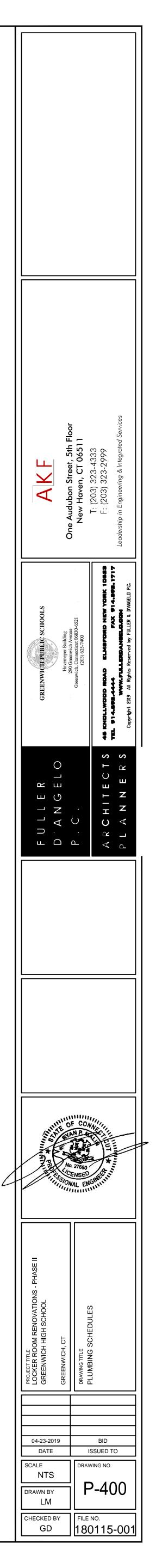


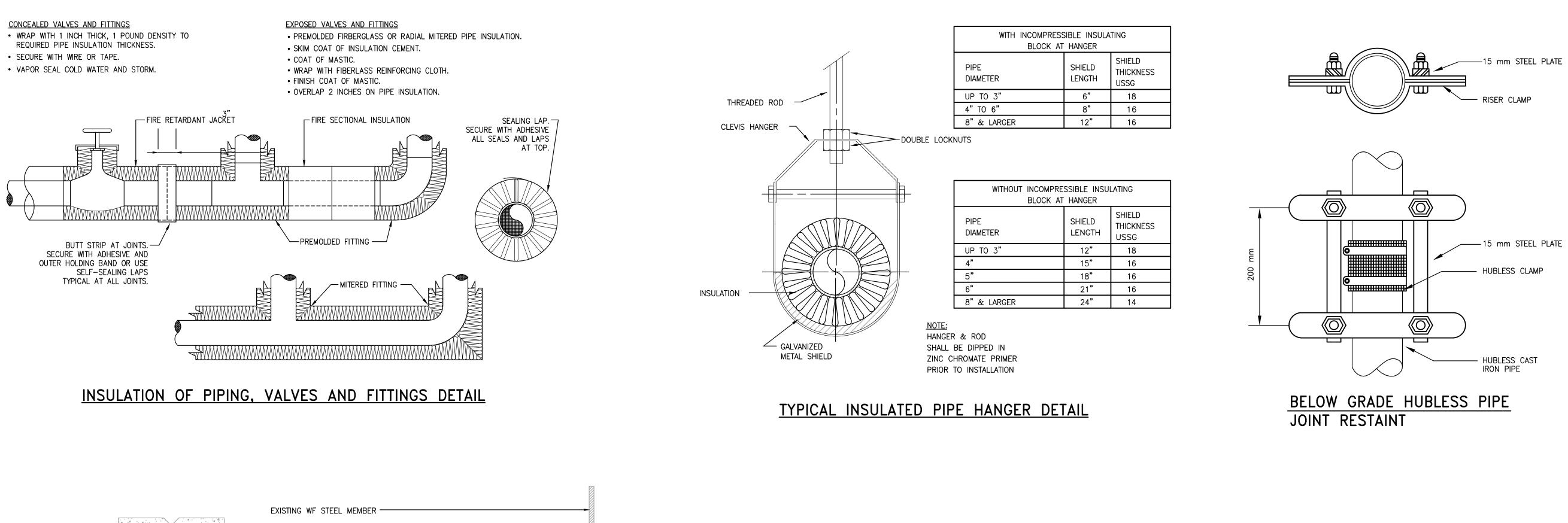


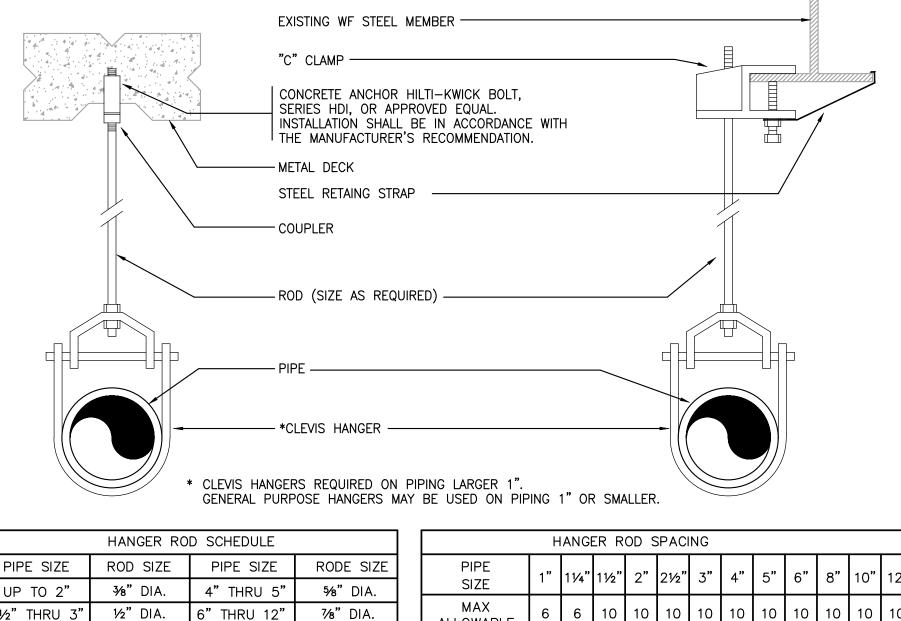
(E) H&CW





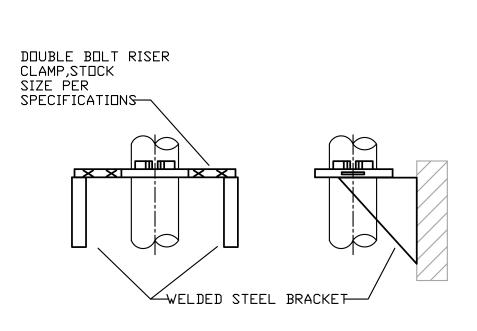




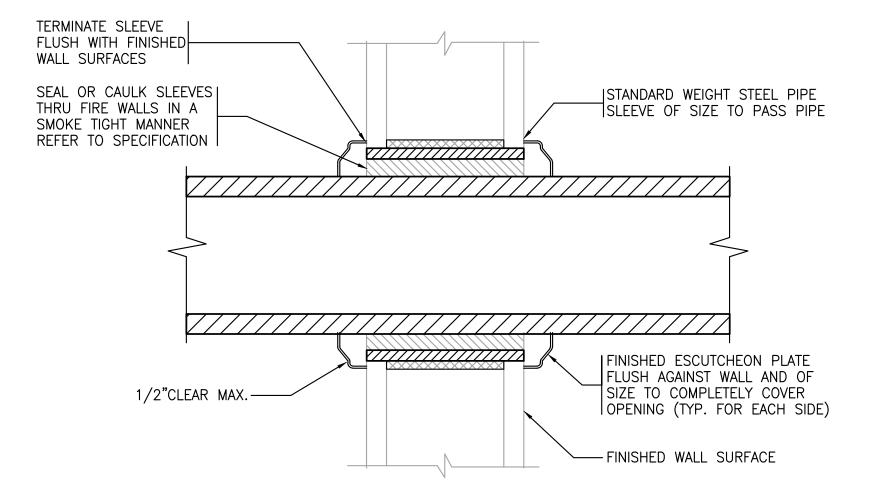


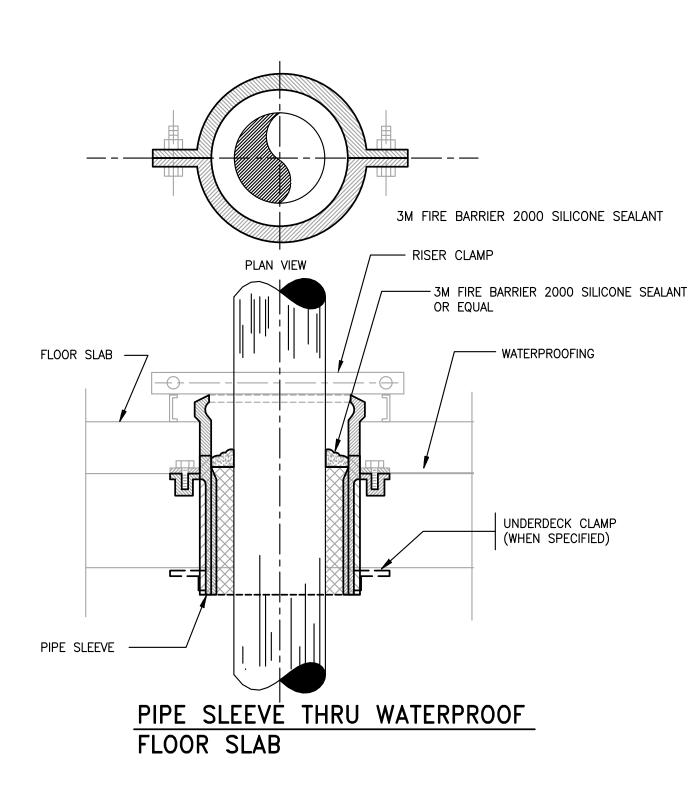
| | | | | 1 |
|---------------|-----------|-------------|-----------|------------------|
| PIPE SIZE | ROD SIZE | PIPE SIZE | RODE SIZE | PIPE |
| UP TO 2" | 3∕8" DIA. | 4" THRU 5" | 5∕8"DIA. | SIZE |
| 21⁄2" THRU 3" | 1⁄2" DIA. | 6" THRU 12" | 7∕8"DIA. | MAX ALLOWABLE |
| | | | | SPACING |





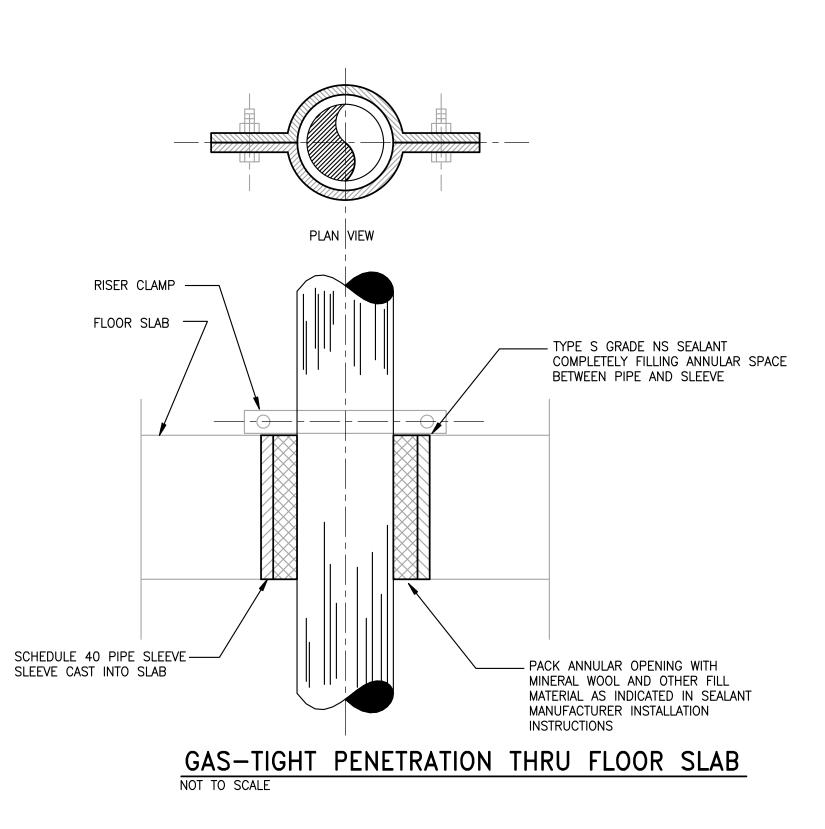
VERTICAL PIPE SUPPORT

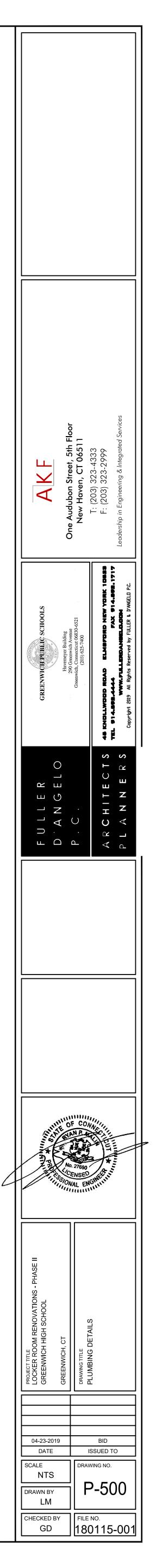




| FT. | FT







FIRE PROTECTION SYMBOL LIST

BASIC SYMBOLS

| | FIRE STANDPIPE PIPING (STANDALONE) |
|--|--|
| | SPRINKLER PIPING |
| DSP | DRY SPRINKLER PIPING |
| PA | PRE-ACTION SPRINKLER PIPING |
| DR | DRAIN PIPING |
| | PIPING BELOW SLAB |
| | EXISTING PIPING |
| - x - x - x - x - x - x - x - x - x - x | EXISTING WORK TO BE REMOVED |
| ····· | HEAT TRACE / FREEZE PROTECTION CABLE & INSULATION |
| | SLOPED CHANGE IN PIPE ELEVATION |
| | BOTTOM PIPE CONNECTION |
| | TOP PIPE CONNECTION |
| † | SIDE CONNECTION |
| G | PIPE DOWN/DROP |
| o | PIPE RISE/UP |
| | PIPE SLOPE |
| X | VALVE IN VERTICAL |
| | UNION |
| | REDUCER |
| ÷ + | WATER PROOF SLEEVE |
| · | SLEEVE |
| | FIRE EXTINGUISHER |
| (FE-X) | A – WATER B – DRY CHEMICAL C – GASEOUS (CO2 OR HALON 1211 – SEE SPEC.) |
| FE-X | FIRE EXTINGUISHER IN CABINET |
| 0-1 | FIRE HOSE VALVE |
| | FIRE HOSE VALVE IN CABINET |
| | FIRE HOSE VALVE w/HOSE IN CABINET |
| | FIRE HOSE VALVE w/FIRE EXTINGUISHER |
| გფ | ROOF MANIFOLD (3-WAY) |
| | SPRINKLER CONTROL VALVE ASSEMBLY |
| X | VALVE ASSEMBLY AC – ALARM CHECK DR – DRY PIPE PA – PRE ACTION |
| — | CONNECT TO EXISTING |
| — | DISCONNECT FROM EXISTING |
| ſ | FIRE DEPARTMENT SIAMESE CONNECTION (WALL MOUNTED) |
| ч © | EXISTING FIRE HYDRANT |
| ۵ | NEW FIRE HYDRANT |
| ₹ | TEMPERATURE AND PRESSURE RELIEF VALVE |
| $\overline{\nabla}$ | PLUG VALVE |
| \boxtimes | MIXING VALVE |
| S S S S S S S S S S S S S S S S S S S | RELIEF VALVE |
| \bowtie | BALL VALVE |
| \bowtie | GATE VALVE |
| \bowtie | GLOBE VALVE |
| 南 | OUTSIDE SCREW & YOKE (OS & Y) VALVE |
| | CHECK VALVE |
| $\overset{\wedge}{\bowtie}$ | PRESSURE REDUCING VALVE (PRV) |
| R R | SOLENOID VALVE |
| Å1 | FLOAT VALVE |
| | Y STRAINER w/BLOW-OFF VALVE |
| ^{مح} م» RPDA | REDUCED PRESSURE DETECTOR ASSEMBLY |
| | DOUBLE CHECK DETECTOR ASSEMBLY |
| | HYDRAULIC REF. POINTS $[\#]$ = ELEMENT, $(\#)$ = NODE |
| | TAMPER SWITCH |
| _ | |
| T | WATERELOW SWITCH |
| T T | WATERFLOW SWITCH |
| | PRESSURE GAUGE w/GAUGE COCK |
| T T | |

ABBREVIATIONS

AUTOMATIC BALL DRIP AREA DRAIN ABOVE FINISHED FLOOR AUTOMATIC TRANSFER SWITCH BOTTOM OF PIPE CUBIC FEET PER MINUTE CHECK VALVE DIAMETER DRAIN DOWN (PENETRATES FLOOR SLAB) EXISTING EXISTING TO BE REMOVED EXISTING TO BE REMOVED & RELOCATED FIRE DEPARTMENT CONNECTION FIRE HOSE CABINET FIRE HOSE RACK FIRE HOSE VALVE FIRE HOSE VALVE CABINET FLOOR DRAIN FLOOR FIRE PUMP FIRE STANDPIPE FEET GENERAL CONTRACTOR GATE VALVE GALLONS GALLONS PER MINUTE HEAT DETECTOR INSIDE DIAMETER INCH JOCKEY PUMP MAXIMUM MINIMUM NORMALLY CLOSE NOT IN THIS CONTRACT NORMALLY OPEN NOT TO SCALE OUTSIDE DIAMETER OUTSIDE SCREW & YOKE GATE VALVE PRE-ACTION POUNDS PER SQUARE INCH (ABSOLUTE) POUNDS PER SQUARE INCH (GAUGE) PRESSURE REDUCING VALVE RELOCATED EXISTING EXISTING TO BE REMOVED AND RETURN TO OWNER SMOKE DETECTOR SPRINKLER TOP OF PIPE TAMPER SWITCH UNLESS OTHERWISE NOTED UP (PENETRATES FLOOR SLAB) VACUUM BREAKER WATER FLOW SWITCH ZONE

FIRE PROTECTION GENERAL NOTES

- GENERAL NOTES, SYMBOL LIST AND DETAILS ARE APPLICABLE TO ALL FIRE 1. PROTECTION DRAWINGS.
- 2. ALL WORK IS NEW UNLESS OTHERWISE NOTED.
- 3. ALL FIRE PROTECTION WORK SHALL BE IN ACCORDANCE WITH THE CURRENT CT STATE FIRE SAFETY CODE, THE PROTECTION CODE AND ALL APPLICABLE LOCAL
- CODES AND DRAWINGS. 4. PROVIDE WET-PIPE SPRINKLERS IN ALL AREAS. ALL SPRINKLER INSTALLATIONS SHALL COMPLY WITH THE NFPA 13 STANDARD.
- 5. SECURE WATER FLOW TEST DATA TAKEN FROM FIRE HYDRANTS NEAREST SITE. IF RECENT FLOW TEST DATA (LESS THAN ONE-YEAR OLD) IS NOT AVAILABLE FROM CITY RECORDS, MAKE NECESSARY TESTS AS REQUIRED BY NFPA STANDARDS TO DETERMINE CHARACTER OF WATER SUPPLY. MINIMUM OF 20 PSI DROP IN PRESSURE BETWEEN STATIC AND RESIDUAL PRESSURE SHALL BE REQUIRED IN ORDER TO OBTAIN ACCURATE DATA.
- 6. SPRINKLER SYSTEM SHALL BE HYDRAULICALLY CALCULATED FOR LIGHT AND ORDINARY, HAZARD OCCUPANCIES EXCEPT AS NOTED.
- 7. ADD 10% CONTINGENCY FACTOR TO HYDRAULIC CALCULATIONS.
- MINIMUM PRESSURE AT END SPRINKLER HEAD 7 PSI, OR AS REQUIRED BY 8. SPRINKLER HEAD, WHICHEVER IS GREATER.
- 9. EQUIVALENT FITTING LENGTHS USED IN HYDRAULIC CALCULATIONS SHALL BE IN ACCORDANCE WITH NFPA STANDARD NO. 13.
- 9.1. WHEREVER FITTINGS ARE USED IN CONJUNCTION WITH SCH.10 LIGHTWALL PIPE, EQUIVALENT FITTING LENGTHS INDICATED IN NFPA-13 SHALL BE INCREASED BY 39%.
- 10. MAXIMUM FLOW VELOCITY SHALL NOT EXCEED 20 F.P.S.
- 11. ALL AUTOMATIC SPRINKLER HEADS, PIPE FITTINGS, PIPE HANGERS, AUTOMATIC CONTROL VALVES AND MANUAL CONTROL VALVES SHALL BE UL LISTED AND SHALL BE APPROVED BY THE ENGINEER PRIOR TO INSTALLATION.
- 12. ALL EXPOSED PIPE, FITTINGS, HANGERS AND SUPPLEMENTARY STEEL SHALL BE PAINTED.
- 13. ENDS OF ALL CROSS MAINS SHALL BE PROVIDED WITH THREADED FLUSHING CONNECTION NO MORE THAN 2 INCHES IN DIAMETER.
- 14. PROVIDE AUXILIARY DRAINS FOR ALL PIPING BELOW DUCT SPRINKLERS AND OPEN
- TRAPPED SECTIONS. PIPING TO ONE SINGLE SPRINKLER IS EXCLUDED. 15. PROVIDE FLUSHING CONNECTIONS WHERE REQUIRED BY NFPA.
- 16. COORDINATE WITH OWNER FOR ALL SHUTDOWNS.
- 17. PROVIDE TEST CONNECTIONS AT EACH SPRINKLER SYSTEM, WITH 1" PIPE AND VALVE. TEST PIPE SHALL BE CONNECTED TO SPRINKLER PIPE AT LEAST 1-1/4" IN SIZE AND SHALL DISCHARGE OUTSIDE BUILDING OR THROUGH 1/2" SMOOTH BORE BRASS OUTLET, WHERE IT CAN BE EASILY SEEN.
- 18. PROVIDE ADDITIONAL HEADS UNDER DUCTWORK LARGER THAN 48" WIDE.
- 19. NEW SPRINKLER HEAD TYPE AND TEMPERATURE RATING SHALL BE IN ACCORDANCE WITH SCHEDULE UNLESS NOTED OTHERWISE AND/OR REQUIRED BY THE LOCAL AUTHORITY HAVING JURISDICTION.
- 20. COORDINATE ALL PIPE PENETRATIONS AND CORING WITH STRUCTURAL ENGINEER AND IN ACCORDANCE WITH DIVISION 01.
- 21. REFER TO ARCHITECTURAL DRAWINGS FOR ALL CEILING RELATED WORK.
- 22. COORDINATE ALL NEW FIRE PROTECTION WORK WITH ALL EXISTING AND/OR NEW DUCTWORK, PIPING AND UTILITIES OF ANY SYSTEMS. DRAWINGS ARE DIAGRAMMATIC AND SHOW THE INTENT OF THE DESIGN. REROUTE ANY PIPING AROUND EXISTING AND/OR NEW SYSTEMS INCLUDING ALL REQUIRED FITTINGS AND SUPPORTS TO MAKE THE INSTALLATION OF THE PIPING AND SPRINKLER HEADS POSSIBLE. RESEAL ANY FIRE AND/OR SMOKE RATED PENETRATIONS THAT HAVE BEEN AFFECTED AS A RESULT OF THE MODIFICATION.
- 23. ALL PIPE, FITTINGS, COMPONENTS AND VALVES INSTALLED IN THE BUILDING FIRE PROTECTION SYSTEM SHALL BE RATED FOR A WORKING PRESSURE OF NOT LESS THAN 175PSI.
- 24. PROVIDE WRITTEN NOTIFICATION TO THE FIRE MARSHAL'S OFFICE OF ANY SHUT-DOWNS TO THE EXISTING FIRE PROTECTION SYSTEMS.
- 25. THIS CONTRACTOR SHALL BE RESPONSIBLE FOR ASSUMING ENGINEERING RESPONSIBILITY FOR THE PROJECT. INCLUDING PROFESSIONAL ENGINEERING SERVICES FOR THE PREPARATION OF WORKING DRAWINGS AND HYDRAULIC CALCULATIONS.

SPRINKLER DESIGN CRITERIA

ENTIRE SPRINKLER SYSTEM SHALL BE HYDRAULICALLY CALCULATED TO MEET FOLLOWING CRITERIA:

- 1. ORDINARY 1 HAZARD OCCUPANCY STORAGES AND MECHANICAL ROOMS DENSITY 0.15 GPM PER SQ. FT OVER MOST HYDRAULICALLY REMOTE 1500 SQ. FT., MAXIMUM COVERAGE PER SPRINKLER HEAD 130 SQ. FT.
- 2. LIGHT HAZARD OCCUPANCY CLASSROOMS, OFFICE SPACE, BATHROOMS, CORRIDORS AND LOCKER AREAS: DENSITY 0.10 GPM PER SQ. FT. OVER MOST HYDRAULICALLY REMOTE 1500 SQ. FT., MAXIMUM COVERAGE PER SPRINKLER HEAD 225 SQ. FT.
- 3. MINIMUM PRESSURE AT SPRINKLER HEAD 7 PSI.
- 4. WHENEVER ROLL GROOVED CONNECTIONS ARE USED, ALLOWANCE FOR ADDITIONAL PRESSURE LOSS AT GROOVES SHALL BE MADE AS FOLLOWS: 4.1. FOR EACH COUPLING ON STRAIGHT RUN INCLUDING STRAIGHT FLOW THROUGH TEE OR CROSS: ADD 1 EQUIVALENT FOOT OF PIPE.
- 4.2. FOR EACH COUPLING AT ELBOW, TEE OR CROSS WHERE DIRECTION OF FLOW CHANGES: ADD 2 EQUIVALENT FEET OF PIPE:
- 5. EQUIVALENT FITTING LENGTHS USED IN HYDRAULIC CALCULATIONS SHALL BE IN ACCORDANCE WITH NFPA STANDARD NO. 13 5.1. WHEREVER FITTINGS ARE USED IN CONJUNCTION WITH LIGHTWALL PIPE,
- EQUIVALENT FITTING LENGTHS INDICATED IN NFPA-13 SHALL BE INCREASED BY 30% 6. DISCHARGE FROM EACH SPRINKLER HEAD SHALL NOT BE LESS THAN
- REQUIRED FOR AREA COVERED BY THIS HEAD. AREA COVERAGE PER HEAD SHALL BE DETERMINED IN ACCORDANCE WITH NFPA STANDARD NO. 13, PARAGRAPH 7-4.3.1.2, OR BY THE MANUFACTURER'S GUIDELINES, WHICHEVER IS GREATER.
- 7. HYDRAULIC CALCULATIONS SHALL BE BROUGHT BACK TO CONNECTION TO WATER SUPPLY FIRE STANDPIPE RISER.
- 8. WATER SUPPLY INFORMATION SHALL BE OBTAINED FROM A CURRENT HYDRANT FLOW TEST PERFORMED AS PER THE WATER UTILITY PROVIDER'S REQUIREMENTS.

| | | | | | SP | RIN | ٢L | ER | ŀ | ΗE | ٩D | | SC | HE | D | JL | E | | |
|-------------|----------|--------------------------|----------|----------|--------------|--------|---------|---------|-------------|----------|----------|----------------------------------|---------------|-----|----------------|-------------------|----------------------------------|--------------------|---|
| | | | MAN | UFACTU | IRER | | | | | | | | | | | | | | |
| DESIGNATION | REQUIRED | TYCO | RELIABLE | GRINNELL | STAR | NIKING | UPRIGHT | PENDENT | FLUSH PLATE | RECESSED | SIDEWALL | SIDEWALL (NATURAL BRONZE FINISH) | FLUSH PENDENT | Å | QUICK RESPONSE | EXTENDED COVERAGE | EXISTING TO BE REMOVED/RELOCATED | EXISTING TO REMAIN | REMARKS |
| DE | RE | | MOD | EL NUN | I BER | | Ч | ΒE | FL | RE | SIC | SIC | Γ | DRY | ß | БХ | Ц | EX | |
| ۲ | • | TYCO | TY3121 | | | | • | | | | | | | | • | | | | NEW UPRIGHT HEAD W/ CAGE GUARD |
| • | • | TYC0 | TY3531 | | | | | • | • | | | | | | • | | | | NEW FLUSH PLATE CONCEALED HEAD |
| ۶ | • | TYC0 | TY3122 | | | | | • | | | | | | | • | | | | NEW PENDENT HEAD W/ CAGE GUARD |
| • | • | TYC0 | RFII TY | 3532 | | | | | • | | | | | | • | • | | | NEW EXTENDED COVERAGE FLUSH PLATE CONCEALED HEAD |
| 0 | | | | | | | | | | | | | | | | | | ٠ | EXISTING TO REMAIN |
| × | | | | | | | | | | | | | | | | | • | | EXISTING TO BE REMOVED/RELOCATED |

<u>NOTES:</u>

1. SPRINKLERS TO BE ORDINARY TEMPERATURE RATING EXCEPT AS OTHERWISE REQUIRED BY THE NFPA 13.

2. EXPOSED HEADS IN OCCUPIED SPACES SHALL BE CHROME FINISH.

3. PROVIDE ESCUTCHEONS WHEN PENETRATING EXPOSED WALL.

4. PROVIDE SPRINKLER GUARDS AT ALL HEADS 7'-0" AND LOWER.

5. COLOR SELECTION BY ARCHITECT.

6. ALL SPRINKLER HEADS SHALL HAVE A MINIMUM K-FACTOR OF 5.6 (US).

| FIRE PR | 01 | ΓΕ | C 1 | ΓΙΟ | DN | | MA | ١ | EF | RIA | ۱L | S | SC | H | ED | U | LE | • | | | | | | | |
|----------------|-----------|-------------------------------|--------------|----------------------|-------------------|-------------------|-------------------|-----------|------------|--------------|----------------|---------|-------|-------|------------|-----------|--------------|----------------|------------------------|----------|----------------------------|-------------------------|---------------------------------|--------|--------|
| SYSTEMS | | | | | PI | ЪΕ | | | | | | | | FI | [TIN | GS | | | | | J | OIN | rs | | |
| | REQUIRED | TYPE 'K' OR 'L' COPPER TUBING | DUCTILE IRON | CAST IRON WATER PIPE | STEEL SCHEDULE 10 | STEEL SCHEDULE 40 | STEEL SCHEDULE 80 | BLACK | GALVANIZED | CEMENT LINED | MALLEABLE IRON | CLASS D | LINED | BLACK | GALVANIZED | VICTAULIC | DUCTILE IRON | WROUGHT COPPER | SCHEDULE 40 STEEL WELD | THREADED | MECHANICAL JOINT - FLANGED | VICTAULIC (AS PER SPEC) | MECHANICAL JOINT RETAINER GLAND | BRAZED | WELDED |
| FIRE SPRINKLER | \bullet | | | | | \bullet | | \bullet | | | ullet | | | ullet | | \bullet | ullet | | | | | \bullet | | | |
| FIRE STANDPIPE | • | | | | | • | | • | | | | | | ۲ | | • | ٠ | | | • | | • | | | • |

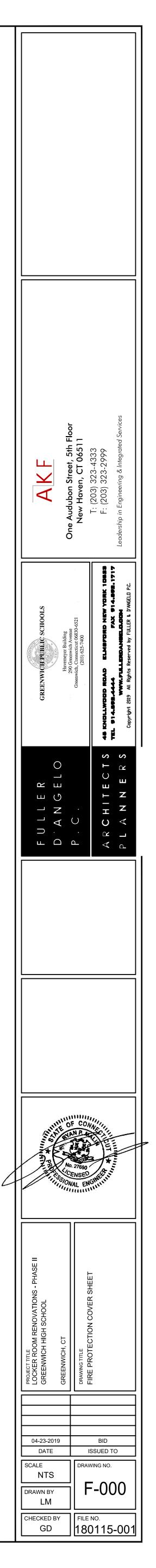
<u>NOTES:</u>

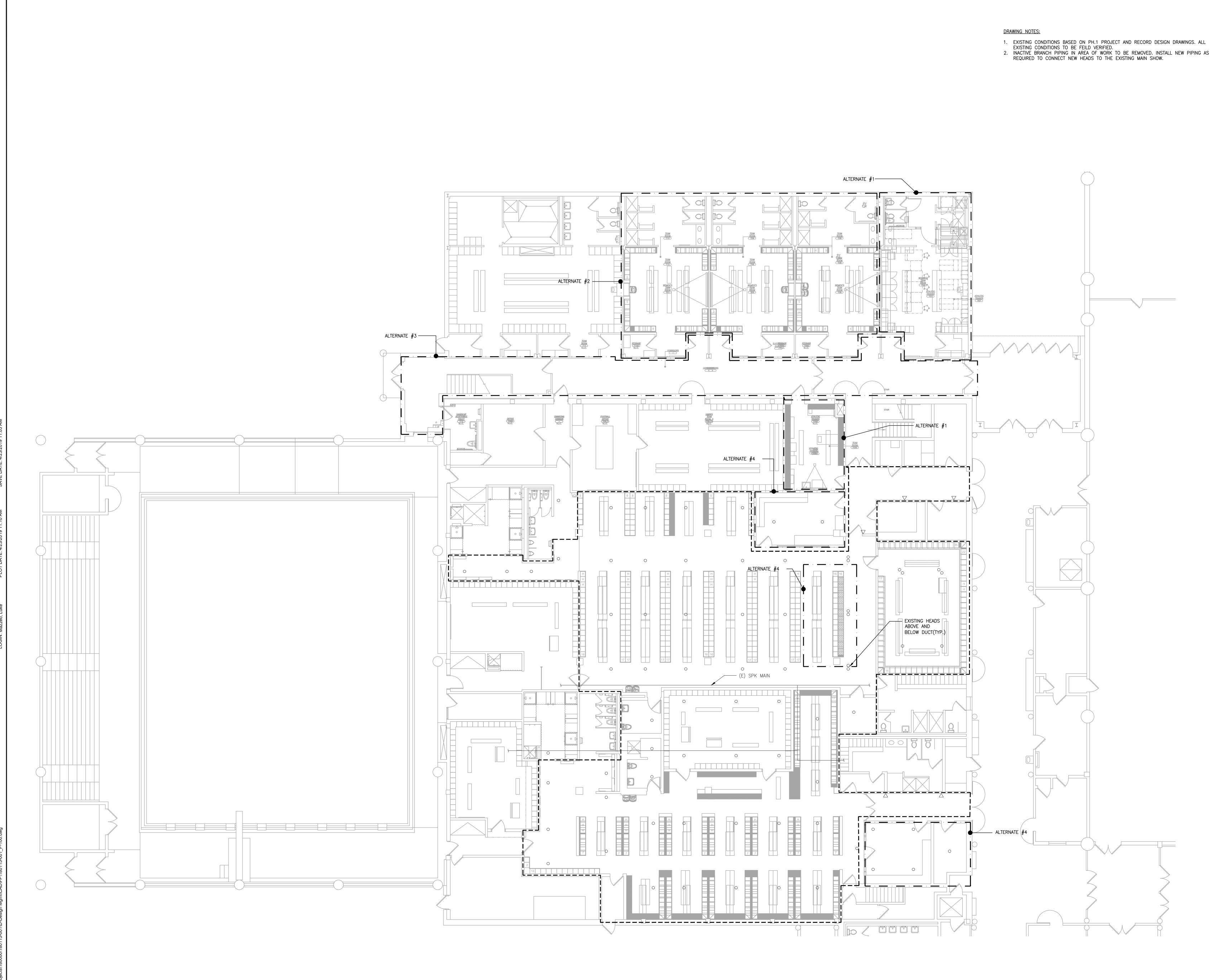
1. ALL MATERIALS SELECTED ON THIS SCHEDULE MUST BE APPROVED BY THE LOCAL AUTHORITIES.

2. MALLEABLE IRON FITTINGS ARE PROHIBITED ON SPRINKLER PIPING 2" AND LARGER.

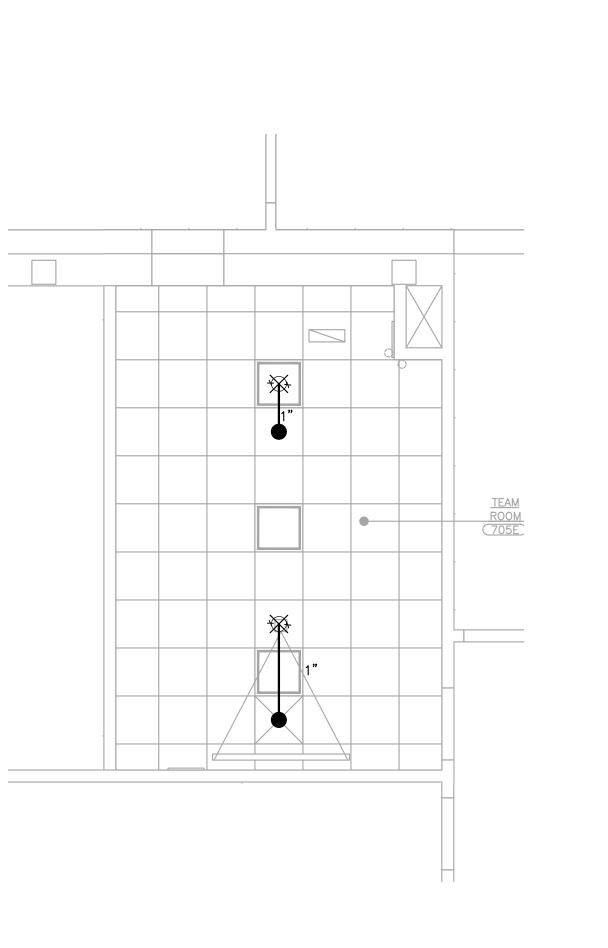
3. CONTRACTOR TO PROVIDE ADD/ALTERNATE PRICING TO USE WELDED PIPING ONLY ON FIRE STANDPIPE PIPING.

| | DRAWING INDEX |
|-------------|--|
| DRAWING NO. | DRAWING TITLE |
| F-000 | FIRE PROTECTION COVER SHEET |
| F-100 | FIRE PROTECTION FLOOR PLAN |
| F-200 | FIRE PROTECTION FLOOR PLAN - ALTERNATE 1 |
| F-201 | FIRE PROTECTION FLOOR PLAN - ALTERNATE 2 |
| F-202 | FIRE PROTECTION FLOOR PLAN - ALTERNATE 3 |
| F-203 | FIRE PROTECTION FLOOR PLAN - ALTERNATE 4 |
| F-300 | FIRE PROTECTION DETAILS |

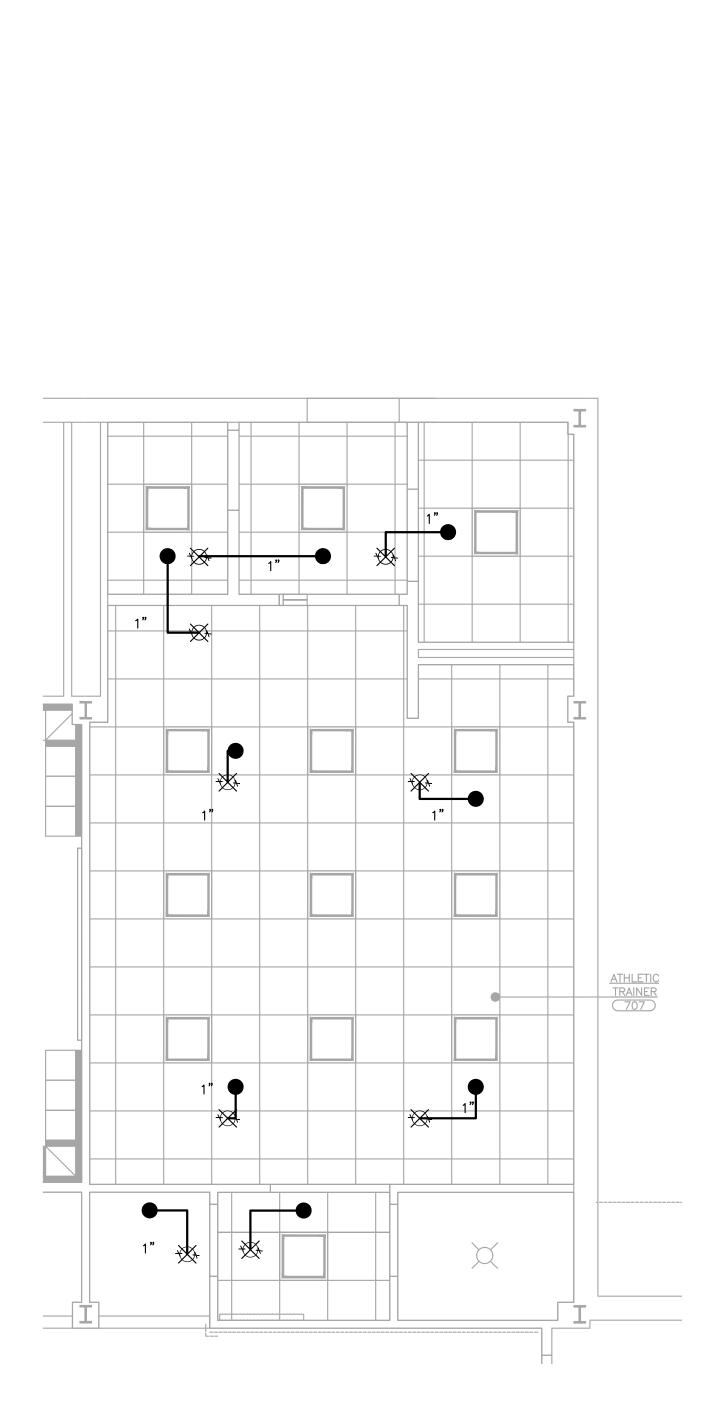








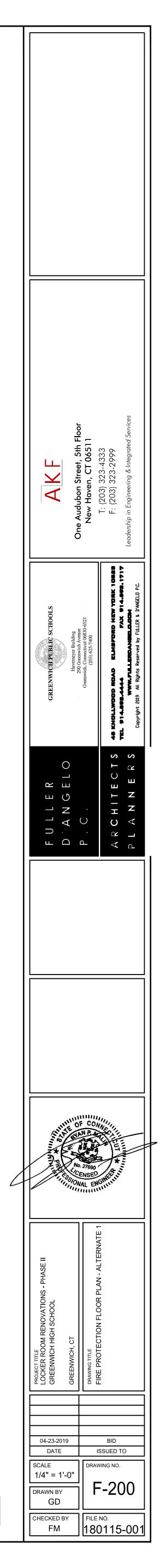




6 FIRE PROTECTION PARTIAL 1ST RCP SCALE: 1/4"=1'-0"

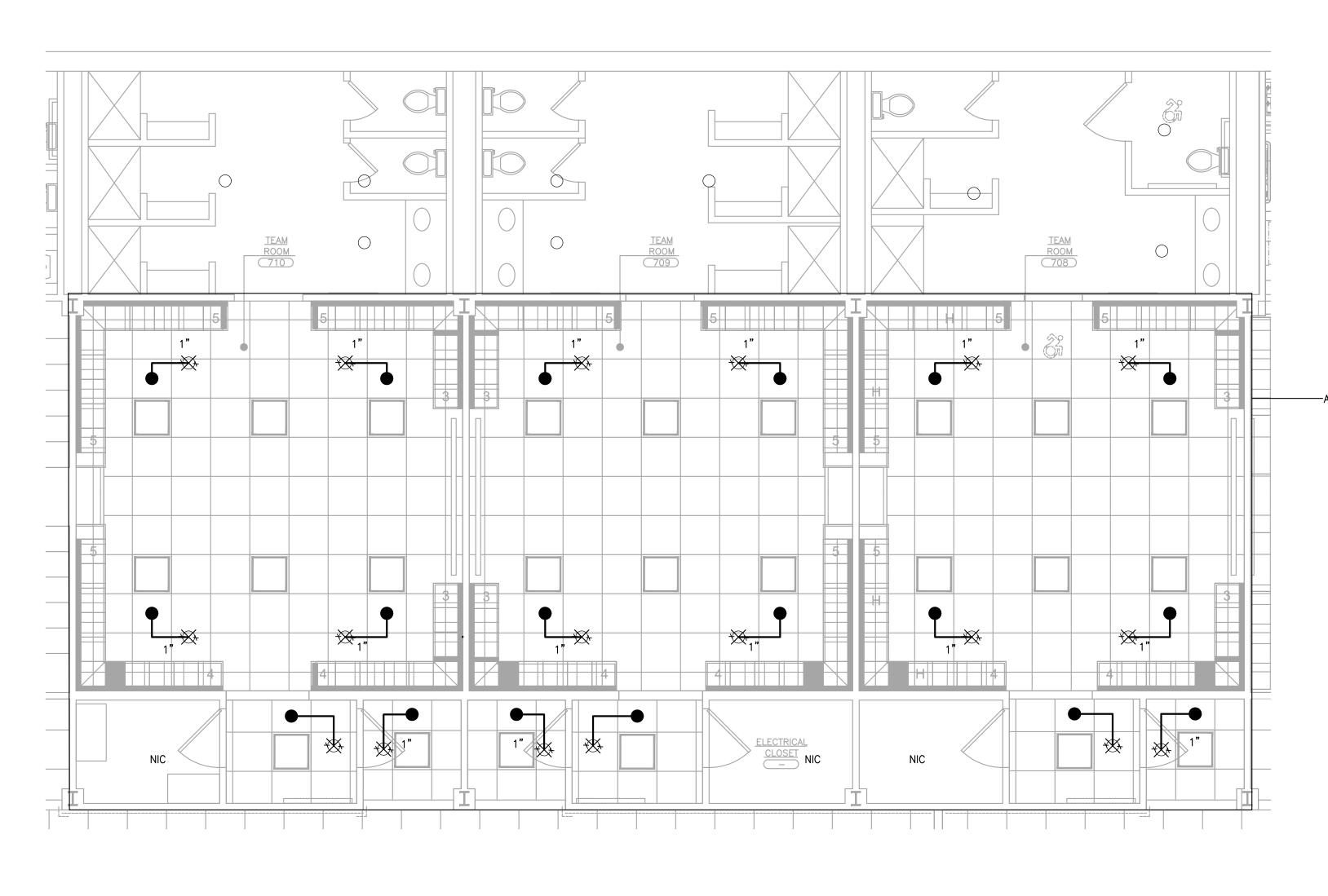
DRAWING NOTES:

1. EXISTING CONDITIONS BASED ON PH.1 PROJECT AND RECORD DESIGN DRAWINGS. ALL EXISTING CONDITIONS TO BE FEILD VERIFIED.

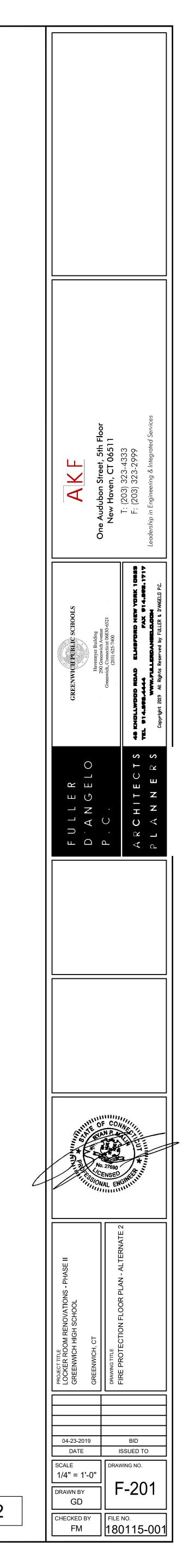


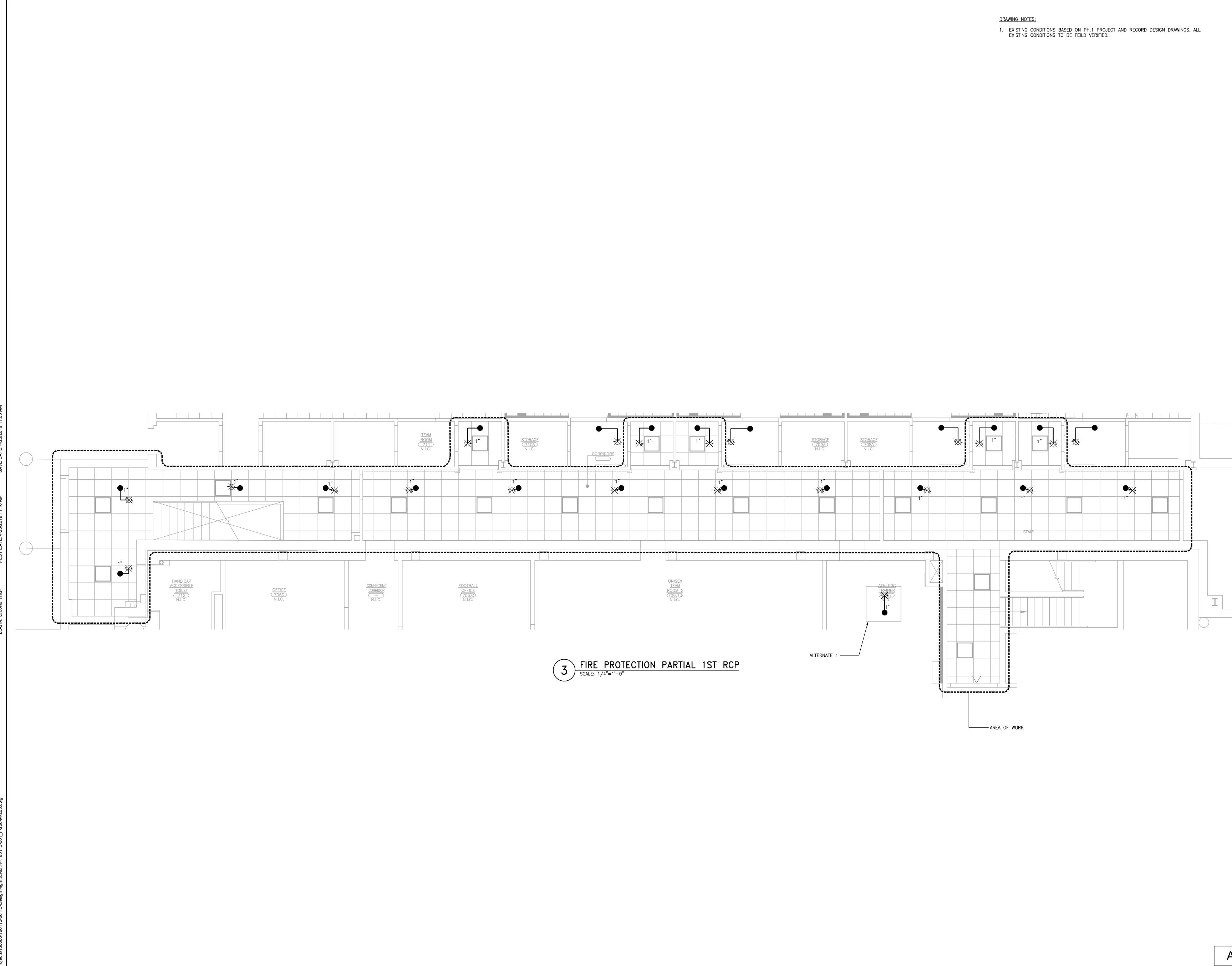
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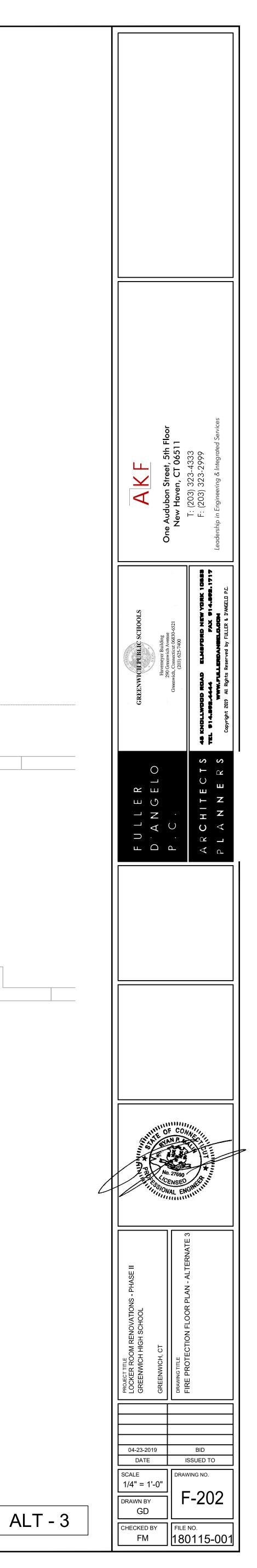
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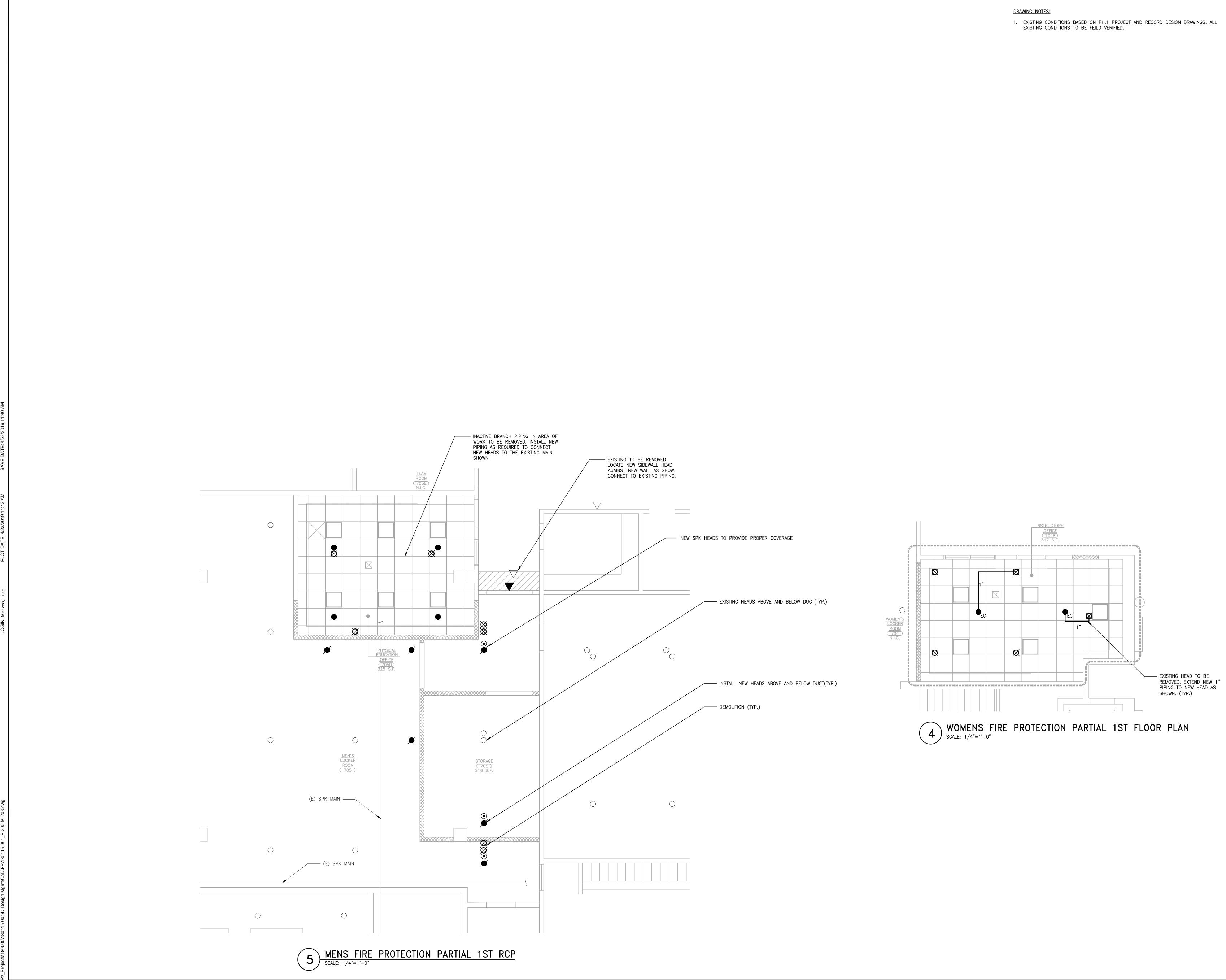


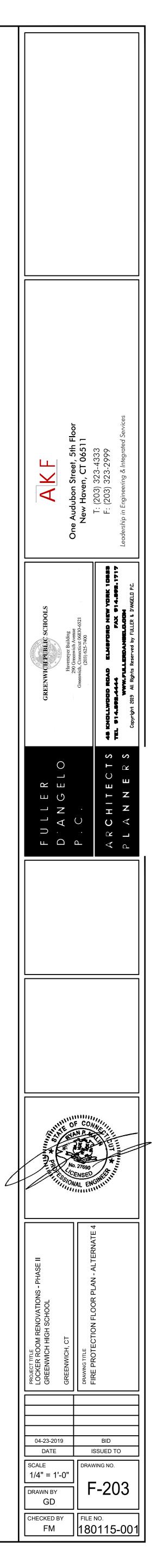
3 FIRE PROTECTION PARTIAL 1ST FLOOR PLAN SCALE: 1/4"=1'-0" DRAWING NOTES: 1. EXISTING HEADS TO BE REMOVED WHERE INDICATED AS EXISTING TO BE REMOVED. EXTEND NEW 1" PIPING TO NEW HEAD AS SHOWN











ALT - 4

