

**FASHION INSTITUTE OF TECHNOLOGY
GOODMAN LOWER LEVEL GALLERY NEW HVAC UNIT
INVITATION FOR BID NUMBER C1592**

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SECTION I:
NOTICE TO BIDDERS

SECTION I: NOTICE TO BIDDERS

FASHION INSTITUTE OF TECHNOLOGY GOODMAN LOWER LEVEL GALLERY NEW HVAC UNIT INVITATION FOR BID NUMBER C1592

For the purposes of this project (the “Project”) the Fashion Institute of Technology and its auxiliary dormitory organization, the F.I.T. Student Housing Corporation, shall hereinafter be collectively referred to as “FIT” unless otherwise distinguished herein. Neither the Fashion Institute of Technology nor F.I.T. Student Housing Corporation will be responsible for receipt of any Bid which does not comply with the instructions as set forth further in this document.

FIT is **ONLY** accepting electronic scanned bids for the subject project. You must email your bid to purchasingbids@fitnyc.edu in PDF format and it should include all the requested documents (See Attachment A – Bid Checklist) including a scanned image of your bid security (Certified Check of 2 percent or Bid Bond of 10 percent of your total bid price), we’ll also need you to mail us the original copy of the bid security to have on file. The bid security must either be mailed to 227 W 27th Street, New York, NY 10001 or dropped off at 333 7th Avenue (16th Floor), New York, NY 10001. Bids must be received by **January 22, 2025, on or before 12:00 P.M.** All bidders will be notified of the bid results within the hour. Bid results are not official until each package has been fully reviewed.

ATTACHMENT A - BID CHECKLIST

FASHION INSTITUTE OF TECHNOLOGY & GOODMAN LOWER LEVEL GALLERY NEW HVAC UNIT INVITATION FOR BID NUMBER C1592

Bidder shall meet the following requirements and submit necessary information with the Bid. Failure to comply with these requirements shall be grounds for rejection of your Bid.

- Did you attend the **mandatory** site inspection?
- Did you include all required documentation? (As per Bidder Requirements – i.e., proof of being in business, permits, licenses, certifications, etc.)
- Did you include the Form of Bid? (See Section VIII.)
- Did you include the Non-Collusive Bidding Certification? (See Section IX.)
- Did you complete in full the Bid Analysis Form, (See Attachment C)
- Did you sign for each Addendum to this project, if any were published? (It is the contractor's responsibility to check FIT's "Current Bid Opportunities" webpage for addendums prior to submitting their bid.)
<http://www.fitnyc.edu/about/administration/finance/purchasing/current-bids.php>
- Did you complete the Contractor Reference Sheet? **Do not list FIT as your projects of similar size and scope.** (See Attachment B)
- Can you provide the required levels of insurance coverage? See: General Conditions – Article 15
- Did you include the Bid Security?
- Can the bidder provide references to at least three (3) different prior contracts that have been completed within the past five (5) years that are similar in size and scope to the project indicated for this Contract?
- Did you provide proof of years in business/date of incorporation?
- Sub-contracting percentage shall **not exceed 50%** of the project cost.
- Did you include an audited or reviewed financial report for the last two (2) years with your bid?

ATTACHMENT B - CONTRACTOR REFERENCE SHEET
FASHION INSTITUTE OF TECHNOLOGY
GOODMAN LOWER LEVEL GALLERY NEW HVAC UNIT
INVITATION FOR BID NUMBER C1592

FIT requests a minimum of three references for **completed** projects of similar size and scope. Please complete the following information for each reference: **(Do not list FIT as your projects of similar size and scope.)**

Contact Name/Title: _____
 Company Name/Address: _____
 Phone Number: _____
 Project Name: _____
 Project Cost: _____
 Project Start/End Date: _____

For FIT Use Only – Reference Responses

Quality of Work: _____ Site Maintenance: _____
 Scheduling: _____ Cooperation: _____ Safety Standards: _____
 Permits: _____ Report Submittals: _____ Payments: _____
 Other Relevant Factors: _____
 Overall Performance Rating: Excellent ___ Satisfactory ___ Marginal ___ Unsatisfactory ___

Contact Name/Title: _____
 Company Name/Address: _____
 Phone Number: _____
 Project Name: _____
 Project Cost: _____
 Project Start/End Date: _____

For FIT Use Only – Reference Responses

Quality of Work: _____ Site Maintenance: _____
 Scheduling: _____ Cooperation: _____ Safety Standards: _____
 Permits: _____ Report Submittals: _____ Payments: _____
 Other Relevant Factors: _____
 Overall Performance Rating: Excellent ___ Satisfactory ___ Marginal ___ Unsatisfactory ___

Contact Name/Title: _____
 Company Name/Address: _____
 Phone Number: _____
 Project Name: _____
 Project Cost: _____
 Project Start/End Date: _____

For FIT Use Only – Reference Responses

Quality of Work: _____ Site Maintenance: _____
 Scheduling: _____ Cooperation: _____ Safety Standards: _____
 Permits: _____ Report Submittals: _____ Payments: _____
 Other Relevant Factors: _____
 Overall Performance Rating: Excellent ___ Satisfactory ___ Marginal ___ Unsatisfactory ___

FIT

Interviewer: _____ Signature: _____ Date: _____

SECTION II:
BID TERMS AND CONDITIONS

SECTION II. BID TERMS AND CONDITIONS

SPECIFICATIONS FOR FASHION INSTITUTE OF TECHNOLOGY GOODMAN LOWER LEVEL GALLERY NEW HVAC UNIT INVITATION FOR BID NUMBER C1592

I. INTRODUCTION

The Fashion Institute of Technology, a community college of art and design, business and technology of the State University of New York, currently has an enrollment of approximately 10,000 full and part-time students. Located in the Chelsea area of Manhattan, FIT's facilities are composed of a twelve-building complex containing administrative/academic offices, classrooms, computer labs, and studios. There are three (3) residence halls located on West 27th Street that currently house approximately 1,250 students and one (1) residence hall located at 406 West 31st Street that houses approximately 1,100 students. F.I.T. Student Housing Corporation is a separate, not-for-profit corporation that was established pursuant to the laws of the State of New York to own and operate these residence halls for the benefit of the College and its students. For purposes of this project all references to FIT shall be recognized to refer to the Fashion Institute of Technology (hereafter, "FIT" or the "College") and the F.I.T. Student Housing Corporation together, unless specifically designated otherwise. The successful responsive and responsible bidder (hereinafter "Contractor") shall be required to enter into a contract with FIT based on the Contract Documents, (including Notice to Bidders, Bid Terms and Conditions, Contract Terms and Conditions, General Requirements, General Conditions, Labor & Material Payment Bond, Performance Bond, Form of Bid, Non-Collusive Bidding Certification, Substitution Form Request, Contract, Affirmative Action Form, Change Order, Form, Contractor's Trade Payment Breakdown, Safety EHS Plan, Prevailing Wage Schedule, Specifications, and Drawings), attached hereto and incorporated herein.

II. SUMMARY OF SCOPE OF WORK

The Work of the Project is defined by the immediately following Project Description herein below and by the Contract Documents.

Project Description: Provide labor, materials, tests, tools and equipment to complete the Goodman Lower Level Gallery new HVAC Unit Project. Contractor may begin survey and procurement of materials immediately following award.

The installation of all equipment in accordance with the Manufacturer's Installation/Operation & Maintenance Manuals & Instructions shall be followed.

III. **BIDDER REQUIREMENTS**

Bidder shall meet the following requirements and submit necessary information with the Bid. Failure to comply with these requirements shall be grounds for rejection of your Bid. FIT reserves the right to reject bids with incomplete information or bid security, or contain conditions not specified in the Bid Terms and Condition herein, or which are presented on a different form other than that provided to bidders. FIT reserves the right to determine whether a Bidder has substantially met all the Bid requirements and to ask for additional information prior to making such a determination.

- A. **Bidder shall have been primarily a mechanical contractor in the HVAC business for a minimum of five (5) years as of the Bid Opening Date. Proof shall be submitted with the Bid.**
- B. Bidder shall have satisfactorily performed work of the size, scope and nature to be performed under this Contract, as evidenced by **references from at least three (3) different successfully completed contracts in an installation similar to those indicated for this Contract in the past five (5) years.** Bidder shall include for each reference: project location, dollar value of contract; initiation and completion date, name, title, address and telephone number of contact person. References cannot be members of FIT staff or FIT consultants.
- C. **Bidder shall attend the mandatory pre-bid meeting and site inspection. Failure to comply with this requirement shall be grounds for rejection of the Bid.**
- D. Bidder is responsible for all necessary field measurements, all necessary data on the existing conditions and verification of all quantities and dimensions listed in the Project Specifications and Drawings, if applicable.
- E. By submitting a Bid, Bidder agrees that s/he has examined the Contract Documents, visited the site, noted all conditions and limitations affecting the Work, and fully understands the nature of the Work. Bidder is required to inform FIT in writing immediately of any instance where changed conditions are encountered.
- F. Bidder shall submit documentation of financial viability, including balance sheets and profit and loss statement for the prior two (2) years, with the Bid.
- G. Bidder, upon request, shall submit copies of current licenses and certifications applicable to the work, including, but not limited to, licenses issued by the Commissioner of Buildings of the City of New York. Proof of the following certificates will also be required: 10 Hour OSHA Outreach Training Program; Asbestos Awareness Training, FDNY Certificate of Fitness, with the Bid.

IV. **APPROVAL OF SUBCONTRACTORS**

Subcontracting shall be permitted **not to exceed 50%** of the work of the Project as determined by FIT. The ratio of the contractors and subcontractors work must be included with your bid submission. All subcontractors are required to gain prior written approval by FIT's Facilities Director. The Mechanical Contractor will be the Prime Contractor (hereinafter "Contractor") and shall be permitted to Subcontract the following types of Services:

- Services to develop, amend and/or upgrade EHS Plan
- Demolition
- Roof installation
- Electrical
- Fire Alarm
- Automatic Temperature Controls
- Metal Fabrication

The Contractor will require that the terms of this Contract apply to the sub-contractors and shall cause all sub-contractors to comply with the terms of this contract.

V. **BID SECURITY**

Failure to provide Bid Security in the prescribed manner shall result in the rejection of the Bid.

Bidder shall provide Bid Security in the form of either a bid deposit or a bid bond, at Bidders option. The bid deposit shall be in the form of a certified check made payable to "Fashion Institute of Technology" in an amount no less than two percent (2%) of the total bid price. The bid bond shall be in an amount no less than ten percent (10%) of the total bid price.

VI. **PRE-BID SITE INSPECTION AND QUESTIONS**

A **mandatory** Pre-Bid Site Inspection for prospective Bidders will be held on **January 7, 2025 at 10:00 A.M.** at the Fashion Institute of Technology, Feldman Building "C Building" Lobby, located 227 27th Street (between 7th and 8th Avenues), New York, NY 10001. **Failure to attend shall be grounds for rejection of your Bid. Please also bring a business card. General contractors are welcome to invite their subcontractors.**

Bidder shall examine the Bid documents carefully. Before bidding, Bidder shall make any requests for interpretation of Bid documents or clarification of any ambiguity therein that should have been detected by a reasonably prudent Bidder. Questions shall be submitted in writing to the attention of Purchasing Department via email: purchasingbids@fitnyc.edu, no later than **January 14, 2025 on or before 3:00 P.M.** Answers shall be provided in the form of an Addendum and be posted on the FIT purchasing department website. Reference Bid number **C1592**.

VII. BID DESIGNATION

- A. FIT is **ONLY** accepting electronic scanned bids for the subject project. You must email your bid to purchasingbids@fitnyc.edu in PDF format and it should include all the requested documents (See Attachment A – Bid Checklist) including a scanned image of your bid security (Certified Check of 2 percent or Bid Bond of 10 percent of your total bid price), we'll also need you to mail us the original copy of the bid security to have on file. The bid security must either be mailed to 227 W 27th Street, New York, NY 10001 or dropped off at 333 7th Avenue (16th Floor), New York, NY 10001. Bids must be received by **January 22, 2025, on or before 12:00 P.M.** All bidders will be notified of the bid results within the hour. Bid results are not official until each package has been fully reviewed.
- B. Bids received late will not be considered.

VIII. PREPARATION OF THE BIDS

- A. Bids must be submitted on the forms supplied by FIT in the Bidder's full legal name or the Bidder's full legal name plus a registered assumed name. All blank spaces for bid prices must be filled in, using both words and figures, words to take precedence over figures. **Conditional bids shall not be accepted.** Bids shall not contain any recapitulation of the Work to be done. Bidder exclusions shall be grounds for bid rejection. Do not modify the bid forms supplied by FIT
- B. Bids that are illegible or that contain omission, alterations, additions or items not called for in the bidding documents may be rejected as not responsive. Any bid which modifies, limits, or restricts all or any part of such bid, other than as expressly provided for in the Notice to Bidders, Bid Terms and Conditions, and Contract Terms and Conditions, may be rejected as not responsive.
- C. FIT may reject any bid not prepared and submitted in accordance with the provisions of the Notice to Bidders, Bid Terms and Conditions, and Contract Terms and Conditions. Neither FIT nor the FIT Student Housing Corporation will be responsible for receipt of any Bid which does not comply with these instructions. Only those Bids emailed to the FIT Purchasing Dept. inbox (purchasingbids@fitnyc.edu) on or before **January 22, 2025, on or before 12:00 PM** will be considered.
- D. Any bid may be withdrawn prior to the scheduled time for the opening of bids or authorized postponement thereof and any bid received after such time and date shall not be considered.
- E. No Bidder may withdraw a bid within ninety (90) days after the actual date of the opening thereof.

IX. AWARD OF CONTRACT

- A. The award of the Contract shall be made to the Bidder submitting the lowest responsible bid if, in the opinion of FIT, the bid is responsive to the bid solicitation, and such Bidder is responsible and qualified to perform the work involved in the sole discretion of FIT. The lowest bidder will be considered the contractor with the lowest bid for the base bid. In case FIT will decide to include the 'alternate' in the scope of work, the lowest bidder will be considered the contractor with the lowest total of the base bid plus the alternate bid.
- B. FIT reserves the right to reject any bid or all bids, to waive any informalities or irregularities or omissions in any bid received.
- C. During the term of the Contract, the Contractor shall promptly notify FIT of any change in the ownership of the Contractor. Failure to notify FIT may result in termination of the Contract.
- D. FIT reserves the right, exercisable in its sole discretion, to cancel and withdraw from the Project at any time in advance of the award.
- E. Prior to the opening of the bids, Bidder shall promptly notify FIT of Change in ownership of the Bidder. Failure to notify with this bid shall be grounds for rejection of the Bid.

X. DAMAGES FOR FAILURE TO ENTER INTO CONTRACT

The successful Bidder, upon failure or refusal to execute and deliver the Contract and bond required within ten (10) days after such Bidder has received notice of the acceptance of such bid, shall forfeit to FIT as damages for such failure or refusal, the security deposited with the Bid or the sum of the difference between the total bid of the successful Bidder and the total bid of the Bidder submitting the next lowest bid, whichever sum shall be higher.

XI. PREVAILING WAGE

This contract is subject to New York State Labor Law 220, Article 8 Prevailing Wage Schedules. The Contractor shall submit with, each invoice, certified payrolls for all labor. Submission of a Certified Payroll with invoice in full compliance with labor laws is a condition of payment.

Contractor and its subcontractors shall pay at least the prevailing wage rate and pay or provided the prevailing supplements in accordance with the Labor Law.

A copy of the prevailing wage schedule, for New York County, can be found at the New York State Department of Labor website. (PRC# 2024015597)

www.labor.ny.gov

Bidder must also comply with all applicable federal, state, and local laws rules, regulations, requirements, and codes, including but not limited to, the statues regulations, laws, rules and requirements specifically referenced in the documents annexed hereto.

XII. M/WBE AND SDVOB

FIT encourages minority and women business enterprise participation in this project by contractors, subcontractors and suppliers, and all bidders are expected to cooperate with that commitment. Also, bidders are encouraged to use Service-Disabled Veteran-Owned Businesses (SDVOB). A directory of New York State Certified Minority and Women's Business Enterprises is available from: Empire State Development Corporation, Minority and Women's Business Development Division at: <http://www.esd.ny.gov/mwbe.html> to assist potential bidders in locating sources of M/WBE subcontractors and reaching these goals. SDVOBs can be readily identified on the directory of certified businesses at: <https://online.ogs.ny.gov/SDVOB/search>."

XIII. MISCELLANEOUS

- A. FIT reserves the right to request clarifications from bidders for purposes of assuring a full understanding of responsiveness and further reserves the right to permit revisions from all bidders who might be, in FIT's sole discretion determined to be viable bidders for contract award, prior to the award.
- B. FIT reserves the right to reject separable portions of any offer, to negotiate terms and conditions consistent with the bid, and to make an award for any or all remaining portions.
- C. FIT reserves the right to eliminate mandatory requirements unmet by all bidders.
- D. Any additional vendor terms which are attached or referenced with a submission shall not be considered part of the bid or proposal, but shall be deemed included for informational purposes only.
- E. Unless otherwise specifically stated in the Bid Terms and Conditions, all specifications and requirements constitute minimum requirements. All bids must meet or exceed stated specifications and requirements.
- F. FIT reserves the right to make an award to the responsive and responsible bidder whose product or service meets the terms, conditions, and specifications of the Bid and whose bid is considered to best serve FIT's interest. In determining the responsiveness and responsibility of the bidder, FIT may consider the following factors, including but not limited to: the ability, capacity, and skill of the bidder to perform as required; whether the bidder can perform promptly, or within the time specified without delay or interference; the character, integrity, reputation, judgment, experience and efficiency of the bidder; the quality of past performance by the bidder; the previous and existing compliance by the bidder with relevant laws and regulations; the sufficiency of the bidder's financial resources; the availability, quality, and adaptability of the bidder's equipment, supplies and/or services to the required use; and the ability of the bidder to provide future maintenance, service, and parts.

SECTION III:
CONTRACT TERMS AND CONDITIONS

SECTION III. CONTRACT TERMS AND CONDITIONS

I. COMPLIANCE REQUIREMENTS

All work hereunder, including but not limited to material and installations, shall be in compliance with the Contract Documents including both specifications and drawings, as well as all applicable state and local building codes (such as the New York City Building Code) and the rules, regulations of governmental agencies and utility companies having jurisdiction over the work.

The following additional notes shall be considered as part of the officially filed drawings:

NONE

THE WORK:

Unless modified by the Contract Documents, the work of each section of the specifications shall include all labor, materials, testing, tools and equipment necessary and reasonably incidental to **the Goodman Lower Level Gallery new HVAC Unit.**

WORKMANSHIP:

All work shall be performed by persons skilled in the work. Work shall be installed true to dimension, plumb and level with neat, accurate cutting and fitting of all materials in accordance with recognized standards of workmanship.

ON-SITE VERIFICATION:

The Contractor shall verify all dimensions and site conditions prior to commencing the work. Dimensions may not be scaled from drawings. Should there be a discrepancy, Contractor is to notify FIT Facilities Director and Architect immediately for clarification.

COORDINATION OF THE WORK:

The Contractor shall be responsible for the coordination of the work and the means and methods of construction and provide FIT with the resume of Contractor's project manager ("Project Manager"). FIT's Facilities Director shall approve the Project Manager and reserves the right to request a replacement Project Manager upon reasonable notice.

WORK HOURS:

Regular work hours are from **7:00 am to 5:00 pm** unless otherwise specified in the Contract Documents. Contractor will have reasonable access to the site in order to complete the work in the given time frame. Contractor shall comply with FIT's additional work rules related to such extended access. All labor costs required to meet this deadline are the sole responsibility of the Contractor and shall be included in the contract price. FIT reserves the right to put the work on hold for any reason as many as three (3) occasions during the course of construction for a total duration of not more than 20 workdays.

PERFORMANCE AND PAYMENT BONDS

In addition to the insurance and bond requirements specified in the General Conditions, Performance and Payment Bonds shall be required for the Work of this Contract.

- A. Simultaneously with the delivery of the executed Contract, Contractor shall furnish to FIT and maintain, at its own cost and expense a Performance Bond in an amount at least equal to one hundred percent (100%) of the contract price as security for faithful performance of the Contract and also a Labor and Material Payment Bond in an amount at least equal to one hundred percent (100%) of the Contract price for the payment of all persons performing labor on the project under the contract or furnishing materials in connection with the Contract. The surety on such bonds shall be a surety company rated B+ or better by A.M. Best Company, shall be licensed to do business in the State of New York, and shall hold a certificate of authority as an acceptable surety on federal bonds or otherwise satisfactory to FIT.
- B. Attorneys-in-fact who sign said bonds on behalf of a surety must affix to each bond a certified and effectively dated copy of their power of appointment.

CONFLICTS, ERRORS AND OMISSIONS:

1. The Contract Documents and typical details apply throughout the work unless noted otherwise.
2. In the event that certain features of the work are not fully shown on the drawings, Contractor must obtain clarification from the FIT Facilities Director and Architect through the use of an AIA Standard RFI form (copies can be obtained from the Architect) before proceeding with the work.
3. In the event of conflicts with the drawings and/or specifications, the Contractor must promptly notify the FIT Facilities Director and Architect. The Architect will determine which shall govern.

MANUFACTURER'S PRODUCTS AND FABRICATIONS:

1. All manufacturers and fabricators printed warnings for handling of their products must be strictly observed.
2. All products and materials must be provided and installed in strict accordance with the recommendations of the manufacturer. In the event of conflict between the drawings or the specifications and the manufacturer's recommendations, Contractor must notify FIT Facilities Director and Architect to obtain clarification before proceeding with the work.
3. Contractor must verify all materials and manufactured items to be in conformance with applicable codes and regulations.

DELIVERY AND STORAGE OF MATERIALS:

1. All materials shall be new and delivered to the site in original, unbroken containers.
2. All materials shall be inspected by the Contractor at time of delivery and Contractor shall reject material evidencing damage or other defects.
3. Contractor shall provide secure and environmentally compatible storage facilities for all materials in accordance with the recommendations of the manufacturer.

PROJECT SCHEDULE:

1. Contractor shall attend a Project Initiation Conference, prior to the commencement of work at the site. Attending this Conference on behalf of the Contractor shall be a representative of FIT and the Project Manager assigned to the project. Contractor shall submit at this Conference a detailed timeline indicating the important milestones of the project and establishing an estimated date of substantial completion in accordance with Contract Documents. He/she shall also present all submittals required by the Contract Documents, such as Insurance Certificates, product tear sheets (not at the initial conference), copy of the General Liability insurance policy (amended to reflect required additional insureds), etc. Project access, storage locations, required crew size and other relevant issues shall also be addressed at this Conference.
2. Time is of the essence. Contractor shall be required to commence work of **the Goodman Lower Level Gallery new HVAC Unit** within five (5) working days of receipt of a Notice to Proceed from FIT. The shop drawings process and ordering need to proceed first. Work shall commence on or about **February 17, 2025. The project shall be Substantially Completed no later than April 30, 2026.** Contractor must be de-mobilized and leave the job site on the ending date of work period. Only close-out, administrative tasks may continue beyond the closing date. Unless otherwise specified, the work is to be performed solely between the hours of **7:00 A.M. to 5:00 P.M.**, Monday through Friday, legal and union holidays excluded. All labor costs encountered to meet this deadline are the sole responsibility of the Contractor and shall be included in the Bid Price. FIT reserves the right, at no financial liability associated with the same, to put the Project work on hold for any reason on as many as three (3) occasions during the course of the construction for a total duration of not more than 20 workdays.
3. On Monday of each week during the construction period, the Contractor shall email to FIT's Facility Director (or such other individual as FIT may designate at its sole discretion) a written report outlining the work completed during the preceding week and the work planned for the upcoming week. Included will be any unforeseen or anticipated problems regarding implementation of the work, in addition to Change Order requests, submission data, etc. Daily reports **MUST** be submitted to the CM and or the Facilities Department Designee.
4. Job meetings will be held at the site on dates to be determined by Architect and FIT. These meetings shall be attended by an officer of the Contractor, the Project Manager, FIT's representative, and the Architect. The purpose of these meetings will be to review

the status of the project, discuss any potential changes to the project scope, and resolve any problems relating to successful completion of the work.

5. Owner's meetings will be held weekly via zoom and in person when needed. The dates to be determined by the Architect and FIT. These meetings shall be attended by the Contractors Project Manager, FIT, and the Architect. The purpose of these meetings is to keep the Owners informed of the process and to discuss any issues relating to the successful completion of the work.

PAYMENT:

In accordance with, and in addition to, the payment requirements of the Contract Documents, the Contractor shall provide sufficient and appropriate documentation for all invoices to FIT including submittal of invoices for actual cost of materials, labor rates, and certified payrolls. Filing of such payrolls shall comply with the New York State Labor Law and is a condition precedent to payment. FIT reserves the right to request additional information and/or documentation at any time.

Contractor is required to submit Monthly Contractor's Compliance Form (as attached in Section XII. Affirmative Action Form) with each Payment Requisition.

Contractor is required to submit a Certificate of Monthly Payment/Lien Waiver signed by each Sub-contractor with each Payment Requisition.

Contractor is required to submit Waste Management Form with each Payment Requisition.

LABOR HARMONY:

- A. Contractor is advised that he/she must maintain labor harmony throughout the duration of the Contract. All labor disputes, slowdowns, strikes and/or sympathy actions will be the sole responsibility of the Contractor to resolve in order to maintain harmony.
- B. All costs, delays and scheduling impacts associated with any labor dispute that arises from such action or inaction will be borne by the Contractor.
- C. Contractor will also be responsible for all costs, damages and scheduling impacts which affect and disrupt any other workers on site as well as FIT employees.
- D. It will be the Contractor's responsibility to resolve all labor disputes immediately.

Contractor is further advised that FIT has a large union presence on the campus. All work performed by the Contractor must provide the required labor harmony to perform work without labor incident or dispute which can delay, obstruct or effect the work and project schedule, or interfere with FIT's ability to operate.

II. GENERAL NOTES

In accordance with, and in addition to, the requirements of the Contract Documents:

1. All work listed on the construction notes and shown or implied on all drawings shall be supplied and installed by the Contractor unless otherwise noted on drawings and/or in specifications.
2. Contractor to determine coordination of trades.
3. Contractor shall verify all dimensions and conditions shown on drawings and shall notify FIT Facilities Director and Architect of any discrepancies, omissions, and/or conflicts before proceeding with the work.
4. Contractor must comply with the rules and regulations of agencies having jurisdiction and shall conform to all construction and safety codes, statutes and ordinances. All fees, taxes, permits and applications to be obtained through governmental agencies shall be the responsibility of the Contractor.
5. Contractor shall comply with the rules and regulations of the building as to hours of availability of loading docks and elevators for the purposes of delivery, waste removal and other needs related to the work. Coordination with FIT Facilities Department is required for the handling materials, movement in and out of building, equipment and debris to avoid conflict and interference with normal building operations.
6. All drawings and construction notes are complementary and what is called for by any will be binding as if called for by all.
7. Contractor shall maintain a current and complete set of construction documents on the construction site during all phases of construction.
8. Do not scale drawings; dimensions shown govern. Larger scale drawings shall govern over smaller scale.
9. Contractor shall maintain a current and complete set of shop drawings on the construction site
10. Contractor shall maintain a current and complete RFI (Request for Information) log on the construction site.
11. Contractor shall submit for approval, prior to commencing work, a list of all sub-contractors to FIT's Facilities Director, with the name, address and phone number of the principal contact of each sub-contractor. In addition, he will file with the owner the emergency numbers available for 24-hour contact.

12. All work shall be performed by skilled and qualified workmen in accordance with the best practices of the trades involved and in compliance with building regulations and/or governmental laws, statutes or ordinances.
13. All materials shall be new, unused and of professional quality, unless otherwise noted, installed as per manufacturer's recommendations and instructions.
14. For purposes of the Specifications and Drawings sections in the Contract, the use of the words "Supplied By" or "Provided" in connection with any item specified is intended to mean that such item shall be furnished, installed and connected where so required.
15. All approvals of submittals shall be for design intent only. Contractor shall be responsible for quantities, dimensions and compliance with Contract Documents and for information pertaining to fabrication processes or techniques of first class construction and for coordination with other trades.
16. All work shall be erected and installed plumb, level, square, true and in proper alignment.
17. Contractor shall be responsible for cutting, patching and restoration required for this work.
18. If, during the course of construction, Contractor believes materials that might contain asbestos may be disturbed during performance of the work, Contractor shall immediately notify FIT of the area(s) of concern, and stop work if that area would be disturbed by the continuing work.
19. All correspondence to FIT shall be directed to the attention of the FIT Facilities Director with a copy of the same forwarded to the Architect.
20. Contractor shall at all times keep the premises free of accumulation of waste materials and rubbish; premises to be broom swept clean daily. At the completion of the work, Contractor shall leave the job site free of construction debris and materials, and "broom clean" including thorough cleaning of toilets, bathrooms, electrical closets, stairwells, and all areas of work or staging, etc.
21. Contractor shall provide all necessary protection against dirt and damage within the premises, as well as public areas, and shall be responsible for keeping these areas clean and free of materials at all times.
22. Contractor shall verify location of existing utilities and coordinate with location shown on drawings.
23. During construction, security and fire exit doors must remain unobstructed at all times.
24. Contractor shall take every precaution to properly protect all existing construction to remain. Contractor shall be responsible for all damaged areas to be returned to original condition.

25. Contractor shall schedule construction, in such a manner so as not to disturb areas outside of the area under construction during normal operating hours. The Contractor shall coordinate with FIT Facilities Director minimum of 24 hours prior to any disruption of services to those areas not under construction even if such a disruption occurs during or after normal operating hours.
26. Contractor shall staff the project with a Project Manager with at least 5 years' experience in this type of project scope, with similar complexity and schedule requirements.
27. The acceptance of shop drawings containing deviations not specifically brought to the attention of FIT, or containing errors or omissions of any sort, shall not relieve Contractor of the responsibility for executing the Work in accordance with the Contract Documents and Contract Terms and Condition.

III. DEMOLITION NOTES

In accordance with, and in addition to, the requirements of the Contract Documents. It shall be Contractor's responsibility to perform the following:

1. Prior to commencement of selective removals and demolition work, inspect the areas in which the work will be performed.
2. Any asbestos contaminated material will be removed by FIT's certified asbestos abatement contractor prior to the work of this contract.
3. Provide temporary barricades and other forms of protection required to protect all FIT personnel, inclusive of its faculty, staff and students as well as the general public from injury due to selective removals and demolition work.
4. Remove and dispose of exposed bolts, supports, brackets, cleats, grounds, and other items, that are no longer required for the purpose for which they were originally installed.
5. Where existing work is required to be removed and replaced but found to be defective in any way, it shall be reported to the FIT Facilities Director and Architect before it is disturbed.
6. All existing work damaged or lost as a result of performing the required new work, shall be patched, repaired or replaced with new, and finished to match the existing work, or as the individual case requires at the Contractor's expense.
7. Perform cutting, drilling and removals in a manner which will prevent damage to construction which is to remain.
8. Promptly repair any and all damages to all property and finishes caused by the removals and demolition work; to FIT's satisfaction and at no extra cost to FIT.

9. Cut, patch, paint and finish existing walls, ceiling and/or floor disturbed to match existing.
10. Perform patching around items penetrating existing construction in a manner that will maintain the water and fire resistive capability of existing construction. Should either of these be compromised, it is the responsibility of the Contractor to repair prior to completion.
11. Remove debris, rubbish and other materials resulting from the removals and demolitions from the building immediately; transport and legally dispose of materials off-site. Disposal method shall be in accordance with city, state and federal statues regulations, and ordinances.
12. Work of this section shall conform to all requirements of the New York City Building Code and all applicable regulations and guidelines of all governmental authorities having jurisdiction, including, but not limited to, Safety, Health and Anti-Pollution regulations.
13. Any existing lead-based paint areas of the building where the contractor and its subcontractors are required to work shall be mitigated prior to beginning work. Such mitigation may include FIT directing the contractor to take necessary precautions and wear protective gear to work in the vicinity of the lead paint. The contractor will not be responsible for delays caused by the mitigation activities or any associated cost.
14. Work is to conform to OSHA requirements.

IV. ADDITIONAL CONTRACTOR'S RESPONSIBILITIES

In accordance with, and in addition to, the requirements of the Contract Documents:

1. Contractor shall coordinate all work with FIT Facilities Department and Director.
2. Contractor to provide daily crew manpower log/count to FIT.
3. Contractor shall perform work in a neat workmanlike manner in accordance with accepted industry standards.
4. FIT Facilities Department shall notify Contractor before commencing work which floors are accessible by Contractor.
5. Contractor shall mask all signs, window frames, door frames, etc. when painting around them.
6. Contractor shall use Benjamin Moore, Regal Paint, or approved equal.
7. Employee Identification and Building Access: All Managers and their crew must wear at all times company identification. All Managers and their crew must sign in and out, upon entering and leaving the facility, at the FIT front security desk.

8. After Bid opening, FIT will evaluate and review submissions and notify the lowest Bidder, who is deemed most responsive and responsible. Within five (5) business days of such written notification, such Bidder shall submit the following information. Failure to comply with these requirements in whole or part shall constitute grounds for rejection of the Bid. FIT reserves the right to determine whether a Bidder has substantially met these requirements and to ask for additional information. Documentation of the following:
 - a. Health and safety training program and procedures for employees and on-site EHS Coordinator.
 - b. Copies of current licenses and certifications applicable to the Work, including but not limited to licenses issued by the Fire Department of New York, Department of Buildings of the City of New York, must be provided to FIT Facilities.
9. Contractor shall complete the attached Outline for Preparing Work-Specific Environment, Health and Safety Plan (“EHS Plan”) which will be reviewed and approved by FIT’s EHS Compliance Director prior to commencement of work. Contractor shall include the costs of completing the EHS Plan in the Bid price. Proof of the 10 Hour OSHA Outreach Training Program for Construction certificate will be required.
10. Contractor shall provide as described in the FIT Safety EHS Plan, legible copies of SDS sheets and estimates of anticipated amounts of chemicals Contractor intends to store on site to the FIT’s Director of EHS Compliance for review and approval at least ten (10) days before Contractor allows on-site storage.
11. Contractor shall ensure that legible copies of all SDS are available at the location of chemical storage and available for review at all times. Contractor shall take all necessary precautions necessary to prevent vapors, fumes, or dust from leaving the work area. This includes but is not limited to the construction of negatively ventilated containments as controls.
12. Contractor shall provide as described in the FIT Safety EHS Plan a written statement of the types of project waste disposed, including the amounts and the name of the waste disposal facility for each type of waste disposed. Contractor shall provide the statement with each Payment Application. Contractor shall provide a separate copy of the statement to FIT’s Director of EHS Compliance.
13. Contractor may not store Hazardous Waste on site at any time. Contractor may not generate or accumulate Hazardous Waste on site without the written approval of FIT’s Director of EHS Compliance. Contractor shall obtain FIT’s Director of EHS Compliance approval at least ten (10) days before the Contractor generates or accumulates Hazardous Waste on site beginning with demolition work.

14. Off-site shipments of Universal or Hazardous Waste. The Contractor may not allow the off-site removal of Universal or Hazardous Waste without the written approval of the FIT Director of EHS Compliance. Contractor will ensure that the FIT Director of EHS Compliance alone signs any shipping papers for the off-site removal of Universal or Hazardous Waste.
15. Contractor's personnel must report daily to the FIT Security area in the Lobby of Building "C" before entering FIT's site. All Contractor's personnel must obtain temporary FIT identification that shall be displayed at all times while on the FIT site. While on FIT property, all Contractor's personnel shall be subject to all FIT campus policies and procedures, including, but not limited to, prohibitions related to tobacco, drug, and alcohol use, and policies and procedures regarding appropriate and civil conduct. Contractor's personnel shall not fraternize with FIT students and employees beyond what is necessary to complete their work or any assigned Projects. FIT policies may be found at FIT reserves the right, in its sole determination, to eject from the campus, any Contractor personnel violating such policies, in addition to any other rights and remedies.

V. PERMITS

Contractor shall be responsible for obtaining all required Permits and paying all costs and fees associated therewith. New York City Department of Buildings (DOB) Work Permit will be required for this project. Contractor will also be required to perform the following functions as it relates to this project:

- A. Contractor shall submit to FIT and Engineer appropriate Workman's Compensation and New York State Disability insurance certificates for use in securing the required Work Permits to be posted at the site. The Contractor shall provide FIT's Facility Director with the appropriate insurance tracking numbers assigned to their firm by the NYC Department of Buildings.
- B. The Contractor shall submit to FIT and Engineer a copy of all Licenses as issued by the NYC Department of Buildings.
- C. Permits for the work shall be posted by the Contractor in a conspicuous location at the site at all times. No work shall begin until the necessary DOB work permits have been obtained by the Contractor.
- D. The Contractor shall be responsible for obtaining any other governmental permits and approvals required to undertake the work, and shall pay any and all fees associated therewith, **including but not limited to fees to the MTA/DOT for setting up a crane, if applicable.**

VI. PROJECT MANAGER

1. The Contractor shall provide the services of an experienced Project Manager, who shall be in continual responsible charge of the work and shall have a valid Certificate of Fitness by the New York City Department of Buildings.
2. The Project Manager shall be on site at all times, shall speak fluent English, shall maintain on the site a complete set of these specifications (including any addenda and/or change orders, as well as all project drawings and all applicable manufacturers' instruction sheets), and shall have full authorization to make all field changes as directed by FIT's Facility Director and Architect.
3. The Project Manager shall be required to maintain a daily log at the site indicating the following:
 - the date
 - the number of workers at the site on said date
 - the specific portions and locations of the Work completed on said date
4. The Project Manager (or another authorized representative of the Contractor) shall telephone FIT's Facility Director at least once daily throughout the construction period, to report on the day's activities and the work planned for the following day.
5. The name of the Project Manager shall be submitted to FIT's Facility Director prior to initiation of the project. This Manager shall remain in charge of the project for its entire length, at FIT's discretion, unless said Manager no longer remains in the employ of the Contractor. In such case, a capable and experienced replacement shall be immediately assigned subject to approval by FIT's Facilities Director.
6. No telephone service is available at the site for use by the Contractor; therefore, the Contractor shall equip the Project Manager with a cellular telephone at the site for the duration of the Project. The Contractor shall provide FIT and Architect with the appropriate contact numbers at the initiation of the Project.

VII. SUBMISSIONS AND SUBSTITUTIONS

1. All submissions called for in the Contract Documents shall be submitted at least twenty (20) working days prior to proposed initiation of any related work.
2. FIT and FIT's Architect and Engineer will review and accept or take other appropriate action regarding Contractor submittals such as Shop Drawings, Product Data and Samples, but only for the limited purpose of checking for

conformance with information given and the design concept expressed in the Contract Documents. FIT's review of all shop drawings submitted by the Contractor shall be for concept only and does not remove the Contractor's responsibility for insuring that all specific details of the installation shall be performed in such a way so as to achieve satisfactory results. Acceptance by FIT, the Architect & Engineer of Contractor submittals does not relieve the Contractor from responsibility for errors which may exist in the submitted data.

3. Where the phrase "or approved equal" or "equal as approved by FIT" occurs in the Contract Documents, the Contractor may not assume that the materials, equipment, or methods will be approved as equal unless the item has been specifically approved by FIT and the Architect.
4. Any proposed substitute products or procedures are to be submitted to FIT's assigned Architect/Engineer for prior approval with any proposed price adjustments to the contract within 14 days of the signing of the agreement between FIT and the Contractor, so that FIT, the Architect and Engineer are permitted adequate time for review.

VIII. PROGRESS PAYMENTS

1. All submissions called for in the Contract Documents shall be submitted at least twenty (20) working days prior to proposed initiation of any related work.
2. Progress payments will be made to the Contractor based solely on actual work completed. Furthermore, payment will not be made for the purchase of materials, nor for their transfer onto the site, nor for any costs associated with mobilization.
3. Payment requests shall be submitted to FIT's Facilities Director on AIA Documents G702 and G703.
4. Payments will be authorized based upon FIT's field visits and review of work. All FIT's decisions regarding progress payments shall be final.
5. The values quoted on the bid form shall constitute the Schedule of Values for AIA Document G703. Additional breakdown of the bid form shall be provided on the Schedule of Values and will be used for progress payments.
6. No progress payments will be processed without submission by the Contractor of properly executed Affidavit of Payment and Release of Liens (AIA Documents G706 and G706A or equivalent forms as may be requested by FIT), up-to-date weekly written reports and timeline in bar chart form, and all submittals, certificates, permits, etc. required pursuant to the terms of the contract.
7. A 10% retainage shall be deducted from all progress payments made by FIT.

8. Payment requests shall be submitted to FIT not more than once per month.
9. Contractor shall provide sufficient and appropriate documentation for all invoices to FIT including submittal of invoices for actual cost of materials, labor rates and certified payrolls. Filing of such payrolls shall comply with the Labor Law and is a condition precedent to payment. FIT reserves the right to request additional information at any time. Contractor required to submit Monthly Contractor's Compliance Form with each Payment Requisition.
10. Contractor required to submit a Certificate of Monthly Payment signed by each Sub-contractor with each Payment Requisition.
11. Contractor shall be required to submit a detailed Trade Payment Breakdown.

IX. SITE VISITS BY ARCHITECT/ENGINEER

1. Failure by Architect/Engineer to detect and/or notify the Contractor of any aspect of the Contractor's actions or materials that are not in conformance with the Contract Documents shall not remove the Contractor's responsibility to adhere to the Contract Documents in all instances, including but not limited to the Contractor's responsibility to expeditiously correct and/or replace all defective work.
2. Architect/Engineer will be the final judge as to whether the work is satisfactorily performed and shall have the authority to order that any work deemed unacceptable or not in conformance with the Contract Documents be redone by the Contractor at no cost to FIT.
3. Architect/Engineer shall have no responsibility for the presence, discovery, identification, handling, removal or disposal of, or exposure of persons to hazardous materials in any form at the Project site.

X. CHANGE ORDERS

1. FIT may order changes in the work of any quantity and without invalidating the Agreement so long as the Contract Sum and/or Contract Time of Completion are adjusted accordingly. All such changes in the work shall be authorized by written Change Order. All Change Orders shall be reviewed by Architect and Engineer and authorized by a representative of FIT.
2. No work shall be performed by the Contractor unless it is specifically included in the Contract Scope of Work or authorized in advance by a bulletin issued by the Architect which will serve as the backup paperwork for a change order. The contractor needs to submit a Change Order. All work to

proceed prior to approval of change orders. Change Orders will be negotiated fairly in separate meetings. All written Change Orders are to be signed by all parties.

3. Any sums to be paid to Contractor as a result of any Change Order or any sums to be credited to FIT as a result of any Change Order shall be computed by one of the following methods:
 - (1) As agreed upon between the parties to the contract in writing prior to commencement of the work required by the Change Order, or;
 - (2) By Unit Prices detailed in the Contract Documents or subsequently agreed upon.

XI. GUARANTEES

1. All work on this project shall be guaranteed by the Contractor for a period of not less than one (1) year, or longer where covered by manufacturer warranty. Warranty to start on the day of the final signoff by FIT.
2. If within the guarantee period any of the work is found to be defective or not in conformance with the Contract Documents, the Contractor shall correct it promptly at his own expense after receipt of written notice from FIT.

XII. FINAL PAYMENT

1. Final payment (retainage) shall be released to the Contractor thirty (30) days after the project has been signed off by FIT and Architect/Engineer and the Contractor has satisfied all requirements of the Contract Documents.
2. In addition to any other requirements of the Contract Documents final payment shall not become due until the Contractor has delivered to FIT and Architect a fully executed 1-year guarantee for all work performed under this project, as well as a complete release of all liens arising out of this Contract, or receipts in full covering all labor, materials, equipment, applicable finance charges, and fines for which a lien could be filed. If such lien remains unsatisfied after payments are made, the Contractor shall refund to FIT all money that FIT may be compelled to pay in discharging such lien, including all costs and reasonable attorneys' fees.
3. A Performance Bond and a Labor & Material Payment Bond, a copy of the "Contractor's Affidavit of Payment of Debts and Claims (AIA Document G706)" and "Consent of Surety to Final Payment (AIA Document G707)" shall be submitted by the Contractor prior to the release of final payment.

4. One (1) set each of record drawings (measuring 24 inches by 36 inches) indicating the “As- Built” manner of installation of all work, shall be submitted to FIT and Engineer prior to the release of final payment.
5. Once the project has reached substantial completion, FIT and Architect will prepare a “Certificate of Substantial Completion”. This certificate must be signed by all parties (Engineer, FIT and Contractor), to acknowledge the date the project has reached substantial completion, and confirm agreement on a final punch-list of work to be performed. The Contractor shall be responsible for completing all punch-list items prior to release of final payment.

XIII. SUPPLEMENTAL CONDITIONS

Project Schedule. Contractor shall complete all work as specified within the time period specified in the Contract Documents, inclusive of rain days, but excluding any shutdowns authorized by FIT.

XIV. PREVENTIVE MAINTENANCE SCHEDULE

Prior to final payment, the contractor shall provide a recommended maintenance schedule from the manufacturer for quarterly, semi-annual and yearly requirements, including part numbers where applicable, upon completion of the job.

BID ANALYSIS FORM FOLLOWS

ATTACHMENT C – BID ANALYSIS FORM

**FASHION INSTITUTE OF TECHNOLOGY &
GOODMAN LOWER LEVEL GALLERY NEW HVAC UNIT
INVITATION FOR BID NUMBER C1592
NYS PREVAILING WAGE SCHEDULE PRC # 2024015597**

BID BREAKDOWN

Line	Description	Total Labor Cost	Total Materials, Tools & Equipment	Line Total
1	DEMOLITION	\$	\$	\$
2	FIRE STOPS	\$	\$	\$
3	VALVES FOR HVAC	\$	\$	\$
4	VIBRATION ISOLATION	\$	\$	\$
5	HVAC SPECIALTIES	\$	\$	\$
6	TESTING AND BALANCING	\$	\$	\$
7	INSULATION FOR HVAC	\$	\$	\$
8	COMMISSIONING	\$	\$	\$
9	HVAC AUTOMATIC TEMPERATURE CONTROLS	\$	\$	\$
10	HVAC INTEGRATION ON BMS	\$	\$	\$
11	PIPING FOR HVAC	\$	\$	\$
12	PUMPS FOR HVAC	\$	\$	\$
13	SHEET METAL DUCTWORK	\$	\$	\$
14	FANS AND GRAVITY VENTILATORS	\$	\$	\$
15	AIR FILTERS	\$	\$	\$
16	AIR HANDLING UNITS	\$	\$	\$
17	VARIABLE FREQUENCY DRIVE	\$	\$	\$
18	COILS	\$	\$	\$
19	HUMIDIFIER	\$	\$	\$
20	ELECTRICAL	\$	\$	\$
21	PLUMBING	\$	\$	\$
22	FIRE ALARM	\$	\$	\$
23	GENERAL REQUIREMENTS	\$	\$	\$
24	GENERAL CONDITIONS	\$	\$	\$

ADD ALTERNATE 1 - PRICE \$ _____

TOTAL BID PRICE (1-24) (Do not include Add Alt. Price) \$ _____

As stated in Section IV of the front-end documents: Subcontracting shall be permitted **not to exceed 50%** of the work of the project. Please provide the ratio of the contractors and subcontractors work that will be used on this project.

Contractor _____%, **Subcontractor(s)** _____%

For Bidding Purposes: the following sections pricing should cover the following items:

General Requirements: permits & licenses; project meetings; administrative overhead for submissions and shop drawings; progress photos; temporary facilities & controls; storage & protection of materials; project closeout; and project record documents.

General Conditions: supervision of work; all testing; coordination drawings; safety programs; insurance and performance & payment bonds.

The undersigned, having carefully examined all Contract Documents, including Notice to Bidders, Bid Terms and Conditions, Contract Terms and Conditions, General Requirements, General Conditions, Labor & Material Payment Bond, Performance Bond, Form of Bid, Non-Collusive Bidding Certification, Substitution Form Request, Contract, Affirmative Action Form, Change Order, Form, Contractor’s Trade Payment Breakdown, Safety EHS Plan, Prevailing Wage Schedule, Specifications, and Drawings and having examined the existing conditions by on-site visit(s), hereby submits this Bid Analysis, covering all labor, materials, equipment, tools, machinery, licensing, insurance, taxes, and fees required to perform the specified work at the above-referenced site, in accordance with the Contract Documents. **No exclusions & no exceptions.**

Company Name and Address of Bidder:

Signature of Bidder _____ Date _____

Printed Name and Title of Representative: _____

Telephone #: _____

Email Address: _____

EIN#: _____

IMPORTANT:

This bid analysis form is the **only** pricing format acceptable. Bidders **must** submit pricing

using this form. **FIT will not accept bid responses on any other form.**

NOTE:

FIT will not sign any bidder generated contract, agreement or scope of work. FIT Bid and Terms and Conditions apply. Bidder requirement for FIT to sign any document will be grounds for rejection. Bidder inclusion of any conditions, clarifications, exceptions or changes which are not in compliance with FIT Bid and Terms and Conditions will be grounds for rejection.

SECTION IV.
GENERAL REQUIREMENTS

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01010 -- SUMMARY OF THE WORK

.01 - Work Under The Contract

The Work shall be as described in the Contract Documents.

.02 - Work by Others

Should any other contractor be engaged by the Owner to perform work on the Site or in areas adjoining or adjacent to the Site, the Contractor and such other contractor shall coordinate the work of the Contractor and such other contractor.

.03 - Items Not Included

The following items shown on the drawings are not included in the Work:

- A. Items indicated "By Others".
- B. Items indicated "N.I.C." (Not in Contract)
- C. Existing construction not indicated or specified to be removed, replaced or altered.

.04 - Openings and Chases

- A. The Contractor shall build openings, including but not limited to channels, chases and flues as required to complete the Work as set forth in the Contract and as directed by the Owner before any work is installed.
- B. After the installation and completion of any work for which openings, including but not limited to, channels, chases and flues, have been provided for the Contractor, the Contractor shall build in, over, around and finish all such openings as required to complete the Work.
- C. If a contractor fails to furnish drawings and information required in connection with such openings before the General Construction Contractor performs any Work affected thereby, said contractor who so fails to furnish such drawings and information shall bear the cost of all cutting and refinishing including that part of the General Construction Contractor's Work affected.
- D. The Contractor shall Furnish and Install all sleeves, inserts, hangers and supports required for the execution of the Work.
- E. Specific instructions shall be obtained from the Owner or the Owner's Representative before cutting beams or other structural members, arches or lintels.
- F. The Contractor shall not endanger the Work and shall not cut or alter the Work unless prior approval and instructions are received from the Owner or the Owner's Representative.

.05 - Surveys and Layout

- A. If, for any reason, stakes, batter boards or monuments are disturbed, it shall be the responsibility of the Contractor to reestablish them.
- B. The Owner or the Owner's Representative may order construction work suspended at any time when location of monuments, stakes, bench marks and other layout markings established by the Contractor are not adequate to permit checking the Work.
- C. The Contractor shall Provide and shall maintain axis lines on each floor and shall establish and shall maintain grade marks 4' 0" above the finished floor on each floor level.
- D. The Contractor shall Furnish such stakes and other required equipment, tools and materials, and all labor as may be required in laying out any part of the Work.

.06 - Scheduling

- A. The Contractor shall deliver to the Owner schedules and forms in accordance with the Contract.
- B. The Owner or the Owner's Representative may require the Contractor to modify schedules which the Contractor has submitted either before or after such schedules are approved so that:
 - 1. The Work shall not be delayed.
 - 2. Changes in the Work are reflected in the schedules of the Contractor.

.07 - Contractor Use of Premises

While performing the Work, the Contractor shall take every precaution against injuries to persons and damage to property.

01080 -- PERMITS AND COMPLIANCE

.01 - Permits and Licenses

The Contractor shall obtain, maintain and pay for all permits and licenses necessary for the execution of the Work and for the use of such Work when completed.

Prior to final payment the Contractor shall deliver to the Owner's Representative all permits and certificates of approval issued by any agency having jurisdiction.

.02 - Compliance

The Contractor shall give all notices, pay all fees and comply with all laws, rules and regulations applicable to the Work.

.03 - Additional Compliance

The Contractor, Subcontractors, and the employees of the Contractor and Subcontractors, shall comply with all regulations governing conduct, access to the premises, operation of equipment and systems and conduct while in or near the premises and shall perform the Work in such a manner as not to unreasonably interrupt or interfere with the conduct of business of the Institution.

.04 - Royalties and Patents

It is the sole responsibility of the Contractor to determine what, if any, patents are applicable to the Project. The Contractor shall pay all royalties and/or license fees. The Contractor shall defend all suits or claims for infringement of any patent rights and save the Owner, Architect, Engineer, Environmental Consultant and Construction Manager harmless from loss, including attorney's fees, on account thereof.

01200 -- PROJECT MEETINGS

.01 - Project meetings shall be held to accomplish the following:

- A. Coordinate the Work.
- B. Establish a sound working procedure and relationship between all contractors, the Owner and the Owner's Representative.
- C. Review requisitions, proposals and change orders.
- D. Review the progress of the Work, review quality of work in place and review approval required by the Work and review delivery of materials.
- E. Expedite the Work to completion within the scheduled time limit.
- F. Review progress payments.

.02 - Initial Job Meeting (Orientation Meeting)

The Owner or the Owner's Representative shall call an initial job meeting which the Contractor shall attend. This meeting shall be called prior to the start of construction.

.03 - Job Progress Meetings

- A. Job progress meetings shall be scheduled by the Owner or the Owner's Representative during the course of construction. The Contractor or the Contractor's duly authorized representative and such Subcontractors as required by the Contractor or the Owner or the Owner's Representative shall be present at all job progress meetings. The Contractors and Subcontractors shall answer questions on progress, workmanship, approvals required, delivery of material and other subjects concerning the Work. The purpose of such meetings is to coordinate the efforts of all

concerned so that the Work proceeds without delay to completion as required by the Contract.

- B. The Owner or the Owner's Representative may require any schedule to be modified so that changes in the Work, delays or acceleration of any segment of the Work shall be reflected in such schedule. The Contractor shall cooperate with the Owner or the Owner's Representative in providing data for such changes in or modifications of schedules.

01300 -- SUBMITTALS

.01 - Schedules & Records

- A. Within the time set forth in the Contract, the Contractor is required to complete and submit to the Owner or the Owner's Representative the following forms:
 - 1. Submit construction progress schedule to the Owner or the Owner's Representative no later than thirty (30) calendar days after receipt by the Contractor of notice to proceed.
 - 2. Submit names and addresses of all Subcontractors to the Owner or the Owner's Representative within thirty (30) calendar days of approval of the construction progress schedule.
 - 3. Submit to the Owner or the Owner's Representative the date on which the Contractor proposes to award each subcontract a minimum of ten (10) days prior to such proposed award.
 - 4. Submit Shop Drawings and material sample schedule to the Owner or the Owner's Representative no later than thirty (30) days after approval of the construction progress schedule. Such schedule shall include the date of all Shop Drawings, samples and materials shall be submitted and the date approval is required.
 - 5. Submit to the Owner or the Owner's Representative on a form approved by the Owner, a schedule of anticipated monthly requisition amounts. Such schedule shall be submitted from time to time as directed by the Owner, the first such submission being required to be made by the Contractor within ten (10) days of receipt by the Contractor of a written order to proceed issued by the Owner. The amounts employed in preparing such schedules in no way shall be binding upon the Owner.
- B. Sample forms shall be provided by the Owner or the Owner's Representative for the above mentioned schedules and records.

01311 – PROJECT ANALYSIS

.01 - Project Control and Progress Meetings

- A. The Contractor shall attend all scheduling meetings as directed by the Owner or the Owner's Representative.
- B. In addition to the Owner or the Owner's Representative and the Contractor's Superintendent and Scheduling Coordinator, such meetings shall also be attended by representatives of such subcontractors as the Contractor, the Owner or the Owner's Representative may deem advisable. The agenda for such meetings shall include the progress and current status of the Work, proposed solutions for problem areas and a review of schedules for future Work in order to meet the Contractor's objectives and his obligations under the Contract. Consideration shall be given to establishing actual start dates, actual completion dates, planned starts and finishes, quantities installed, man hours worked, as well as other data relevant to the performance of the Contract.
- C. At least one week before each meeting described in subsection .01A of this Division 01311, the Contractor shall furnish progress data in the form required by the Owner or the Owner's Representative as follows:
 - 1. The status of all activities as of date determined by the Owner or the Owner's Representative.
 - 2. A list of actual start and completion dates for all activities.
 - 3. Projected durations of completion of those activities in progress.
 - 4. Relevant data of submittals in progress including equipment releases and equipment in fabrication.
 - 5. All other information which in the discretion of the Owner or its Representative, may be required to complete the Project Schedule Update.

.02 – Payment

The Contractor's Payment Breakdown and Monthly Requisition as called for by Section 17.01 of the General Conditions of the Contract shall be the basis by which the Contractor is to be paid.

.03 - Time of Completion

It is the sole responsibility of the Contractor to complete the Work within the time of completion required by the Contract.

01340 -- SHOP DRAWINGS AND SAMPLES

.01 - Contractor Submittal

- A. The Contractor shall submit the Shop Drawings and samples required by the Architect and the Contractor shall adhere to all submittal and scheduling requirements for Shop Drawings and samples. After examination of such Shop Drawings and samples by the Architect and the return of such items by the Architect to the Contractor, the Contractor shall make corrections indicated and shall furnish to the Architect the required number of corrected copies of Shop Drawings or samples.
- B. Shop Drawings shall be accompanied by a letter of transmittal to the Owner or the Owner's Representative requesting approval and date approval is desired.
- C. Each Shop Drawings and letter of transmittal shall be identified with the following information:
 - 1. Project title
 - 2. Contract name
 - 3. Date of the drawing, including dates of any revisions
 - 4. Name of Contractor, name of Subcontractor, material supplier and manufacturer, as applicable
 - 5. Name of person or firm preparing Shop Drawings
 - 6. Contract drawing numbers and specifications, section division and paragraph numbers used as references in preparing Shop Drawings, and titles of items to which the Shop Drawing refers.
- D. Shop Drawings shall show the design, dimensions, connections and other details necessary to insure that the Shop Drawings accurately interpret the Contract Documents and shall also show adjoining Work in such Detail as required to provide proper connections with said adjoining Work. Where adjoining connected Work requires Shop Drawings, such Shop Drawings shall be submitted to the Owner or the Owner's Representative for approval at the same time so that connections can be checked.
- E. The Contractor shall verify all field measurements. Measurements available prior to submittal of Shop Drawings shall be shown and so noted on the Shop Drawings. Measurements not available prior to submission of Shop Drawings shall be noted on the Shop Drawings as not available and such measurements shall be obtained prior to fabrication.

- F. The Contractor shall submit manufacturer's drawings and specifications when necessary to fully explain apparatus or equipment required by the Work. These manufacturer's drawings and specifications shall be treated as Shop Drawings. Manufacturer's catalog numbers alone are not acceptable as sufficient information for compliance with this requirement.
- G. Samples shall be accompanied by a letter of transmittal to the Owner or the Owner's Representative requesting approval, and date approval is desired.
- H. Each sample shall be labeled with the following information:
 - 1. Project title
 - 2. Contract name
 - 3. Date of submission
 - 4. Name and quality of the material
 - 5. Name of Contractor, name of Subcontractor, material supplier and manufacturer, as applicable
 - 6. Contract drawing numbers and specification section, division and paragraph numbers used as reference in preparing samples.
- I. Samples shall be of sufficient size and number to show the quality, type, color, finish and texture of the material required to be furnished by the Contractor pursuant to the Contract.

.02 - Contractor Review

The Contractor shall review, verify and determine all field measurements, field construction criteria, materials, catalog numbers and similar data, shall coordinate each Shop Drawing and sample with the requirements of the Contract and shall determine whether or not such Shop Drawings are in conformity with the provisions of the Contract before submitting the Shop Drawings to the Architect for approval.

.03 - Contractor Responsibility

The Architect's approval of Shop Drawings and samples shall not relieve the Contractor of responsibility for any deviation from the requirements of the Contract. The Contractor shall be responsible for the accuracy of the Shop Drawings and samples and for the conformity of Shop Drawings and samples with the Contract unless the Contractor has notified the Architect of the deviation in writing at the time of submission and has received from the Architect written approval of the specified deviations. The Architect's approval shall not relieve the Contractor of responsibility for errors or omissions in the Shop Drawings or samples.

.04 - Commencement of Work

No portion of the Work shall be commenced until required Shop Drawings or samples are approved by the Architect.

01380 -- PROGRESS PHOTOGRAPHS

.01 - Contractor Submission

- A. The Contractor shall furnish to the Owner, progress photographs of the Work as follows: three (3) 8" x 10" glossy prints of each of the following views:
1. Two (2) different views of the area in which the building or buildings are to be located, taken before excavation starts.
 2. Two (2) different views for each building when footings are in place and forms completed.
 3. Four (4) different views for each building when foundations are completed.
 4. Four (4) different views for each building when exterior wall is fifty per cent (50%) completed.
 5. Four (4) different views for each building when the structure is ready for roofing.
 6. Four (4) different exterior views in color for each building at completion.
 7. Six (6) interior views in color for each building as directed upon completion.
- B. A title identifying the view shown by each photograph and date taken shall appear on the back of each print.

01500 -- TEMPORARY FACILITIES AND CONTROLS

.01 - Requirements

The Contractor shall Provide the temporary facilities and controls as hereinafter specified and as required by law.

.02 - Temporary Lighting and Electric Service

The Contractor shall Provide and maintain all temporary lighting and power required in connection with the Contractor's operations from the commencement of the Work until the completion of each structure or for such other time as

directed by the Owner or the Owner's Representative. When the use of such temporary lighting and power is no longer required, all temporary wiring and equipment shall be completely removed by the Contractor. The Contractor shall make the necessary application to the lighting company and pay for all charges, costs and expenses incidental to the installation and maintenance of temporary lighting and power as required in connection with the Contractor's operations, and the Contractor shall pay for all power used. The minimum temporary lighting to be provided is at the rate of one-quarter watt per square foot and is to be maintained in each room and changed as required when interior walls are being erected. The required temporary lighting must be maintained for twenty-four (24) hours a day and seven (7) days a week at all stair levels and in all corridors below ground; in all other spaces temporary lighting is to be maintained only during working hours. All temporary wiring and equipment shall be in conformity with the National Electric Code. Three-phase temporary power circuits shall be installed as required to operate construction equipment of the various trades and to install and test equipment such as pumps and elevators. The Contractor shall install and maintain temporary or permanent service for the permanently installed building equipment such as sump pumps, boilers, boiler controls, fans, pumps, so that such equipment may be operated when required and so ordered by the Owner or the Owner's Representative for drainage or for temporary heat.

.03 - Material Hoists

A. General

1. Material hoists shall be operated by diesel, gasoline or steam engines and shall be complete with all equipment necessary for operation. Such hoists shall run from grade to roof, shall be installed immediately following the structural framing, centering or form work, and centering or form work unless otherwise approved by the Owner or the Owner's Representative. Electrically operated hoists shall not be used except as otherwise allowed by the Contract.
2. Material hoists shall meet any and all requirements of law, rule or regulation.
3. Hoist cars shall be of required size and design for the hoisting of all normal size building materials.

B. The Contractor shall:

1. Furnish, install, maintain and operate at the Contractor's expense, all hoisting equipment required for the Work.
2. Furnish all labor required for the Work.

.04 - Temporary Use of Permanent Elevator as Equipment Material Hoist

- A. The Contractor shall:
 - 1. Use the temporary hoists until a building is completed, or until the Contractor may, with the Owner's permission, use the equipment of one (1) elevator in a building for temporary service after the permanent elevator equipment and the permanent electric service have been installed.
 - 2. If the Contractor elects to use such permanent elevator equipment, the Contractor shall:
 - a. Provide adequate protection for such equipment and shall operate such equipment within a capacity not to exceed that allowed by law, rule or regulation.
 - b. Provide for the maintenance of the elevator equipment as approved by the Owner or the Owner's Representative.
 - c. Leave such equipment in perfect condition.
- B. The permanent elevator equipment shall be ready for use when required by the Work and shall permit any use approved by the Owner or the Owner's Representative.

.05- Temporary Enclosures

The Contractor shall:

- A. Provide, install and maintain any temporary weather resistant enclosures for all openings in exterior walls and roof that are not enclosed.
- B. After building is enclosed, maintain proper temperatures required by the Contract.

.06 - Temporary Fence Enclosures

The Contractor shall Provide, Install and maintain any temporary fence enclosures required by the Contract.

.07 - Maintenance of Permanent Roadways

The Contractor shall immediately remove dirt and debris which may collect on permanent roadways due to the Work.

.08 – Traffic Control

- A. Routes to and from the location of the Work shall be as indicated in the Contract or as directed by the Owner or the Owner's Representative.
- B. Parking areas for the use of those engaged in the Work shall be as indicated in the Contract or as directed by the Owner or the Owner's Representative.

.09 - Fire Prevention Control

The Contractor Shall:

- A. Provide private unlisted telephone service reserved for fire calls at a location or locations approved by the Owner or the Owner's Representative. Such service shall be in addition to any other telephone service. The Contractor shall pay all costs thereof until completion and acceptance of the Work or as otherwise directed by the Owner or the Owner's Representative.
- B. Comply with the safety provisions of the National Fire Protection Association's "National Fire Codes" pertaining to the Work and, particularly, in connection with any cutting or welding performed as part of the Work.

.10 - Pollution Control

The Contractor shall:

- A. Comply with all laws, rules and regulations governing pollution control, including but not limited to those of the Department of Environmental Conservation of the State of New York.
- B. Take all necessary precautions including, but not limited to digging and maintaining settling basins and dams; diverting streams, and taking all other actions that may be necessary to prevent silt, and waste of any kind from being deposited, silting and reduction of quality of streams below the construction area and downstream properties as a result of the Work.
- C. Refrain from the disposal of volatile fluid wastes into storm or sanitary sewer systems, approved sewage disposal systems or any waterway.
- D. Refrain from burning trash or waste materials.

.11 - Temporary Field Office

- A. The Contractor may Provide a temporary office structure, for the Contractor's use during the course of the Work.
 - 1. The Contractor must receive prior written approval from the Owner or the Owner's Representative for such temporary office structure in relation to location, type of structure, and included facilities.
 - 2. All toilet and sink facilities in any such office structure shall be connected to an approved sewage disposal system.
 - 3. The Contractor shall remove the temporary office structure from the Site and shall repair the Site and finish the area as directed by the Owner or the Owner's Representative.

- B. The Contractor shall:
 - 1. Provide a temporary office structure completely separate from any other office structures at a location approved by the Owner or the Owner's Representative until the Work is completed and is accepted.
 - 2. Provide such office structure for the exclusive use of the Owner.
 - 3. Bear all costs in relation to the furnishing, construction and removal of such office structure.
 - 4. Repair and refinish the area as directed by the Owner or the Owner's Representative.
 - 5. Construct such office structure and furnish such office structure as required by the Contract.
 - 6. Maintain such office structure in a sanitary condition and in proper repair, properly heat the structure, furnish the fuel and furnish all utilities and pay all utility charges.
 - 7. Install a telephone for the sole use of the Owner or the Owner's Representative and pay all service and local toll charges incurred as a result of the use of such telephone service.

- C. **With** the prior written approval of the Owner or the Owner's Representative any other Contractor may erect a substantial office structure at the Site for the use of such Contractor in relation to the Work.
 - 1. All toilet and sink facilities in any such office structure shall be connected to an approved sewage disposal system.

2. Such Contractor shall remove the temporary office structure from the Site and shall repair the Site and finish the area as directed by the Owner or the Owner's Representative.
- D. When adequate space is available in a building, the Contractor may transfer such office to available space with the prior written permission of the Owner or the Owner's Representative.
- E. Trailers providing comparable facilities may be accepted at the discretion of the Owner or the Owner's Representative.

.12 - Rubbish Removal

- A. The Contractor shall:
 1. Keep the Work free from rubbish at all times.
 2. Clean all enclosed structures daily.
 3. Remove rubbish from the Site at least once a week.
- B. The Contractor shall conform with the following:
 1. Burning of rubbish shall not be permitted.
 2. All rubbish shall be lowered by way of chutes, taken down by hoists, or lowered in receptacles. Under no circumstances shall any rubbish be dropped or thrown from one (1) level to another inside or outside any building.

.13 - Discontinuance, Changes and Removal

The Contractor shall:

- A. Discontinue all temporary services required by the Contract when so directed by the Owner or the Owner's Representative. The discontinuance of any such temporary service prior to the completion of the Work shall not render the Owner liable for any additional cost entailed thereby.
- B. Remove and relocate such temporary facilities as directed by the Owner or the Owner's Representative without additional cost to the Owner, and shall restore the Site and the work to a condition satisfactory to the Owner.

.14 - Project Identification

- A. No signs or advertisements shall be displayed on the site except as required by the Contract.

- B. The Contractor shall Furnish, erect and maintain the Site, the exact location thereof to be designated by the Owner or the Owner's Representative, a construction sign, in the form provided by the Contract.

.15 - Moisture and Condensation Control

The Contractor shall provide for ventilation of all structures until Physical Completion and acceptance of the Work and shall control such ventilation to avoid excessive rates of drying of construction materials, including but not limited to concrete and to plaster, and to prevent condensation on sensitive surfaces.

.16 - Protective Services

The Contractor shall provide security services required by the Contract.

01600 -- MATERIAL AND EQUIPMENT

.01 - Storage and Protection

- A. Materials stored on the Site shall be neatly piled and protected, and shall be stored in an orderly fashion in locations that shall not interfere with the progress of the Work or with the daily functioning of the Institution.
- B. Should it become necessary during the course of the Work to move materials or equipment stored on the Site, the Contractor, at the direction of the Owner or the Owner's Representative, shall move such material or equipment.

01700 -- PROJECT CLOSE OUT

.01 - Final Cleanup

- A. The Contractor shall leave the Work ready for use and occupancy without the need of further cleaning of any kind.
- B. The Contractor shall remove all tools, appliances, projects signs, material and equipment from the premises as soon as possible upon completion of the Work.
- C. The Work is to be turned over to the Owner in new condition, in proper repair and in perfect adjustment.

.02 - Required Close Out Documentation

- A. Prior to final payment the Owner shall receive the following documents as required by the Contract:

1. The Contractor's general guarantee.
 2. Specific guarantees, material, equipment and other items of work.
 3. All certificates obtained in connection with the Work.
 4. All final photographs of the Work.
- B. The Owner shall also receive from the Contractor prior to final payment:
1. A complete listing of all Subcontractors, business addresses and items supplied by each such Subcontractor.
 2. A listing of manufacturer's of major materials, equipment and systems installed in the Work.
 3. A copy of all test data taken in connection with the Work.
 4. Three (3) copies of all operation and maintenance manuals.
 5. All keys, tools, screens, spare construction material, finishing material and equipment required to be furnish to the Owner as part of the Work.

.03 - Orientation Instruction

Prior to final payment appropriate maintenance personnel of the Owner shall be oriented and instructed by the Contractor in the operation of all systems and equipment as required by the Contract.

.04 - Project Close Out Inspections

- A. When the Work has reached such a point of completion that the building or buildings, equipment or apparatus or any part thereof required by the Owner for occupancy or use can be so occupied and used for the purpose intended, the Owner or the Owner's Representative shall make a detailed inspection of the Work to insure that all requirements of the Contract have been met and that the Work is complete and is acceptable.
- B. A copy of the report of the inspection shall be furnished to the Contractor as the inspection progresses so that the Contractor may proceed without delay with any part of the Work found to be incomplete or defective.
- C. When the items appearing on the report of inspection have been completed or corrected, the Contractor shall so advise the Owner and the Owner's Representative. After receipt of the notification, the Owner or the Owner's Representative shall inform the Contractor of the date and time of final inspection. A copy of the report of the final inspection containing all

remaining contract exceptions, omissions and incompletions shall be furnished to the Contractor.

- D. After receipt of notification of completion and all remaining contract exceptions, omissions and incompletions from the Contractor, the Owner and the Owner's Representative shall make an inspection to verify completion of the exception items appearing on the report of final inspection.

01720 -- PROJECT RECORD DOCUMENTS

.01 - Project Record Drawings

- A. The purpose of the project drawings is to record the actual location of the Work in place including but not limited to underground lines, concealed piping within buildings, concealed valves and control equipment, and to record changes in the Work.
- B. In addition to the sets of contract drawings that are required by the Contractor on the Site to perform the Work, the Contractor shall maintain, at the Site, one (1) copy of all drawings, specifications and addenda that are part of the Contract as awarded. Each of these documents should be clearly marked "Project Record Copy", maintained in a clean and neat condition available at all times for inspection by the Owner or the Owner's Representative, and shall not be used for any other purpose during the progress of the Work.
- C. Project Record Requirements
 - 1. The Contractor shall mark-up the "Project Record Copy" to show:
 - (a) Approved changes in the Work.
 - (b) Location of underground Work and concealed Work.
 - (c) Details not shown in the original Contract Documents.
 - (d) Any relocation of Work.
 - (e) All changed in dimensions.
 - (f) All access doors.
 - (g) Location of all plumbing, heating, ventilating, air conditioning or electrical assemblies.
 - 2. Such information shall include, but shall not be limited to:

- (a) Footing depth in relation to finished grade elevations.
 - (b) Any change in floor elevations.
 - (c) Any structural changes.
 - (d) Any substitutions.
 - (e) Elevations and locations of all underground utilities, services, or structures referenced to permanent above-ground structures or monuments.
 - (f) Designation of all utilities as to the size and use of such utilities.
 - (g) All invert elevations of manholes.
 - (h) The location of all utilities, services and appurtenances concealed in building structures that have been installed different from that required by the Contract.
 - (i) Any approved change order.
- D. The Contractor shall keep the Project Record Documents up-to-date from day to day as the Work progresses. Appropriate documents are to be updated promptly and accurately; no Work is to be permanently concealed until all required information has been recorded.
- E. The project record drawings are to be submitted by the Contractor to the Owner or the Owner's Representative when all the Work is completed and is approved by the Owner and the Owner's Representative before the Contractor may request final payment.

01740 -- WARRANTIES, GUARANTEES, AND BONDS

See the Contract Documents for details.

SECTION V.
GENERAL CONDITIONS

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ARTICLE 1 -- DEFINITIONS

Section 1.01 - The following terms as used in the Contract Documents shall be defined as follows:

Beneficial Occupancy - The use, occupancy or operation by the Owner of the Work, or any part thereof, as evidenced by a notification of Beneficial Occupancy executed by the Owner.

Construction Completion - Acceptance by the Owner of the Work as evidenced by a Notification of Construction Completion executed by the Architect.

Construction Manager - A person, persons, firm, partnership or corporation, regularly engaged in the management of construction projects, and so designated by the Owner.

Consultant - A person, persons, firm, partnership or corporation providing Architectural, Engineering or other professional services, and so designated by the Owner.

Contract - The agreement between the Owner and the Contractor consisting of the Contract Documents including all amendments and supplements thereto.

Contract Documents - The Contract, Notice to Bidders, Bid Checklist, Bid Terms and Conditions, Contractor Reference Sheet, Contract Terms and Conditions, Bid Analysis Form, Affirmative Action Form, Change Order Form, Contractors Trade Payment Breakdown, Safety EHS Plan, Prevailing Wage Schedule, Information for Bidders, Form of Bid, General Conditions, General Requirements, Bonds, Drawings, Specifications, Addenda, Change Orders and any supplementary data together with all provisions of law deemed to be inserted in the Contract or incorporated by reference.

Contractor - A person, persons, firm, partnership or corporation with whom the Contract is entered into by the Owner to perform the Work.

Extra Work - Any work in addition to the Work initially required to be performed by the Contractor pursuant to the Contract.

Furnish - To deliver to the site ready for installation.

Install - To unload at the delivery point at the Site and perform every operation necessary to establish secure mounting and correct operation at the proper location.

Owner – The Fashion Institute of Technology and/or its auxiliary corporations, as applicable.

Owner's Representative - A person, persons, firm, partnership or corporation so designated by the Owner.

Project - Work at the Site(s) carried out pursuant to one or more sets of Contract Documents.

Provide - To Furnish and Install complete in place and ready for operation and use.

Shop Drawings - Diagrams, fabrication drawings, illustration, schedules, test data, performance charts, cuts brochures and other data which are submitted by the Contractor to the Architect and illustrate any portion of the Work. These drawings and data are reviewed and acted upon by the architect.

Site - The area within the Contract limit, as indicated by the Contract.

Subcontract - An agreement between the Contractor and Subcontractor for work on the Site.

Subcontractor - A person, persons, firm, partnership or corporation under contract with the Contractor, or under contract with any subcontractor, to provide labor and material at the Site.

Substantial Completion - Stage of construction at which the Architect determines there is a minimal amount of the Work to be completed, or Work to be corrected.

Work - The performance of all obligations imposed upon the Contractor by the Contract.

ARTICLE 2 -- CONTRACT DOCUMENTS

Section 2.01 - Captions

The table of contents, titles, captions, headings, running headlines and marginal notes contained herein and in said documents are solely to facilitate reference to various provisions of the Contract Documents and in no way affect the interpretation of the provisions to which they refer.

Section 2.02 - Conflicting Conditions

Should any provision in any of the Contract Documents be in conflict or inconsistent with any of the General Conditions or Supplements thereto, the General Conditions or Supplements thereto shall govern.

Section 2.03 - Notice and Service Thereof

Any notice to the Contractor from the Owner relative to any part of the Contract shall be in writing and service considered complete when said notice is mailed to the Contractor at the last address given by the Contractor, or when delivered in person to said Contractor or the Contractor's authorized representative.

Section 2.04 - Nomenclature

Materials, equipment or other Work described in words which have a generally accepted technical or trade meaning shall be interpreted as having said meaning in connection with the Contract.

Section 2.05 - Invalid Provisions

If any term or provision of the Contract Documents or the application thereof to any person, firm or corporation or circumstance shall, to any extent, be determined to be invalid or unenforceable, the remainder of the Contract Documents, or the application of such terms or provisions to persons, firms or corporations or circumstances other than those to which it is held invalid or unenforceable, shall not be affected thereby and each term or provision of the Contract Documents shall be valid and be enforced to the fullest extent permitted by law.

ARTICLE 3 -- INTERPRETATION OF CONTRACT DOCUMENTS

Section 3.01 – Owner/Architect

- A. The Owner's representative/Architect shall give all orders and directions contemplated under the Contract relative to the execution of the Work. The Architect shall determine the amount, quality, acceptability of the Work and shall decide all questions which may arise in relation to said Work. The Owner's estimates and decisions shall be final except as otherwise expressly provided. In the event that any question arises between the Owner and Contractor concerning the Contract, the decision of the Owner shall be a condition precedent to the right of the Contractor to receive any money or payment under the Contract.
- B. Any differences or conflicts concerning performance which may arise between the Contractor and other contractors performing Work for the Owner shall be adjusted and determined by the Owner's representative.
- C. The Owner may act through a representative designated by the Owner.

Section 3.02 - Meaning and Intent of Contract Documents

The meaning and intent of all Contract Documents shall be as interpreted by the Architect.

Section 3.03 - Order of Preference

- A. Figured dimensions shall take precedence over scaled dimensions. Larger scale drawings shall take precedence over smaller scale drawings. Latest addenda shall take precedence over previous addenda and earlier dated drawings and specifications.
- B. Should a conflict occur in or between or among any parts of the Contract Documents that are entitled to equal preference, the better quality or greater quantity of material, of the more specific compared to the general, shall govern, unless the Architect/Owner's representative directs otherwise.
- C. Drawings and specifications are complementary. Anything shown on the drawings and not mentioned in the specifications, or mentioned in the specifications and not shown on the drawings, shall have the same effect as if shown or mentioned in both.

ARTICLE 4 -- MATERIALS AND LABOR

Section 4.01 - Contractor's Obligations

- A. The Contractor shall, in a good workmanlike manner, perform all the Work required by the Contract Documents within the time specified in the Contract.
- B. The Contractor shall Furnish, erect, maintain, and remove such construction plant and such temporary Work as may be required for the performance of its work. The Contractor shall be responsible for the safety, efficiency and adequacy of the Contractor's plant, appliances and methods, and for damage which may result from failure or improper construction, maintenance or operation of said plant, appliances and methods. The Contractor shall comply with all terms of the Contract, and shall, carry on and complete the entire Work to the satisfaction of the Owner.
- C. Any labor, materials or means whose employment or utilization during the course of this Contract may tend to or in any way cause or result in strike, work stoppages, delays, suspension of Work or similar troubles by workmen employed by the Contractor, its subcontractors or material suppliers, or by any of the trades working in or about the buildings and premises where Work is being performed under this Contract, or by other contractors, their subcontractors or material suppliers pursuant to other contracts shall not be allowed. Any violation by the Contractor of this requirement may in the sole judgment of the Owner be considered as proper and sufficient cause for declaring the Contractor to be in default, and for the Owner to take action against the Contractor as set forth in the General Conditions Article entitled "Termination" or such other action as the Owner may deem proper.

Section 4.02 - Contractor's Title to Materials

- A. No materials or supplies for the Work shall be purchased by the Contractor or by any Subcontractor subject to any chattel mortgage or under a conditional sale or other agreement by which an interest is retained by any other party. The Contractor warrants that the Contractor has full, good and clear title to all materials and supplies used by the Contractor in the Work, or resold to the Owner pursuant to the Contract free from all liens, claims or encumbrances.
- B. All materials, equipment and articles which become the property of the Owner shall be new unless specifically stated otherwise.

Section 4.03 - "Or Equal" Clause

- A. Whenever a material, article or piece of equipment is identified on the plans or in the specifications by reference to manufacturers' or vendors' names, trade names, catalogue number or make, said identification is intended to establish a standard. Any material, article or equipment of other manufacturers and vendors which performs satisfactorily the duties imposed by the general design may be considered equally acceptable provided that, in the opinion of the Architect/Engineer, the material, article or equipment so proposed is of equal quality, substance and function and the Contractor shall not Provide, Furnish or Install any said proposed material, article or equipment without the prior written approval of the Architect/Engineer. The burden of proof and all costs related thereto concerning the "or equal" nature of the substitute item, whether approved or disapproved, shall be borne by the Contractor.
- B. Where the Architect/Engineer, pursuant to the provisions of this Section, approves a product proposed by the Contractor and said proposed product requires a revision of the Work covered by this Contract, or the Work covered by other contracts, all changes to the Work of all contracts, revision or redesign, and all new drawings and details required therefore shall be provided by the Contractor at the cost of the Contractor and shall be subject to the approval of the Consultant.
- C. No substitution will be permitted which may result in a delay to the Project.

Section 4.04 - Quality, Quantity and Labeling

- A. The Contractor shall Furnish materials and equipment of the quality and quantity specified in the Contract.
- B. When materials are specified to conform to any standard, the materials delivered to the Site shall bear manufacturer's labels stating that the materials meet said standards.

- C. The above requirements shall not restrict or affect the Owner's right to test materials as provided in the Contract.
- D. The Contractor shall develop and implement quality control plans to assure itself and the Owner that all Work performed by the Contractor and its Subcontractors complies fully with all Contract requirements, and shall submit the plans to the Owner as required by the Contract. See Submittals Section of the General Requirements. The Contractor's quality control plans shall be independent of any testing or inspection performed by or on behalf of the Owner.

ARTICLE 5 -- CONTRACTOR

Section 5.01 - Supervision by Contractor

- A. The Contractor shall provide full-time competent supervision for the duration of the Contract; during the course of on-site work the Contractor shall provide a full-time on-site superintendent who shall have full authority to act for the Contractor at all times. The Superintendent shall be able to read, write and speak English fluently, as well as communicate with the workers.
- B. If at any time the supervisory staff is not satisfactory to the Owner, the Contractor shall, if directed by the Owner, immediately replace such supervisory staff with other staff satisfactory to the Owner.
- C. The Contractor shall remove from the Work any employee of the Contractor or of any Subcontractor when so directed by the Owner.

Section 5.02 - Representations of Contractor

The Contractor represents and warrants:

- A. That it is financially solvent and is experienced in and competent to perform the Work, and has the staff, equipment, subcontractors and suppliers available to complete the Work within the time specified for the Contract price.
- B. That it is familiar with all Federal, State or other laws, ordinances, orders, rules and regulations that may in any way affect the Work.
- C. That any temporary and permanent Work required by the Contract can be satisfactorily constructed, and that said construction will not injure any person or damage any property.
- D. That it has carefully examined the Contract and the Site of the Work and that, from the Contractor's own investigations and through the bid process and requirements is satisfied as to the nature and materials likely to be encountered, the character of equipment and other facilities needed

for the performance of the Work, the general and local conditions and all other materials or items which may affect the Work.

- E. That it is satisfied that the Work can be performed and completed as required in the Contract, and warrants that it has not been influenced by any oral statement or promise of the Owner or the Consultant.

SECTION 5.03 – COPIES OF CONTRACT DOCUMENTS FOR CONTRACTORS

- A. The Owner shall furnish to the Contractor, without charge, up to five (5) copies of Contract Documents.
- B. Any sets in excess of the number mentioned above may be furnished to the Contractor at the cost of reproduction and mailing or delivery.

SECTION 5.04 - MEETINGS

The Contractor shall attend all meetings as directed by the Owner or the Owner's Representative.

SECTION 5.05 – RELATED WORK

To ascertain the relationship of its work to all Work required by the Contract Documents, the Contractor shall examine the Contract Documents for Work of its Contract and any related work of other contracts.

SECTION 5.06 – ERRORS OR DISCREPANCIES

The Contractor shall examine the Contract thoroughly before commencing the Work and report in writing any errors or discrepancies to the Owner or the Owner's Representative within five (5) days of discovery.

ARTICLE 6 -- SITE CONDITIONS

SECTION 6.01 – SUBSURFACE OR SITE CONDITIONS FOUND DIFFERENT

- A. The Contractor acknowledges that the Contract amount set forth in its bid includes such provisions which the Contractor deems proper for all Site

conditions the Contractor could reasonably anticipate encountering as indicated in the Contract or from the Contractor's inspection and examination of the Site prior to submission of bids.

SECTION 6.02 – VERIFYING DIMENSIONS AND CONDITIONS

- A. The Contractor shall take all measurements and verify all dimensions and conditions at the Site before proceeding with the Work. If said dimensions or conditions are found to be in conflict with the Contract, the Contractor immediately shall refer said conflict to the Architect in writing. The Contractor shall comply with any revised Contract Documents.
- B. During the progress of Work, the Contractor shall verify all field measurements prior to fabrication of building components or equipment and proceed with the fabrication to meet field conditions.
- C. The Contractor shall consult all Contract Documents to determine exact location of all Work and verify spatial relationships of all Work. Any question concerning said location or spatial relationships may be submitted in a manner approved by the Architect.
- D. Special locations for equipment, pipelines, ductwork and other such items of Work, where not dimensioned on plans, shall be determined in consultation with other affected contractors.
- E. The Contractor shall be responsible for the proper fitting of the Work in place.

SECTION 6.03 - SURVEYS

Unless otherwise expressly provided in the Contract, the Owner shall furnish the Contractor all surveys of the property necessary for the Work, but the Contractor shall lay out the Work.

ARTICLE 7 -- INSPECTION AND ACCEPTANCE

SECTION 7.01 – ACCESS TO THE WORK

The Owner, the Owner's Representative, and the architect shall at all times have access to the Work and the Contractor shall provide proper facilities for said access.

SECTION 7.02 – NOTICE FOR TESTING

If the Contract Documents, the Owner's instructions, laws, rules, ordinances or regulations require that any Work be inspected or tested, the Contractor shall give the Architect and/or Owner's representative a minimum of three (3) work days written notice of readiness of the Work for inspection or testing and the date fixed for said inspections or testing.

SECTION 7.03 – REEXAMINATION OF WORK

Reexamination of any part of the Work may be ordered by the Owner, and if so ordered, the Work must be uncovered by the Contractor. If said Work is found to be in accordance with the Contract, the Owner shall pay the cost of reexamination. If said Work is not found to be in accordance with the Contract, the Contractor shall pay the cost of reexamination and replacement.

SECTION 7.04 – INSPECTION OF WORK

All Work, all materials whether or not incorporated in the Work, all processes of manufacture and all methods of construction shall be, at all times and places, subject to the inspection of the Owner or the Owner's Representative or the architect, and the Architect shall be the final judge of the quality and suitability of the Work, materials, processes of manufacture and methods of construction for the purposes for which said Work, materials, processes of manufacture and methods of construction are used. Any Work not approved by the Architect shall be reconstructed, made good, replaced or corrected immediately by the Contractor including all Work of other contractors destroyed or damaged by said removal or replacement. Rejected material shall be removed immediately from the Site. Acceptance of material and workmanship by the Owner shall not relieve the Contractor from the Contractor's obligation to replace all Work which is not in compliance with the Contract.

SECTION 7.05 – DEFECTIVE OR DAMAGED WORK

If, in the opinion of the Owner, it is undesirable to replace any defective or damaged materials or to reconstruct or correct any portion of the Work damaged or not performed in accordance with the Contract, the compensation to be paid to the Contractor shall be reduced by an amount which, in the judgment of the Owner, shall be deemed to be equitable.

SECTION 7.06 - TESTING

All materials and equipment used in the Work shall be subject to inspection and testing in accordance with accepted standards to establish conformance with specifications and suitability for uses intended, unless otherwise specified in the Contract. If any Work shall be covered or concealed without the approval or consent of the Architect, said Work shall, if required by the Architect, be uncovered for examination. Any inspection by the Architect or by a testing laboratory on behalf of the Owner does not relieve the Contractor of the responsibility to maintain quality control of materials, equipment and installation to conform to the requirements of the Contract. If any test results are below specified minimums, the Architect may order additional testing. The cost of said additional testing, any additional professional services required, and any other expenses incurred by the Owner as a result of said additional testing shall be at the Contractor's expense. The Owner may deduct such costs from moneys due the Contractor.

SECTION 7.07 - ACCEPTANCE

No previous inspection shall relieve the Contractor of the obligation to perform the Work in accordance with the Contract. No payment, either partial or full, by the Owner to the Contractor shall excuse any failure by the Contractor to comply fully with the Contract Documents. The Contractor shall remedy all defects and deficiencies, paying the cost of any damage to other Work resulting therefrom.

ARTICLE 8 -- CHANGES IN THE WORK

SECTION 8.01 - CHANGES

- A. Without invalidating the Contract, the Owner/Architect may order Extra Work or make changes by altering, adding to, or deducting from the Work, the Contract consideration being adjusted accordingly. No claims for Extra Work shall be allowed unless such Extra Work is ordered in writing by the Owner/Architect. No changes in the Work shall be made unless such Work is ordered in writing by the Owner/Architect or Owner's Representative. If the time for completion is affected by this change, the revised time for completion shall be included in the change order. The Owner may order the Contractor to perform the Extra Work and proceed under the Dispute Article.

- B. The amount by which the Contract consideration is to be increased or decreased by any change order may be determined by the Owner by one or more of the following methods:
1. By applying the applicable unit price or prices contained in the Contract.
 2. By estimating the fair and reasonable cost of the Extra Work:
 - a. Labor, including all wages, required wage supplements and insurance required by law, paid to employees below the rank of superintendent directly employed at the Site. Wages are the prevailing rate of wages defined in the Contract Documents and supplemental updates.
 - b. Premiums or taxes paid by the Contractor for worker's compensation insurance, unemployment insurance, FICA tax and other payroll taxes as required by law, net of actual and anticipated refunds and rebates.
 - c. Materials
 - d. Equipment, excluding hand tools, which in the judgment of the Owner, would have been or will be employed in the Work. It is the duty of the Contractor to utilize either rented or self-owned equipment that is of a nature and size appropriate for the Work to be performed. The Owner reserves the right to determine reasonable and appropriate equipment sizing, and at the Owner's discretion, to adjust the costs allowed to reflect a smaller or less elaborate piece of equipment more suitable for performance of the Extra Work.
 3. By determining the actual cost of the Extra Work in the same manner as in Article 8, Section 8.01, Subsection B. 2. except that the actual costs of the Contractor shall be used in lieu of estimated costs.
- C. The Owner shall have the option of determining by which method the Contractor shall proceed with said Extra Work. Wages are the prevailing rate of wages defined in the Contract Documents and supplemental updates. The Contractor shall submit a signed and notarized Labor Rate Worksheet(s) to the Owner to be used to determine hourly rates for various classifications of workers. The Contractor agrees to provide documentation verifying costs and calculations at the Owner's request.

- D. Regardless of the method used by the Owner in determining the value of a change order, the Contractor shall, within the time-frame given by the Owner, submit to the Owner or Owner's Representative a detailed breakdown of the Contractor's estimate of the value of the omitted or Extra Work.
- E. Unless otherwise specifically provided for in a change order, the compensation specified therein for Extra Work includes full payment for the Extra Work covered thereby, and the Contractor waives all rights to any other compensation for said Extra Work, damage or expense.
- F. The Contractor shall furnish satisfactory bills, payrolls and vouchers covering all items of cost and when requested by the Owner shall give the Owner access to all accounts and records relating thereto, including records of subcontractors and material suppliers.
- G. Increased bonding costs for the Work which may result from Owner issued Changes in the Work will be addressed by the Owner at the completion of the Project Work upon submission of satisfactory proof of Contractor's increased cost.
- H. Increased contractual liability insurance premium costs which may result from changes in the Work will be addressed by the Owner at the completion of the Work upon submission of satisfactory proof of Contractor's increased cost.

SECTION 8.02 – OVERHEAD AND PROFIT ALLOWANCE

A. See Example A for changes in the Work performed directly by the Contractor, whether a base cost is arrived at by estimated cost or actual cost method; add to base cost a sum equal to twenty percent. See Exceptions - Paragraphs “D” and “E”.

Example A:

Contractor base cost	\$1,000
20% overhead and profit	<u>200</u>
Total	\$1,200

B. See Example B for changes in the Work performed by a Subcontractor under contract with the Contractor, where estimated or actual cost is Ten Thousand Dollars (\$10,000.00) or less; add to the base cost a sum equal to twenty percent of cost, for the benefit of the Subcontractor. For the benefit of the Contractor; add an additional sum equal to ten percent of the Subcontractor's base cost.

Example B:

Subcontractor base cost	\$1,000
20% Subcontractor overhead and profit	<u>200</u>
Subcontractor Total	\$1,200
10% Contractor overhead and profit on base cost	<u>100</u>
Total	\$1,300

C. See Example C for changes in the Work performed by a Subcontractor, under contract with the Contractor, which exceeds a base cost of Ten Thousand Dollars (\$10,000) in estimated or actual cost; add to the base cost a sum equal to twenty percent of cost for the benefit of the Subcontractor. For the benefit of the Contractor; add an additional sum equal to ten percent of the first Ten Thousand Dollars (\$10,000) of the Subcontractor's base cost, plus five percent of the next Ninety Thousand Dollars (\$90,000) of the Subcontractor's base cost, plus three percent of any sum in excess of One Hundred Thousand Dollars (\$100,000) of the Subcontractor's base cost.

Example C:

Subcontractor base cost	\$200,000
20% Subcontractor overhead and profit	<u>40,000</u>
Subcontractor Total	\$240,000
10% Contractor overhead and profit on first \$10,000 base cost	1,000
5% on next \$90,000 base cost	4,500
3% on base cost over \$100,000	<u>3,000</u>
Total	\$248,500

D. See Example D for overhead and profit on major equipment such as: switchgear, transformers, air handling units, boilers, etc. For extra equipment purchases by the Contractor or Subcontractors which exceeds a base cost of Ten Thousand dollars (\$10,000) in estimated or actual cost; add to the base cost for the benefit of the Contractor a sum equal to ten percent of the first Ten Thousand dollars (\$10,000) of the vendor's base cost plus five percent of the next Ninety Thousand dollars (\$90,000) of the vendor's base cost, plus three percent of any sum in excess of One Hundred Thousand dollars (\$100,000) of the vendor's base cost. If the equipment is supplied by the Subcontractor, the Contractor is entitled to a maximum of ten (10) percent of the first Ten Thousand dollars (\$10,000) of the base cost.

Example D:

Vendor base cost	\$200,000
10% Contractor or Subcontractor overhead and profit on first \$10,000 base cost	1,000
5% on next \$90,000 base cost	4,500
3% on base cost over \$100,000	<u>3,000</u>
Contractor or Subcontractor Total	\$208,500
10% Contractor overhead and profit on first \$10,000 base cost when equipment is supplied by the Subcontractor, no other mark-up allowed	<u>1,000</u>
Total	\$209,500

E. See Example E for overhead and profit on a material only Change Order. For increased material purchases by the Contractor or Subcontractors which exceed a base cost of Ten Thousand dollars (\$10,000) in estimated or actual costs; add to the base cost for the benefit of the Contractor a sum equal to ten percent of the first Ten Thousand dollars (\$10,000) of the supplier's cost plus five percent of the next Ninety Thousand dollars (\$90,000) of the supplier's cost, plus three percent of any sum in excess of One Hundred Thousand dollars (\$100,000) of the supplier's cost. If the material is supplied by the Subcontractor, the Contractor is entitled to a maximum of ten (10) percent of the first Ten Thousand dollars (\$10,000) of the base cost.

Example E:

Material cost (net difference between original contract and revised)	\$200,000
10% Contractor or Subcontractor overhead and profit on first \$10,000 base cost	1,000
5% on next \$90,000 base cost	4,500
3% on base cost over \$100,000	<u>3,000</u>
Contractor or Subcontractor Total	\$208,500
10% Contractor overhead and profit on first \$10,000 base cost when material is supplied by the Subcontractor, no other mark-up allowed	1,000
Total	\$209,500

F. Other than the overhead and profit described in General Conditions Section 7.02A, no further overhead and profit will be allowed for changes to the Work performed by a Subcontractor under Subcontract with the Contractor or for major equipment or material supplier determined to be an affiliate of or controlled by the Contractor. An affiliate is considered any firm or entity in which the Contractor or any individual listed on the Contractor's NYS Vendor Responsibility Questionnaire either owns 5% or more of the shares of, or is one of the five largest shareholders, a director, officer, member, partner or proprietor of said Subcontractor, major equipment or material supplier; a controlled firm is any firm or entity which, in the opinion of the Owner, is controlled by the Contractor or any individual listed on the Contractor's NYS Vendor Responsibility Questionnaire.

1. The Owner, in its sole and exclusive discretion, will determine if a firm or entity is an affiliate of or controlled by the Contractor.

G. No overhead and profit shall be paid for changes in the Work performed by a Subcontractor not under Subcontract with the Contractor. No overhead and profit shall be paid on the premium portion of overtime pay. Where the changes in the Work involve both an increase and a reduction in similar or related Work, the overhead and profit allowance shall be applied only to the cost of the increase that exceeds the cost of the reduction.

SECTION 8.02A – DEDUCT CHANGE ORDER

The amount of credit to be allowed by the Contractor to the Owner for a deletion or change which results in a decrease in the Contract amount shall be as determined by the Owner. The credit shall include the overhead and profit allocable to the deleted or changed Work unless the Owner, in its sole and exclusive discretion, determines otherwise.

SECTION 8.03 – FORM OF CHANGE ORDERS

All Change Orders shall be processed, executed and approved on AIA document G701, which is included herein and made part of the Contract Documents. No alteration to this form shall be acceptable to the Owner and no payment for Extra Work shall be due the Contractor unless it executes a Change Order on said form.

ARTICLE 9 -- TIME OF COMPLETION

SECTION 9.01 – TIME OF COMPLETION

- A. The Work shall be commenced at the time stated in the Owner's written notice to proceed, and shall be completed no later than the time of completion specified in the Contract Documents. Notwithstanding anything to the contrary, a schedule submitted by the Contractor showing a time of completion earlier than that specified in the Contract shall not entitle the Contractor to any additional compensation in the event the earlier time of completion is not realized.
- B. It is hereby understood and mutually agreed, by and between the Contractor and the Owner, that the time for completion of the Work, as specified in the Contract Documents, is an essential and material condition of the Contract.
- C. The Contractor agrees that the Work shall be prosecuted regularly, diligently and uninterruptedly at such rate of progress as shall insure full completion thereof within the time specified. It is expressly understood and agreed, by and between the Contractor and the Owner, that the time for completion of the Work described herein is a reasonable time for completion of the same.
- D. If the Contractor shall neglect, fail or refuse to complete the Work within the time specified, or any proper extension thereof granted by the Owner, the Contractor agrees to pay to the Owner for loss of beneficial use of the structure an amount specified in the Contract, not as a penalty, but as liquidated damages, for each and every calendar day that the Contractor is in default. Default shall include abandonment of the Work by the Contractor.
- E. Said amount of liquidated damages is agreed upon by and between the Contractor and the Owner because of the impracticability and extreme difficulty of fixing and ascertaining the actual damages which the Owner would sustain for loss of beneficial use of the structure in the event of delay in completion, and said amount is agreed to be the amount of damages sustained by the Owner and said amount may be retained from time to time by the Owner.

- F. It is further agreed that time is of the essence for each and every portion of the Work. In any instance in which additional time is allowed for the completion of any Work, the new time of completion established by said extension shall be of the essence. The Contractor shall not be charged with liquidated damages or any excess cost if the Owner determines that the Contractor is without fault and that the delay in completion of the Work is due:
1. to an unforeseeable cause beyond the control and without the fault of, or negligence of the Contractor, and approved by the Owner, including, but not limited to, acts of God or of public enemy, acts of the Owner, fires, epidemics, quarantine, restrictions, strikes, freight embargoes and unusually severe weather; and
 2. to any delays of Subcontractors or suppliers occasioned by any of the causes specified in Subsections 1. of this paragraph.

The Contractor shall, within ten (10) days from the beginning of any such delay, notify the Owner, in writing, of the causes of the delay.

- G. The time for completion can be extended only by Change Order approved by the Owner and may be extended for:
1. all of the Work, or
 2. only that portion of the Work altered by the Change Order.

- H. The foregoing liquidated damages are intended to compensate the Owner only for the loss of beneficial use of the structure. In addition, the Contractor shall be liable to the Owner for whatever actual damages (other than actual loss of beneficial use) the Owner may incur as a result of any actions or inactions of the Contractor or its Subcontractors including, without limitation, interest expense and carrying costs, liabilities to other Contractors working on the project or other third parties, job extension costs and other losses incurred by the Owner. The provisions of this paragraph are for the exclusive use of the Owner, and shall not accrue to other contractors or third parties.

ARTICLE 10 -- TERMINATION OR SUSPENSION

SECTION 10.01 – TERMINATION FOR CAUSE

In the event that any provision of the Contract is violated by the Contractor or by any Subcontractor, the Owner may serve written notice upon the Contractor and upon the Contractor's surety, if any, of the Owner's intention to terminate the Contract; such notice shall contain the reasons for the intention to terminate the Contract upon a date specified by the Owner. If the violation or delay shall not cease or arrangements satisfactory to the Owner shall not be made, the Contract shall terminate upon the date so specified by the Owner. In the event of any such termination, the Owner may take over the Work and prosecute same to completion by Contract or otherwise for the account and at the expense of the Contractor, and the Contractor and Contractor's surety shall be liable to the Owner for all costs occasioned the Owner thereby. In the event of such termination the Owner may take possession of and may utilize such materials, appliances and plant as may be on the Site and necessary or useful in completing the Work.

SECTION 10.02 – TERMINATION FOR CONVENIENCE OF OWNER

The Owner, at any time, may terminate the Contract in whole or in part. Any such termination shall be effected by delivering to the Contractor a notice of termination specifying the extent to which performance of Work under the Contract is terminated and the date upon which the termination becomes effective. Upon receipt of the notice of termination, the Contractor shall act promptly to minimize the expenses resulting from the termination. The Owner shall pay the Contractor for Work of the Contract performed by the Contractor and accepted by the Owner for the period extending from the date of the last approved Application for Payment up to the effective date of the termination, including retainage. In no event shall the Contractor be entitled to compensation in excess of the total consideration of the Contract. . In the event of such termination the Owner may take over the Work and prosecute the Contract to completion and may take possession of and may utilize such materials, appliances, and equipment as may be on the Site and necessary or useful in completing the Work.

SECTION 10.03 – OWNER'S RIGHT TO DO WORK

The Owner may, after notice to the Contractor, without terminating the Contract and without prejudice to any other right or remedy the Owner may have, perform or have performed by others all of the Work or any part thereof and may deduct the cost thereof from any moneys due or to become due the Contractor.

SECTION 10.04 – SUSPENSION OF WORK

- A. The Owner may order the Contractor in writing to suspend, delay or interrupt performance of all or any part of the Work for a reasonable period of time as the Owner may determine. The order shall contain the reason or reasons for issuance which may include but shall not be limited to the following: latent field conditions, substantial program revisions, acquisition of rights of way or real property, financial crisis, labor disputes, civil unrest or acts of God.
- B. Upon receipt of a suspension order, the Contractor shall, as soon as practicable, cease performance of the Work as ordered and take immediate affirmative measures to protect such Work from loss or damage.
- C. The Contractor specifically agrees that such suspension, interruption or delay of the performance of the Work pursuant to this Article shall not increase the cost of performance of the Work of this Contract.
- D. Time for completion of the Work may be extended to such time as the Owner determines shall compensate for the time lost by the suspension, interruption or delay, such determination to be set forth in writing.

ARTICLE 11 -- DISPUTES

SECTION 11.01 – CLAIMS FOR EXTRA WORK

- A. If the Contractor claims that any Work which the Contractor has been ordered to perform will be Extra Work, or that any action or omission of the Owner is contrary to the terms and provisions of the Contract and will require the Contractor to perform Extra Work the Contractor shall:
 - 1. Promptly comply with said order.
 - 2. File with the Owner and the architect within fifteen (15) working days after being ordered to perform the Work claimed by the Contractor to be Extra Work or within fifteen (15) working days after commencing performance of the Work, whichever date shall be earlier, or within fifteen (15) working days after the said action or omission on the part of the Owner occurred, a written notice of the basis of the Contractor's claim, including estimated cost, and request for a determination thereof.

3. Proceed diligently, pending and subsequent to the determination of the Owner with respect to any said disputed matter, with the performance of the Work in accordance with all instructions of the Owner.
- B. No claim for Extra Work shall be allowed unless the same was done pursuant to a written order of the Owner. The Contractor's failure to comply with any or all parts of this Article shall be deemed to be:
1. a conclusive and binding determination on the part of the Contractor that said order, Work, action or omission does not involve Extra Work and is not contrary to the terms and provisions of the Contract,
 2. a waiver by the Contractor of all claims for additional compensation or damages as a result of said order, Work, action or omission.
- C. The value of claims for Extra Work, if allowed, shall be determined by the methods described in the Contract.

SECTION 11.02 – CLAIMS FOR DELAY

No claims for increased costs, charges, expenses or damages of any kind shall be made by the Contractor against the Owner for any delays or hindrances from any cause whatsoever; provided that the Owner, in the Owner's discretion, may compensate the Contractor for any said delays by extending the time for completion of the Work as specified in the Contract.

SECTION 11.03 – FINALITY OF DECISIONS

- A. Any decision or determination of the Architect, Owner or the Owner's Representative shall be final, binding and conclusive on the Contractor unless the Contractor shall, within ten (10) working days after said decision, make and deliver to the Owner a verified written statement of the Contractor's contention that said decision is contrary to a provision of the Contract. The Owner shall determine the validity of the Contractor's contention. Pending the decision of the Owner, the Contractor shall proceed in accordance with the original decision.
- B. Wherever it is required in the Contract that an application must be made to the Owner or a determination made by the Owner, the decision of the Owner on said application or the determination of the Owner under the Contract shall be final, conclusive and binding upon the Contractor unless the Contractor, within ten (10) working days after receiving notice of the Owner's decision or determination, files a written statement with the Owner that the Contractor reserves the Contractor's rights in connection with the matters covered by said decision or determination.

ARTICLE 12 -- SUBCONTRACTS

SECTION 12.01 – SUBCONTRACTING

- A. The Contractor may utilize the services of Subcontractors subject to the bid terms and conditions.
- B. The Contractor shall submit to the Owner, in writing, the name of each proposed Subcontractor as required by the Contract or earlier when requested. The Owner reserves the right to disapprove any proposed Subcontractor. Such disapproval shall not result in additional cost to the Owner.
- C. The Contractor shall be fully responsible for the Work, acts and omissions of Subcontractors, and of persons either directly or indirectly employed by Subcontractors.
- D. The Contractor shall cause appropriate provisions to be inserted in all subcontracts relative to the Work to bind Subcontractors to the Contractor by the terms of the Contract Documents insofar as applicable to the work of Subcontractors.
- E. The Contractor's use of Subcontractors shall not diminish the Contractor's obligation to complete the Work in accordance with the Contract Documents. The Contractor shall control and coordinate the work of Subcontractors.
- F. Nothing contained in the Contract or any subcontract shall create any contractual relationship between Subcontractors and the Owner.

ARTICLE 13 -- CONTRACT COORDINATION AND COOPERATION

SECTION 13.01 – COOPERATION WITH OTHER CONTRACTORS

- A. During the progress of the Work, other contractors may be engaged in performing work. The Contractor shall coordinate the Contractor's Work with the work of said other contractors in such a manner as the Owner may direct.
- B. If the Owner shall determine that the Contractor is failing to coordinate the Work with the work of other contractors as the Owner has directed:
 - 1. the Owner shall have the right to withhold any payments due under the Contract until the Owner's directions are complied with by the Contractor; and
 - 2. the Contractor shall assume the defense and pay on behalf of the Owner any and all claims or judgments or damages and from any costs or damages to which the Owner may be subjected or which the Owner may suffer or incur by reason of the Contractor's failure to promptly comply with the Owner's directions.
- C. If the Contractor notifies the Owner, in writing, that another contractor on the Site is failing to coordinate the work of said contractor with the Work, the Owner shall investigate the charge. If the Owner finds it to be true, the Owner shall promptly issue such directions to the other contractor with respect thereto as the situation may require. The Owner shall not be liable for any damages suffered by the Contractor by reason of the other contractor's failure to promptly comply with the directions so issued by the Owner, or by reason of another contractor's default in performance.
- D. Should the Contractor sustain any damage through any act or omission of any other contractor having a contract with the Owner or through any act or omission of any Subcontractor of said other contractor, the Contractor shall have no claim against the Owner for said damage.
- E. Should any other contractor having or which shall have a contract with the Owner sustain damage through any act or omission of the Contractor or through any act or omission of a Subcontractor, the Contractor shall reimburse said other contractor for all said damages and shall indemnify and hold the Owner harmless from all said claims.

- F. The Owner cannot guarantee the responsibility, efficiency, unimpeded operations or performance of any Contractor. The Contractor acknowledges these conditions and shall bear the risk of all delays including, but not limited to, delays caused by the presence or operations of other contractors and delays attendant upon any construction schedule approved by the Owner and the Owner shall not incur any liability by reason of any delay.

SECTION 13.02 – SEPARATE CONTRACTS

- A. The Owner may award other contracts, work under which may proceed simultaneously with the execution of the Work. The Contractor shall coordinate the Contractor's operations with those of other contractors as directed by the Owner. Cooperation shall be required in the arrangements for access, the storage of material and in the detailed execution of the Work.
- B. The Contractor shall keep informed of the progress and workmanship of other contractors and any Subcontractors and shall notify the Owner in writing immediately of lack of progress or defective workmanship on the part of other contractors or subcontractors, where said delay or defective workmanship may interfere with the Contractor's operations.
- C. Failure of a Contractor to keep so informed and failure to give notice of lack of progress or defective workmanship by others shall be construed as acceptance by the Contractor of said progress and workmanship as being satisfactory for proper coordination with the Work.
- D. Where the Contractor shall perform Work in close proximity to work of other contractors or subcontractors, or where there is evidence that Work of the Contractor may interfere with work of other contractors or subcontractors, the Contractor shall assist in arranging space conditions to make satisfactory adjustment for the performance of said work and the Work. If the Contractor performs work in a manner which causes interference with the work of other contractors or subcontractors, the Contractor shall make changes necessary to correct the condition.

SECTION 13.03 – COORDINATED COMPOSITE DRAWINGS

The Contractor shall prepare coordinated composite scale reproducible drawings and sections, on reproducible paper, clearly showing how the Work of the Contractor is to be performed in relation to work of other contractors or subcontractors.

ARTICLE 14 -- PROTECTION OF RIGHTS, PERSONS AND PROPERTY

SECTION 14.01 – ACCIDENT PREVENTION

The Contractor shall, at all times, take every precaution against injuries to persons or damage to property and for the safety of persons on or about the Site or engaged in the performance of the Work.

SECTION 14.02 – SAFETY PROGRAMS

The Contractor shall be responsible for the initiation, maintenance and supervision of safety precautions and programs in connection with the Work.

SECTION 14.03 – PROTECTION OF WORK AND PROPERTY

- A. The Contractor shall, at all times, guard the Owner's property from injury or loss in connection with the Work. The Contractor shall, at all times, guard and protect the Contractor's Work, and adjacent property. The Contractor shall replace or make good any said loss or injury unless said loss or injury is caused directly by the Owner.
- B. The Contractor shall have full responsibility to protect and maintain all materials and supplies on and off site in proper condition and forthwith repair, replace and make good any damage thereto until construction completion. The Contractor shall maintain an inventory of all materials and supplies for the Project that are delivered to the Site or approved for off-site storage facilities.
- C. The Contractor shall report any loss, theft, burglary, vandalism or damage of materials or installed work to the Owner by phone and fax as soon as it is discovered. If vandalism, theft, or burglary are suspected as the cause of the loss, the Contractor shall notify site security personnel and the municipal police. The Contractor shall also protect the place of the loss until released from protection by the Owner or the Owner's Representative. The Contractor shall insure that no potential evidence relating to the loss is removed from the place of the loss.

SECTION 14.04 – ADJOINING PROPERTY

The Contractor shall protect all adjoining property and shall repair or replace any said property damaged or destroyed during the progress of the Work.

SECTION 14.05 – RISKS ASSUMED BY THE CONTRACTOR

- A. The Contractor solely assumes the following distinct and several risks whether said risks arise from acts or omissions, whether supervisory or otherwise, of the Owner, of any Subcontractor, of third persons or from any other cause, including unforeseen obstacles and difficulties which may be encountered in the execution of the Work, whether said risks are within or beyond the control of the Contractor and whether said risks involve any legal duty, primary or otherwise, imposed upon the Owner, excepting only risks which arise from faulty designs as shown by the plans and specifications or from the negligence of the Owner or the Owner's members, officers, representatives or employees that caused the loss, damage or injuries hereinafter set forth:
1. The risk of loss or damage, includes direct or indirect damage or loss, of whatever nature to the Work or to any plant, equipment, tools, materials or property furnished, used, installed or received by the Owner, the Construction Manager, the Contractor or any Subcontractor, material or workmen performing services or furnishing materials for the Work. The Contractor shall bear said risk of loss or damage until construction completion or until completion or removal of said plant, equipment, tools, materials or property from the Site and the vicinity thereof, whichever event occurs last. In the event of said loss or damage, the Contractor immediately shall repair, replace or make good any said loss or damage.
 2. The risk of claims, just or unjust, by third persons against the Contractor or the Owner and the Construction Manager on account of wrongful death, bodily injuries and property damage, direct or consequential, loss or damage of any kind whatsoever arising or alleged to arise out of or as a result of or in connection with the performance by the Contractor of the Work, whether actually caused by or resulting from the performance of the Work, or out of or in connection with the Contractor's operations or presence at or in the vicinity of the Site. The Contractor shall bear the risk for all deaths, injuries, damages or losses sustained or alleged to have been sustained prior to the construction completion of the Work. The Contractor shall bear the risk for all deaths, injuries, damages or losses sustained or alleged to have been sustained resulting from the Contractor's negligence or alleged negligence which is discovered, appears or is manifested after acceptance by the Owner.

3. The Contractor assumes entire responsibility and liability for any and all damage or injury of any kind or nature whatsoever, including death resulting therefrom, to all persons, whether employees of the Contractor or otherwise, and to all property, caused by, resulting from, arising out of or occurring in connection with the execution of the Work. If any person shall make said claim for any damage or injury, including death resulting therefrom, or any alleged breach of any statutory duty or obligation on the part of the Owner, the Owner's Representative, Construction Manager, servants and employees, the Contractor shall assume the defense and pay on behalf of the Owner, the Owner's Representative, the Construction Manager, servants and employees, any and all loss, expense, damage or injury that the Owner, the Owner's Representative, Construction Manager, servants and employees, may sustain as the result of any claim, provided however, the Contractor shall not be obligated to indemnify the Owner, the Owner's Representative, Construction Manager, servants and employees for their own negligence, if any. The Contractor agrees to assume, and pay on behalf of the Owner and the Owner's Representative, Construction Manager, servants and employees, the defense of any action at law or equity which may be brought against the Owner and the Owner's Representative, Construction Manager, servants and employees. The assumption of defense and liability by the Contractor includes, but is not limited to the amount of any legal fees associated with defending, all costs of investigation, expert evaluation and any other costs including any judgment or interest or penalty that may be entered against the Owner and the Owner's Representative, Construction Manager, servants and employees, in any said action.
 4. The Contractor is advised that the Work required under this Contract may impose certain obligations and requirements mandated by the U.S. Department of Labor Occupational Safety and Health Administration regulations, Title 29 CFR Part 1926.62 Lead Exposure in Construction, relative to the potential exposure to lead by its employees. The Contractor assumes entire responsibility and liability for complying fully in all respects with these regulations.
- B. The Contractor's obligations under this Article shall not be deemed waived, limited or discharged by the enumeration or procurement of any insurance for liability for damages. The Contractor shall notify its insurance carrier within twenty four (24) hours after receiving a notice of loss or damage or claim from the Owner.

The Contractor shall make a claim on its insurer specifically under the provisions of the contractual liability coverages and any other coverages afforded the Owner including those of being an additional insured where applicable.

- C. Neither Final Acceptance of the Work nor making any payment shall release the Contractor from the Contractor's obligations under this Article. The enumeration elsewhere in the Contract of particular risks assumed by the Contractor or of particular claims for which the Contractor is responsible shall not be deemed to limit the effect of the provisions of this Article or to imply that the Contractor assumes or is responsible for only risks or claims of the type enumerated; and neither the enumeration in this Article nor the enumeration elsewhere in the Contract of particular risks assumed by the Contractor or of particular claims for which the Contractor is responsible shall be deemed to limit the risks which the Contractor would assume or the claims for which the Contractor would be responsible in the absence of said enumerations.

Upon the conclusion of any action, proceeding or lawsuit, should a final binding determination of responsibility be made which allocates responsibility to the Owner, or the Owner's members, officers, employees or representatives, the Owner agrees that the obligation to indemnify and hold harmless shall not be applicable to the portion of any uninsured money judgment for which the Owner is responsible, and the Owner agrees to pay the Contractor the percentage of uninsured defense costs which the Contractor incurred based upon an apportionment of the Owner's allocated responsibility.

The Contractor agrees that any claim or costs of the Owner and/or Construction Manager arising from obligations in this Article and/or Article 15 shall be set off or deducted from payments due the Contractor.

ARTICLE 15--INSURANCE AND CONTRACT SECURITY

SECTION 15.01 – INSURANCE PROVIDED BY CONTRACTOR

- A. The Contractor shall procure and maintain all of the insurance required under this Article until all Work, including punch list items, is complete.

The Contractor shall provide insurance as follows:

1. Workers' Compensation and Employers Liability Insurance
 - a. Statutory Workers' Compensation (including occupational disease)

- b. Employers Liability (with a minimum limit of \$1,000,000) New York Statutory Endorsement
2. Commercial General Liability (CGL) with a combined single limit for Bodily Injury, Personal Injury and Property Damage of at least \$2,000,000 per occurrence & aggregate. The limit may be provided through a combination of primary and umbrella/excess liability policies.

Coverage shall provide and encompass the following:

- a. Written on an occurrence form;
 - b. Endorsement naming the following as additional insureds: The Fashion Institute of Technology, its auxiliary corporations, the State University of New York, the New York City Department of Education and the City and State of New York, the Construction Manager (if applicable) and other entities specified.
 - c. Policy or policies must be endorsed to be primary as respects the coverage afforded the Additional Insureds and such policy shall be primary to any other insurance maintained by the Owner. Any other insurance maintained by the Owner shall be excess of and shall not contribute with the Contractor's or Subcontractor's insurance, regardless of the "other insurance" clause contained in the Owner's own policy of insurance.
3. Commercial Automobile Liability and Property Damage Insurance covering all owned, leased, hired and non-owned vehicles used in connection with the Work with a combined single limit for Bodily Injury and Property Damage of at least \$1,000,000 per occurrence. The limit may be provided through a combination of primary and umbrella/excess liability policies.
4. Umbrella/excess liability insurance with limits of:
- \$5,000,000 per occurrence
 - \$5,000,000 general aggregate

- B. Before commencement of Work, the Contractor shall submit to the Owner for approval two (2) Certificates of Insurance, indicating the Project. Certificates shall provide thirty (30) days' written notice prior to the cancellation, non-renewal, or material modification of any policy. Upon request, the Contractor shall furnish the Owner and the Construction Manager with certified copies of each policy. In addition, where applicable, the Contractor shall provide copies of Certificates of Insurance to the Construction Manager.

Certificates shall be forwarded to Owner in care of: Purchasing

Sammy Li
Purchasing Deputy Director
FIT Purchasing
333 Seventh Avenue, 15th Floor
New York, NY 10001

Certificate(s) of Insurance, when submitted to the Owner, constitutes a warranty by the Contractor that the insurance coverage described is in effect for the policy term shown.

Should the Contractor engage a Subcontractor, the same conditions as are applicable to the Contractor under these insurance requirements shall apply to each Subcontractor of every tier. Proof thereof shall be supplied to the Owner at the address listed above.

- C. All insurance required to be procured and maintained must be procured from insurance companies licensed to do business in the State of New York and rated at least B+ by A.M. Best and Company, or meet such other requirements as are acceptable to the Owner.
- D. Should the Contractor fail to provide or maintain any insurance required by this Contract, the Owner may, after providing written notice to the Contractor, purchase insurance complying with the requirements of this Article and charge back such purchase to the Contractor.
- E. At any time that the coverage provisions and limits on the policies required herein do not meet the provisions and limits set forth above, the Contractor shall immediately cease Work on the Project. The Contractor shall not resume Work on the Project until authorized to do so by the Owner. Any delay or time lost as a result of the Contractor not having insurance required by this Article shall not give rise to a delay claim or any other claim against the Owner or the Client.
- F. Notwithstanding any other provision in this Article, the Owner may require the Contractor to provide, at the expense of the Owner, any other form or limit of insurance necessary to secure the interests of the Owner.
- G. The Contractor shall secure, pay for, and maintain Property Insurance necessary for protection against the loss of owned, borrowed or rented capital equipment and tools, including any tools owned by employees, and any tools or equipment, staging towers, and forms owned, borrowed or rented by the Contractor. The requirement to secure and maintain such insurance is solely for the benefit of the Contractor. Failure of the Contractor to secure such insurance or to maintain adequate levels of coverage shall not render the Additional Insureds or their

agents and employees responsible for any losses; and the Additional Insureds, their agents and employees shall have no such liability.

- H. Neither the procurement nor the maintenance of any type of insurance by the Owner, the Contractor or the Construction Manager shall in any way be construed or deemed to limit, discharge, waive or release the Contractor from any of the obligations or risks accepted by the Contractor or to be a limitation on the nature or extent of said obligations and risks.

SECTION 15.01A – OTHER INSURANCE PROVIDED BY CONTRACTOR

Railroad Protective Liability insurance: If any Work of the Contract is to be performed on or within fifty (50) feet of a railroad property or railroad right of way or will require entrance upon railroad property or right of way or will require assignment of a railroad employee, the Contractor shall provide and maintain a Railroad Protective Liability policy with the policy limits required by the owner(s) of the railroad, including the MTA. For purposes of this paragraph, a subway is a railroad. The policy form shall be ISO-RIMA or an equivalent form approved by the owner(s) of the railroad. The railroad owner(s) shall be the named insured on the policy and the definition of “physical damage to property” shall mean direct and accidental loss of or damage to all property of any named insured and all property in any named insured’s care, custody, or control. If the Contractor shall provide a Railroad Protective Liability insurance policy, the Contractor and any Subcontractor performing on or within fifty (50) feet of railroad property or railroad right of way or entering railroad property or right of way or requiring assignment of a railroad employee shall have their CGL insurance policy endorsed to delete the exclusion of coverage for Work within fifty (50) feet of railroad property.

SECTION 15.02 – GENERAL CONFORMANCE

The Contractor and Subcontractors shall not violate, or be permitted to violate, any term or condition of their insurance policies, and shall at all times satisfy the safety requirements of the Owner and of the insurance companies issuing such policies.

SECTION 15.03 – CONTRACT SECURITY

The Contractor shall furnish a surety bond in an amount at least equal to one hundred (100%) of the Contract price as security for the faithful performance of the Contract and also labor and material bond in the form set forth in the Contract in an amount at least equal to one hundred (100%) of the Contract price for the payment of all persons performing labor or providing materials in connection with the Work. The surety on said bond shall be a surety company authorized to do business in the State of New York and shall be rated at least B+ by A.M. Best and Company, or meet such other requirements as are acceptable to the Owner.

SECTION 15.04 – ADDITIONAL OR SUBSTITUTE BOND

If at any time the Owner shall become dissatisfied with any surety or sureties upon the performance bond, or the labor and material payment bond, or if for any other reason said bonds shall cease to be adequate security to the Owner, the Contractor shall, within five (5) days after notice from the Owner to do so, substitute an acceptable bond or bonds in such form and sum and signed by such other surety or sureties as may be satisfactory to the Owner. The premiums on said bond or bonds shall be paid by the Contractor. No further payments shall be deemed due nor shall be made until the new surety or sureties shall have furnished an acceptable bond or bonds to the Owner.

SECTION 15.05 – FAILURE TO COMPLY WITH PROVISIONS OF ARTICLE 15

The Contract may, at the sole option of the Owner, be declared void and of no effect if the Contractor fails to comply with the provisions of Article 15.

ARTICLE 16 -- USE OR OCCUPANCY PRIOR TO ACCEPTANCE BY OWNER

SECTION 16.01 – OCCUPANCY PRIOR TO ACCEPTANCE

NOT APPLICABLE

ARTICLE 17 -- PAYMENT

SECTION 17.01 – PROVISION FOR PAYMENT

- A. The Owner may make a partial payment to the Contractor on the basis of an approved estimate of the Work performed during each preceding business month. The Owner shall retain ten percent (10%) of the amount of each said estimate.

The Contractor shall submit a detailed Contract Payment Breakdown prior to the Contractor's first application for payment. The model contract payment breakdown included in the Contract Documents shall establish the minimum level of detail required for the Contractor's payment breakdown. It is understood and the Contractor acknowledges that this model is included as an administrative tool for

the purpose of illustrating a format and minimum level of detail required for the Contract Payment Breakdown and shall not be considered as delineating the Contractor's Scope of Work. The Owner may request further and more detailed Contract Payment Breakdown. Further, the Owner reserves the right to accept only those cost distributions which, in the Owner's opinion, are reasonable, equitably balanced and correspond to the estimated quantities in the Contract Documents.

No payment shall be made by the Owner until the Contract Payment Breakdown is approved by the Owner.

Each monthly partial payment requisition must include Affirmative Action Form AAP 7.0, Contractor's Compliance Report, properly executed, as a condition precedent to requisition payment by the Owner.

- B. In preparing estimates for partial payment, material delivered to the Site and properly stored and secured at the Site, and Material approved to be stored off-site under such conditions as the Owner shall prescribe may be taken into consideration. All costs related to the storage of materials are the sole responsibility of the Contractor.

The Owner will provide an Agreement for Materials Stored Off-Site and specific forms which the Contractor must complete and submit with any request for approval of partial payment for such material. Required information includes but is not limited to: a general description of the material; a detailed list of the materials; a pre-approved storage area; segregation and identification of the material; insurance covering full value against all risks of loss or damage, with non-cancellation provision; immediate replacement agreement in event of loss or damage; agreement to pay the expense of all inspections of the material; ownership provisions; delivery guarantee; project completion statement; bill of sale, releases, and inventory.

- C. Any partial payment made shall not be construed as a waiver of the right of the Owner to require the fulfillment of all the terms of the Contract.
- D. After the Owner has determined Substantial Completion of the Work, the Contractor shall submit to the Owner, for the Owner's approval, a detailed estimate of the value of the known remaining items of Work as set forth by the Owner and a schedule of completion for said items of Work. The Owner shall review that estimate and make the final determination.

The Owner, when all the Work is substantially complete, shall pay to the Contractor the balance due the Contractor pursuant to the Contract, less:

1. two (2) times the value of any remaining items of Work to be completed or corrected; and
2. an amount necessary to satisfy any and all claims, liens or judgments against the Contractor.

As the remaining items of Work are completed and accepted by the Owner, the

Owner shall pay the appropriate amount pursuant to the duly completed and submitted monthly requisitions.

The list of remaining Work items may be expanded to include additional items of corrective or completion Work until final acceptance as certified by the Owner's execution of "Notification of Construction Completion". Appropriate payments may be withheld to cover the value of these items pursuant to this Section.

- E. All Monthly Requisitions submitted by the Contractor shall be on AIA documents G702 and G703. The Contractor shall furnish such affidavits, vouchers and receipts as to delivery and payment for materials as required by the Owner to substantiate each and every payment requested. The Contractor and its Subcontractors will submit with all applications for payment copies of the certified payrolls and certification of payment of wage supplements in a form satisfactory to the Owner. The submission of Contractor and Subcontractor certified payrolls is required at least monthly. No progress payments will be processed without submission by the Contractor of properly executed Affidavit of Payment and Release of Liens (AIA Documents G706 and G706A).”

Section 17.02 - Acceptance of the First Payment Pursuant to Section 17.01 D. of the Contract Constitutes Release

The acceptance by the Contractor of the first payment pursuant to Section 17.01 D. shall be and shall operate as a release to the Owner of all claims by and all liability to the Contractor for all things in connection with the Work and for every act and neglect of the Owner and others relating to or arising out of the Work. No payment, final or otherwise, shall operate to release the Contractor or the Contractor's sureties from any obligations under this Contract or the performance or labor and material payment bonds.

SECTION 17.03 – RELEASE AND CONSENT OF SURETY

Notwithstanding any other provision of the Contract Documents to the contrary, the first payment pursuant to Section 17.01 D. shall not become due until the Contractor submits to the Owner a General Release and a Consent of Surety to said payment pursuant to Section 17.01 D., both in form and content acceptable to the Owner.

SECTION 17.04 - LIENS

Upon the Owner's receipt of a lien, a sum which shall be one and one-half (1 1/2) times the amount stated to be due in the notice of lien shall be deducted from the current payment due the Contractor. This sum shall be withheld until the lien is discharged.

SECTION 17.05 – WITHHOLDING OF PAYMENTS

- A. The Owner may withhold from the Contractor any part of any payment as may, in the judgment of the Owner, be necessary:
1. to assure payment of just claims of any persons supplying labor or materials for the Work;
 2. to protect the Owner from loss due to defective Work not remedied; or
 3. to protect the Owner, Construction Manager or Consultant from loss due to failure to defend, loss due to injury to persons or damage to the Work or property of other contractors, Subcontractors or others caused by the act or neglect of the Contractor or Subcontractors.
 4. to assure payment of fines and penalties which may be imposed on the Contractor pursuant to the provisions of this Contract.
- B. The Owner shall have the right to apply any such amounts so withheld, in such manner as the Owner may deem proper to satisfy said claims, fines and penalties or to secure said protection. Said application of the money shall be deemed payments for the account of the Contractor.
- C. The provisions of this Article 17 are solely for the benefit of the Owner, and any action or non-action hereunder by the Owner shall not give rise to any liability on the part of the Owner.

SECTION 17.06 – OWNER’S RIGHT TO AUDIT AND INSPECTION OF RECORDS

The Contractor shall maintain and keep, for a period of at least six (6) years after the date of final payment, all records and other data relating to the Work, including records of Subcontractors and material suppliers. The Owner or the Owner's Representative shall have the right to inspect and audit all records and other data of the Contractor, Subcontractors and material suppliers relating to the Work.

SECTION 17.07 – FALSE STATEMENTS/INFORMATION

- A. False statements, information or data submitted on or with applications for payment may result in one or more of the following actions:
1. Termination of the Contract for cause;
 2. Disapproval of future bids or contracts and sub-contracts;
 3. Withholding of final payment on the Contract; and
 4. Civil and/or criminal prosecution.

- B. These provisions are solely for the benefit of the Owner, and any action or non-action hereunder by the Owner shall not give rise to any liability on the part of the Owner.

ARTICLE 18 -- TAX EXEMPTION

SECTION 18.01 – TAX EXEMPTION

- A. The Owner is exempt from payment of Federal, State, local taxes and sales and compensating use taxes of the State of New York and of cities and counties on all materials and supplies incorporated into the completed Work. These taxes are not to be included in bids. This exception does not apply to tools, machinery, equipment or other property leased by or to the Contractor or a Subcontractor, or to supplies and materials which, even though they are consumed, are not incorporated into the completed Work, and the Contractor and Subcontractors shall be responsible for and pay any and all applicable taxes, including sales and compensating use taxes, on said leased tools, machinery, equipment or other property and upon all said unincorporated supplies and materials.
- B. The Contractor and Subcontractors shall obtain any and all necessary certificates or other documentation from the appropriate governmental agency or agencies, and use said certificates or other documentation as required by law, rule or regulation.

ARTICLE 19 -- GUARANTEE

SECTION 19.01 - GUARANTEE

The Contractor shall in all respects guarantee the Work to the Owner and be responsible for all material, equipment and workmanship of the Work. The Contractor shall forthwith repair, replace or remedy in a manner approved by the Owner, any said material, equipment, workmanship, or other part of the Work found by the Owner to be defective or otherwise faulty and not acceptable to the Owner, which defect or fault appears during the minimum period of one (1) year, or such longer period as may be prescribed by the Contract, from the date of Construction Completion or any part thereof, by the Owner. The Contractor shall also pay for any damage to the Work resulting from said defect or fault.

ARTICLE 20 -- STANDARD PROVISIONS

SECTION 20.01 – PROVISIONS REQUIRED BY LAW DEEMED INSERTED

Each and every provision of law and clause required by law to be inserted in the Contract shall be deemed to be inserted therein and the Contract shall read and shall be enforced as though so included therein.

SECTION 20.02 – COMPLIANCE WITH LAWS, RULES AND REGULATIONS

The Contractor shall comply fully with all applicable laws, rules and regulations.

SECTION 20.03 – LAW GOVERNING THE CONTRACT

The Contract shall be governed by the laws of the state of New York.

SECTION 20.04 - ASSIGNMENT

The Contractor shall not assign the Contract in whole or in part without prior written consent of the Owner. If the Contractor assigns all or part of any moneys due or to become due under the Contract, the instrument of assignment shall contain a clause substantially to the effect that the Contractor and assignee agree that the assignee's right in and to any moneys due or to become due to the Contractor shall be subject to all prior claims for services rendered or materials supplied in connection with the performance of the Work.

SECTION 20.05 – NO THIRD PARTY RIGHTS

Nothing in the Contract shall create or shall give to third parties any claim or right of action against the Owner, the Fashion Institute of Technology, the State University of New York, Board of Education of the City of New York, the City or State of New York and the Construction Manager beyond such as may legally exist irrespective of the Contract.

SECTION 20.06 – CONTRACT DEEMED EXECUTORY

The Contractor agrees that the Contract shall be deemed executory to the extent of moneys available and that no liability shall be incurred by the Owner beyond the moneys available therefore.

SECTION 20.07 – ANTI-RIOT PROVISIONS

- A. The Contractor agrees that no part of the Contract funds shall be used to make payments, give assistance, or supply services, in any form, to any individual convicted in any Federal, State or local court of competent jurisdiction for inciting, promoting, or carrying on a riot or engaging in any group activity resulting in material damage to property or injury to persons found to be in violation of Federal, State or local laws designed to protect persons or property.
- B. The Contractor and each Subcontractor shall notify their employees of all rules and

regulations adopted pursuant to Article 129-A of the Education Law of the State of New York. Notices containing the text of the aforementioned rules and regulations shall be posted by the Contractor at the Site.

SECTION 20.08 – DOMESTIC STEEL

The Contractor agrees, that if the value of this contract exceeds \$100,000 all structural steel, reinforcing steel and other major steel items to be incorporated in the Work of this Contract shall be produced and made in whole or substantial part in the United States, its territories or possessions.

SECTION 20.09 – PROTECTION OF LIVES AND HEALTH

- A. Each Contractor and Subcontractor shall comply with all applicable provisions of the laws of the State of New York, the United States of America and with all applicable rules and regulations adopted or promulgated by agencies or municipalities of the State of New York or the United States of America. The Contractor's and Subcontractor's attention is specifically called to the applicable rules and regulations, codes and bulletins of the New York State Department of Labor and to the standards imposed under the Federal Occupational Safety and Health Act of 1970, as amended.
- B. The Contractor shall maintain an accurate record of all cases of death, occupational disease, and injury requiring medical attention or causing loss of time from work, arising out of and in the course of employment of Work under the Contract, and shall immediately notify the Owner in writing of any injury which results in hospitalization or death. The Contractor shall provide to the Owner a copy of Form C-2, Employers Report of Injury/Illness within twenty- four (24) hours of any job related injury on the Owner's job site. Further, a copy of the OSHA Log of Injury and Illness shall also be provided to the Owner for any reporting period in which a job related injury or illness is recorded. The Contractor shall also provide a list of witnesses to the Owner. The list shall include at least the full name, home address, occupation and telephone number of each person who saw or has knowledge of the incident which caused the injury or illness.
- C. The Contractor alone shall be responsible for the safety, efficiency and adequacy of the Contractor's Work, plant, appliances and methods, and for any damage which may result from the failure or the improper construction, maintenance or operation of such Work, plant, appliances and methods.
- D. If, in the performance of the Work, a harmful hazard is created for which appliances or methods of elimination have been approved by regulatory authorities, the Contractor shall install, maintain and operate said appliances or methods.
- E. The Owner may impose a payment penalty on the Contractor for any act of non-compliance with this section. The payment penalty shall not exceed one twentieth

(1/20) of the Contract price or a maximum of One Thousand Dollars (\$1,000.00) for each time the Contractor fails to perform or to provide the information, reports or forms required in this section. This payment penalty is not exclusive, the Owner may avail itself of any other contractual remedy available.

- F. The Owner, Owner's Representative, or Architect may inspect the Site at any time without notice to the Contractor. If the Owner or its representatives find that the Contractor is not complying with Section 20.10 A or any other provision of Section 20.10, the Owner may send written notice to the Contractor to correct any deficiency. Upon re-inspection, if the Owner finds the deficiencies have not been corrected, or in instances where a safety violation (s) must be corrected before Work continues and the Contractor is given three (3) hours to make correction (s) and they are not made, the Owner may let a separate contract to correct any deficiencies and back charge the cost of the separate contract to the Contractor at a premium rate. The Contractor cannot pass these additional charges on to the Owner. No action taken under this section shall be deemed as a basis for any delay claim or any other claim against the Owner by the Contractor.

- G. The Contractor shall preserve and safeguard the scene of an accident involving a ladder, scaffold, mobile machinery, equipment, safety railing or uncovered floor opening or any other incident where the injured person required emergency medical treatment. The Contractor shall "tape off" the area, and not allow any material object or property to be altered, changed, moved or removed from the accident site. In addition to "taping off" the accident site, the Contractor shall telephone and send a facsimile or email to Owner immediately, and post a person at the accident site to protect it. Safeguarding and protecting the accident site shall only be abandoned by the Contractor upon release by the Owner or the Owner's Representative. Failure of the Contractor to comply with the provisions of this paragraph shall be deemed a breach of this Contract. In addition to any other contractual remedies available, the Owner may satisfy the breach by imposing the penalties set out in paragraph 20.10 E or void the entire Contract and retain any or all amounts due the Contractor under this Contract.

SECTION 20.10 – PROHIBITED INTERESTS / ETHICAL CONDUCT

- A. No officer, employee, architect, attorney, engineer, inspector or consultant of or for the Owner authorized on behalf of the Owner to exercise any legislative, executive, administrative, supervisory or other similar functions in connection with the Contract or the Work, shall become personally interested, directly or indirectly, in the Contract, material supply contract, subcontract, insurance contract, or any other contract pertaining to the Work.
- B. The Owner strongly discourages the Contractor from offering or giving anything of value to employees of the Owner under circumstances which may constitute, or even suggest, impropriety. Contractor, or its agents, shall not directly or indirectly offer or give any gift whether in the form of money, service, loan, travel, lodging, meals, refreshments, entertainment, discount, forbearance or promise, or in any other form, to an employee or any representatives of the Owner.
- C. To promote a working relationship with the Owner based on ethical business practices, the Contractor shall:
- furnish all goods, materials and services to the Owner as contractually required and specified,
 - submit complete and accurate reports to the Owner and its representatives as required,
 - not seek, solicit, demand or accept any information, verbal or written, from the Owner or its representatives that provides an unfair advantage over a competitor,
 - not engage in any activity or course of conduct that restricts open and fair competition on Owner-related projects and transactions,
 - not engage in any course of conduct with Owner employees or its representatives that constitutes a conflict of interest, in fact or in appearance, and
 - not offer or give any unlawful gifts or gratuities, or engage in bribery or other criminal activity.
- D. The Owner encourages the Contractor to advance and support ethical business conduct and practices among its directors, officers and employees, through the adoption of corporate ethics awareness training programs and written codes of conduct.
- E. Although the Contractor may employ relatives of Owner's employees, the Owner must be made aware of such circumstances as soon as possible, in writing, to ensure a conflict of interest situation does not arise. The Owner reserves the right to request that the Contractor modify the work assignment of a relative of an Owner's

employee or representative where a conflict of interest, or the appearance thereof, is deemed to exist.

- F. The Contractor may hire former employees of the Owner. However, as a general rule, former employees of the Owner may neither appear nor practice before the Owner, nor receive compensation for services rendered on a matter before the Owner, for a period of *two (2) years* following their separation from service with the Owner. In addition, former employees of the Owner are subject to a "*lifetime bar*" from appearing before the Owner or receiving compensation for services regarding any transaction in which they personally participated or which was under their active consideration during their tenure with the Owner.
- G. The Contractor agrees to notify Stephen Tuttle, Esq., the Owner's attorney, at (212) 217-4030 of any activity by an employee of the Owner that is inconsistent with the contents of this Section.
- H. Any violation of these provisions shall justify termination of this Contract and may result in Owner's rejection of the Contractor's bids or proposals for future contracts.

SECTION 20.11 – STATE AND FEDERAL LABOR LAW PROVISIONS

- A. Although the Work of this Contract is not public work, the Owner intends that all applicable provisions of the Labor Law of the State of New York shall be carried out in the performance of the Work.
- B. The Contractor specifically agrees to comply with Labor Law, Sections 220 and 220-d as amended, that:
 - 1. no laborer, workman or mechanic, in the employ of the Contractor, Subcontractor or other person doing or contracting to do the whole or any part of the Work contemplated by the Contract shall be permitted or required to work more than eight (8) hours in any one (1) calendar day and more than five (5) days in any one week, except in the extraordinary emergencies set forth in the Labor Law;
 - 2. the wages paid for a legal day's work shall be not less than the prevailing rate of wages as defined by law;
 - 3. the minimum hourly rate of wage to be paid and supplement provided shall be not less than that stated in the Contract and as shall be designated by the Industrial Commissioner of the State of New York; and
 - 4. the Contractor and every Subcontractor shall post in a prominent and accessible place on the Site, a legible statement of all minimum wage rates and supplements to be paid or provided for the various classes of laborers and mechanics to be engaged in the Work and all deductions, if any,

required by law to be made from unpaid wages actually earned by the laborers and mechanics so engaged.

- C. The minimum wage rates, if any, herein specified for apprentices shall apply only to persons working with the tools of the trade which such persons are learning under the direct supervision of journeyman mechanics. Except as otherwise required by law, the number of apprentices in each trade or occupation employed by the Contractor or any Subcontractor shall not exceed the number permitted by the applicable standards of the New York State Department of Labor, or, in the absence of such standards, the number permitted under the usual practice prevailing between the unions and the employers' association of the respective trades or occupations.
- D. All employees of the Contractor and each Subcontractor shall be paid in accordance with the provisions of the Labor Law. Certified payroll copies shall be provided to the Owner as specified in these General Conditions and otherwise upon request.
- E. The Contractor agrees that, in case of underpayment of wages to any worker engaged in the Work by the Contractor or any Subcontractor, the Owner shall withhold from the Contractor out of payments due an amount sufficient to pay such worker the difference between the wages required to be paid under the Contract and the wages actually paid such worker for the total number of hours worked, and that the Owner may disburse such amount so withheld by the Owner for and on account of the Contractor to the employee to whom such amount is due. The Contractor further agrees that the amount to be withheld pursuant to this paragraph may be in addition to the percentages to be retained by the Owner pursuant to other provisions of the Contract.
- F. Pursuant to subdivision 3 of section 220 and section 220-d of the Labor Law the Contract shall be forfeited and no sum paid for any Work done thereunder upon a Contractor's or Subcontractor's second conviction for willfully paying or providing less than:
 - 1. the stipulated wage scale or supplement as established by the fiscal officer, or
 - 2. less than the stipulated minimum hourly wage scale as designated by the Industrial Commissioner.
- G. Pursuant Labor Law, Section 220-e, the Contractor specifically agrees:
 - 1. That in the hiring of employees for the performance of Work under the Contract or any subcontract hereunder, or for the manufacture, sale or distribution of materials, equipment or supplies hereunder, but limited to operation performed within the territorial limits of the State of New York, no Contractor, Subcontractor, nor any person acting on behalf of such Contractor or Subcontractor, shall by reason of race, creed, color, disability, sex or national origin discriminate against any citizen of the State of New York who is qualified and available to perform the Work to which the employment relates;

2. That no Contractor, Subcontractor, nor any person on behalf of such Contractor or Subcontractor shall, in any manner, discriminate against or intimidate any employee hired for the performance of work under the Contract on account of race, creed, color, disability, sex or national origin;
3. That there may be deducted from the amount payable to the Contractor, by the Owner under the Contract, a penalty of fifty dollars (\$50.00) for each person for each calendar day during which such person was discriminated against or intimidated in violation of the terms of the Contract; and
4. That the Contract may be canceled or terminated by the Owner and all moneys due or to become due hereunder may be forfeited for a second or any subsequent violation of the terms or conditions of this section of the Contract, or when one final determination involves the falsification of payroll records or the kickback of wages and/or supplements.

H. The Contractor specifically agrees:

1. That the Contractor shall certify its payrolls and keep these certified records on site and available, and provide copies to the Owner upon request.
2. That the Contractor shall provide each worker with a written notice informing the worker of the prevailing wage requirements for the job. The notice shall contain a simple statement or declaration for the worker's

SECTION 20.12 - NONDISCRIMINATION

During the performance of the Work, the Contractor agrees as follows:

- A. The Contractor will not discriminate against any employee or applicant for employment because of race, religion/creed, color, sex, sexual orientation, gender, gender identity/expression, national origin, age, disability, marital status, or any other protected category.
- B. If directed to do so by the Commissioner of Human Rights, the Contractor will send to each labor union or representative of workers with which the Contractor has or is bound by a collective bargaining or other agreement or understanding, a notice, to be provided by the State Commissioner of Human Rights, advising such labor union or representative of the Contractor's agreement under clauses A through G (hereinafter called "non-discrimination clauses"). If the Contractor was directed to do so by the Owner as part of the bid or negotiation of this Contract, the Contractor shall request such labor union or representative to furnish a written statement that such labor union or representative will not discriminate because of race, creed, color, sex, national origin, age, disability or marital status, and that such labor union or representative will cooperate, within the limits of its legal and contractual authority, in the implementation of the policy and provisions of these nondiscrimination clauses and that it consents and agrees that recruitment, employment and the terms and conditions of employment under this Contract shall be in accordance with the purposes and provisions of these nondiscrimination clauses. If such labor union or representative fails or refuses to comply with such a request that it furnish such a statement, the Contractor shall promptly notify the State Commissioner of Human Rights of such failure or refusal.
- C. If directed to do so by the Commissioner of Human Rights, the Contractor shall post and keep posted in conspicuous places, available to employees and applicants for employment, notices to be provided by the State Commissioner of Human Rights setting forth the substance of the provisions of clauses A and B and such provisions of the State's laws against discrimination as the State Commissioner of Human Rights shall determine.
- D. The Contractor shall state, in all solicitations or advertisement for employees placed by or on behalf of the Contractor, that all qualified applicants will be afforded equal employment opportunities without discrimination because of race, creed, color, sex, national origin, age, disability or marital status.
- E. The Contractor shall comply with the provisions of Section 290-299 of the Executive Law and with the Civil Rights Law, will furnish all information and reports deemed necessary by the State Commissioner of Human Rights under these nondiscriminatory clauses and such sections of the Executive Law, and will permit access to the Contractor's books, records and accounts by the State Commissioner for the purposes of investigation to ascertain compliance with these nondiscrimination clauses and such sections of the Executive Law and Civil Rights Law.

- F. This Contract may be forthwith canceled, terminated or suspended, in whole or in part, by the Owner upon the basis of a finding made by the State Commissioner of Human Rights that the Contractor has not complied with these nondiscrimination clauses, and the Contractor may be declared ineligible for future contracts made by or on behalf of the State or a public authority or agency of the State, until the Contractor satisfies the State Commissioner of Human Rights that the Contractor has established and is carrying out a program in conformity with the provisions of these nondiscrimination clauses. Such finding shall be made by the State Commissioner of Human Rights after conciliation efforts by the Commissioner have failed to achieve compliance with these nondiscrimination clauses and after a verified complaint has been filed with the Commissioner, notice thereof has been given to the Contractor and an opportunity has been afforded the Contractor to be heard publicly in accordance with the Executive Law. Such sanctions may be imposed and remedies invoked independently of or in addition to sanctions and remedies otherwise provided by law.
- G. The Contractor shall include the provisions of clauses A through F above in every subcontractor purchase order in such a manner that such provisions will be binding upon each Subcontractor or vendor as to operation to be performed within the State of New York. The Contractor shall take such action in enforcing such provisions of such Subcontract or purchase order as the State Commissioner of Human Rights or the Owner may direct, including sanctions or remedies for noncompliance. If the Contractor becomes involved in or is threatened with litigation with a Subcontractor or vendor as a result of such direction by the State Commissioner of Human Rights or the Owner, the Contractor shall promptly so notify the Attorney General, requesting the Attorney General to intervene and to protect the interests of the State of New York.

SECTION 20.13 – LIMITATION ON ACTIONS

No action or proceeding shall lie in favor of or shall be maintained by the Contractor against the Owner unless such action shall be commenced within six (6) months after receipt by the Owner of the Contractor's final requisition or, if the Contract is terminated by the Owner, unless such action is commenced within six (6) months after the date of such termination.

SECTION 20.14 – WAIVER OF REMEDIES

Inasmuch as the Contractor can be compensated adequately by money damages for any breach of the Contract which may be committed by the Owner, the Contractor agrees that no default, act or omission of the Owner shall constitute a material breach of Contract entitling the Contractor to cancel or rescind the same or to suspend or abandon performance thereof; and the Contractor hereby waives any and all rights and remedies to which the Contractor might otherwise be or become entitled to because of any wrongful act or omission of the Owner saving only the Contractor's right to money damages.

SECTION 20.15 – WAIVER OF CERTAIN CAUSES OF ACTION

No action or proceeding shall lie or shall be maintained by the Contractor, nor anyone claiming under or through the Contractor, against the Owner upon any claim arising out of or based upon the Contract, relating to the giving of notices or information.

SECTION 20.16 – CONTRACTOR RELATIONSHIP

The relationship created by the Contract between the Owner and the Contractor is one of an independent contractor and it is no way to be construed as creating an agency relationship between the Owner and the Contractor nor is it to be construed as, in any way or under any circumstances, creating or appointing the Contractor as an agent of the Owner for any purpose whatsoever.

SECTION 20.17 – FAILURE TO COMPLY WITH THIS ARTICLE

The Contract shall be void and of no effect unless the Contractor complies with the provisions of this Article 20.

SECTION 20.18 – YEAR 2000 WARRANTY

SECTION DELETED

SECTION 20.19 – FALSE RECORDS/KICKBACKS

The Contractor agrees that this Contract may be canceled or terminated for cause by the Owner and all moneys due or to become due hereunder may be forfeited upon the Owner's determination that the Contractor has submitted false records to the Owner and/or that the Contractor has participated in the kickback of wages. Said determination by the Owner must first allow the Contractor an opportunity to show why its Contract should not be canceled or terminated for cause for said actions.

ARTICLE 21- COOPERATION WITH INVESTIGATIONS

The Contractor agrees to cooperate fully and faithfully with any investigation, audit or inquiry conducted by the Owner or any other duly authorized representative of the Owner ("Representative").

The Contractor shall grant the Owner or the Representative the right to examine all books, records, files, accounts, computer records, documents and correspondence, including electronically-stored information, in the possession or control of the Contractor, its subsidiaries and affiliated companies and any other company directly or indirectly controlled by the Contractor, relating to the Contract. These shall include, but not be limited to: Subcontracts; bid files; payroll and personnel records; cancelled checks; correspondence; memoranda; reports; audits; vendor qualification records; original estimate files; change order/amendment estimate files; detailed worksheets; Subcontractor, consultant and supplier proposals for both successful and unsuccessful bids; back-charge logs; any records detailing cash, trade, or volume discounts earned; insurance proceeds, rebates or dividends received; payroll and personnel records; tax returns, and the supporting documentation for the aforesaid books and records.

At the Owner's or the Representative's request, said materials shall be provided in a computer readable format, where available. At the request of the Owner or the Representative, the Contractor shall execute such documents, if any, as are necessary to give the Owner or the Representative access to Contract-related books, documents or records which are, in whole or part, under control of the Contractor but not currently in the Contractor's physical possession. The Contractor shall not enter into any agreement with a Subcontractor, consultant or supplier, in connection with the Contract, that does not contain a right to audit clause in favor of the Owner. The Contractor shall assist the Owner or the Representative in obtaining access to past and present Subcontractor, consultant and supplier amendment/change order files (including detailed documentation covering negotiated settlements), accounts, computer records, documents, correspondence, and any other books and records in the possession of Subcontractors, consultants and suppliers pertaining to the Contract, and, if appropriate, enforce the right-to-audit provisions of such agreements.

The Contractor shall assist the Owner or the Representative in obtaining access to, interviews with, and information from all former and current persons employed and/or retained by the Contractor, for purposes of the Contract.

The Contractor shall require each Subcontractor to include in all agreements that the

Subcontractor may hereinafter enter into with any and all Subcontractors, consultants and suppliers, in connection with the Contract, a right-to-audit clause in favor of the Owner conferring rights and powers of the type outlined in this section. The Contractor shall not enter into any Subcontract with a Subcontractor in connection with the Contract that does not contain such a provision.

The Contractor shall not make any payments to a Subcontractor, consultant or supplier from whom the Contractor has failed to obtain and supply to the Owner or the Representative complete, accurate and truthful information in compliance with a request from the Owner or the Representative to the Contractor.

Any violation of the provisions of this Article shall justify termination of this Contract and may result in the Owner's rejection of the Contractor's bids or proposals for future contracts.

SECTION VI.

LABOR & MATERIAL PAYMENT BOND

LABOR & MATERIAL PAYMENT BOND

KNOW ALL BY THESE PRESENTS:

That _____
(Here insert the name and address or legal title of the Contractor)

as Principal, hereinafter called Principal, and _____

(Here insert the legal title of Surety)

(Address)

as Surety, hereinafter called Surety, are held and firmly bound unto The Fashion Institute of Technology, as applicable, as Obligee, hereinafter called Owner, for the use and benefit of the claimants as hereinbelow defined, in the amount of _____

_____ and /100 Dollars (\$_____)

WHEREAS, Principal has by written agreement dated _____

entered into a Contract with Owner for _____

in accordance with the Contract Documents and any changes thereto, which are made a part hereof, and are hereinafter referred to as the Contract.

NOW, THEREFORE, THE CONDITION OF THIS OBLIGATION is such that if the Principal shall promptly make payment to all claimants as hereinafter defined, for all labor and material used or reasonably required for use in the performance of the Contract, then this obligation shall be void; otherwise such obligation shall remain in full force and effect, subject, however, to the following conditions:

1. A claimant is defined as one having a direct Contract with the Principal or with a Subcontractor of the Principal for labor, material, or both, used or reasonably required for use in the performance of the Contract, labor and material being construed to include that part of water, gas, power, light, heat, oil, gasoline, telephone service or rental of equipment directly applicable to the Contract.
2. The above named Principal and Surety hereby jointly and severally agree with the Owner that every claimant as herein defined, who has not been paid in full

before the expiration of a period of ninety (90) days after the date on which the last of such claimant's work or labor was done or performed, or materials were furnished by such claimant, may sue on this bond for the use of such claimant, prosecute the suit to final judgment for such sum or sums as may be justly due claimant, and have execution thereon. The Owner shall not be liable for the payment of any costs or expenses of any such suit.

3. No suit or action shall be commenced hereunder by any claimant:
 - a. Unless claimant, other than one having a direct contract with the Principal, shall have given written notice to any two (2) of the following: 1) the Principal, 2) the Owner, or 3) the Surety above named, within ninety (90) days after such claimant did or performed the last of the work or labor, or furnished the last of the materials for which said claim is made, stating with substantial accuracy the amount claimed and the name of the party to whom the materials were furnished, or for whom the work or labor was done or performed. Such notice shall be served by mailing the same by registered mail or certified mail, postage prepaid, in an envelope addressed to the Principal, Owner, or Surety, at any place where an office is regularly maintained by said Principal, Owner, or Surety for the transaction of business, or served in any manner in which legal process may be served in the State in which the aforesaid project is located, save that such service need not be made by a public officer.
 - b. After the expiration of one (1) year following the date on which Principal ceased work of said Contract, however, if any limitation embodied in this bond is prohibited by any law controlling the construction hereof such limitation shall be deemed to be amended so as to be equal to the minimum period of limitation permitted by such law.
 - c. Other than in a State court of competent jurisdiction in and for the county or other political subdivision of the State in which the project, or any part thereof, is situated, or in the United States District Court for the district in which the project, or any part thereof, is situated, and not elsewhere.
4. The penal sum of this Bond is in addition to any other Bond furnished by the Contractor and in no way shall be impaired or affected by any other Bond.
5. The amount of this Bond shall be reduced by and to the extent of any payment or payments made in good faith hereunder, inclusive of the payment by Surety of Mechanics' Liens which may be filed of record against said improvement, whether or not claim for the amount of such lien be presented under and against this Bond.

Signed this _____ day of _____ 20__.

IN THE PRESENCE OF:

(Principal)

(Surety)

(Signature)

(Signature)

(Print Name and Title)

(Print Name and Title)

(Address)

(Address)

(City, State, Zip)

(City, State, Zip)

Telephone (____) _____

Fax No. _____

ACKNOWLEDGEMENT OF PRINCIPAL, IF A CORPORATION

STATE OF _____) ss:

COUNTY OF _____)

On the _____ day of _____ in the year 20__, before me personally came _____ to me known, who, being by me duly sworn, did depose and say that (s)he resides at _____, that (s)he is the _____ of _____, the corporation described in and which executed the above instrument; and that (s)he signed her/his name thereto by order of the Board of Directors of said corporation.

Notary Public

ACKNOWLEDGEMENT OF PRINCIPAL, IF A PARTNERSHIP

STATE OF _____)ss:

COUNTY OF _____)

On the _____ day of _____ in the year 20__ , before me personally came

_____, to me known and known to me to be a member of the firm _____, described in and who executed the foregoing instrument, and (s)he duly acknowledged to me that (s)he executed the same for and in behalf of said firm for the uses and purpose mentioned therein.

Notary Public

ACKNOWLEDGEMENT OF PRINCIPAL, IF AN INDIVIDUAL

STATE OF _____) ss:

COUNTY OF _____)

On the _____ day of _____ in the year 20__ , before me personally came _____, to me known and known to me to be the person described in and who executed the foregoing instrument and (s)he duly acknowledged that (s)he executed the same.

Notary Public

ACKNOWLEDGEMENT OF SURETY

STATE OF NEW YORK)

COUNTY OF _____) ss:

On the _____ day of _____ in the year 20__ , before me personally came _____ to me known, who, being by me duly sworn, did depose and say that (s)he resides at _____, that (s)he is the _____ of _____, the corporation described in and which executed the above instrument; and that (s)he signed her/his name thereto by order of the Board of Directors of said corporation.

Notary Public

SECTION VII.
PERFORMANCE BOND

PERFORMANCE BOND

KNOW ALL BY THESE PRESENTS:

That _____
(Here insert the name and address or legal title of the Contractor)

as Principal, hereinafter called Principal, and _____

(Here insert the legal title of Surety)

(Address)

as Surety, hereinafter called Surety, are held and firmly bound unto The Fashion Institute of Technology, as applicable, as Obligee, hereinafter called Owner, in the amount of _____ and ____ /100 Dollars (\$ _____) for the payment whereof Contractor and Surety bind themselves, their heirs, executors, administrators, successors and assigns, jointly and severally, firmly by these presents.

WHEREAS, CONTRACTOR has by written agreement dated _____ entered into a Contract with Owner for _____

in accordance with the Contract Documents and any changes thereto, which are made a part hereof, and are hereinafter referred to as the Contract.

1. If the Contractor performs the Contract, the Surety and the Contractor shall have no obligation under this Bond, except to participate in conferences as provided in Subparagraph 2.1.
2. If there is no Owner default, the Surety's obligation under this Bond shall arise after:
 - 2.1 The Owner has notified the Contractor, the Surety at its address described in Paragraph 8. below that the Owner is considering declaring a Contractor in default.
 - 2.2 The Owner has declared a Contractor in default and formally terminated the Contractor's right to complete the Contract.

- 2.3 The Owner has agreed to pay the Balance of the Contract Price to the Surety in accordance with the terms of the Contract or to a Contractor selected to perform the Contract in accordance with the terms of the Contract with the Owner.
3. When the Owner has satisfied the conditions of Paragraph 2 herein., the Surety shall, at the Owner's option, promptly and at the Surety's expense take on the following actions:
 - 3.1 Arrange for the Contractor, with consent of the Owner, to perform and complete the Contract; or
 - 3.2 Undertake to perform and complete the Contract itself, through its agents or through independent contractors; or
 - 3.3 Obtain bids or negotiated proposals from qualified contractors acceptable to the Owner for a contract for performance and completion of the Contract, arrange for a contract to be prepared for execution by the Owner and the Contractor selected with the Owner's concurrence, to be secured with performance and payment bonds executed by a qualified Surety equivalent to the bonds issued on the Contract, and pay to the Owner the amount of damages as described in Paragraph 5. in excess of the Balance of the Contract Price incurred by the Owner resulting from the Contractor default.
4. If the Surety does not proceed with reasonable promptness, the Surety shall be deemed to be in default on this Bond, and the Owner shall be entitled to enforce any remedy available to the Owner.
5. After the Owner has terminated the Contractor's right to complete the Contract, and if the Surety elects to act under Subparagraph 3.1, 3.2, or 3.3 above, then the responsibilities of the Surety to the Owner shall not be greater than those of the Contractor under the Contract, and the responsibilities of the Owner to the Surety shall not be greater than those of the Owner under the Contract. To the limit of the amount of this Bond, but subject to commitment by the Owner of the Balance of the Contract Price to mitigation of costs and damages on the Contract, the Surety is obligated without duplication for:
 - 5.1 The responsibilities of the Contractor for correction of defective work and completion of the Contract;
 - 5.2 Additional legal, design, professional, and delay costs resulting from the Contractor's Default, and resulting from the actions or failure to act of the Surety under Paragraph 3.; and
 - 5.3 Liquidated Damages, or if no liquidated damages are specified in the Contract, actual damages caused by delayed performance or non-performance of the Contractor. 3
6. The Surety shall not be liable to the Owner or others for obligations of the Contractor that are unrelated to the Contract, and the Balance of the Contract Price shall not be reduced or set off on account of any such unrelated obligations. No right of action shall accrue on this Bond to any person or entity other than the Owner or its heirs, executors, administrators or successors.
7. The Surety hereby waives notice of any change, including changes of time, to the Contract

or to related subcontracts, purchase orders, and other obligations.

8. Notice of the Surety and the Contractor shall be mailed or delivered to the address shown on the signature page. Notice to the Owner shall be mailed or delivered to the address shown in the preamble.
9. Definitions:
 - 9.1 Balance of the Contract Price: The total amount payable by the Owner to the Contractor under the Contract after all proper adjustments have been made, including allowance to the Contractor of any amounts received or to be received by the Owner in settlement of insurance or other claims for damages to which the Contractor is entitled, reduced by all valid and proper payments made to or on behalf of the Contractor under the Contract.
 - 9.2 Contract: The agreement between the Owner and the Contractor identified on the signature page, including all Contract Documents and changes thereto.
 - 9.3 Contractor Default: Failure of the Contractor, which has neither been remedied nor waived, to perform or otherwise to comply with the terms of the Contract.
 - 9.4 Owner Default: Failure of the Owner, which has neither been remedied nor waived, to pay the Contractor as required by the Contract or to perform and complete or comply with the other terms thereof.

The penal sum of this Bond is in addition to any other Bond furnished by the Contractor and in no way shall be impaired or affected by any other Bond.

Any suit under this Bond must be instituted before the expiration of two (2) years from the date on which Final Payment is made under this Contract.

Signed this _____ day of _____ 20__.

IN THE PRESENCE OF:

(Principal)

(Surety)

(Signature)

(Signature)

(Print Name and Title)

(Print Name and Title)

(Address)

(Address)

(City, State, Zip)

(City, State, Zip)

Telephone (____) _____

Fax No. _____

ACKNOWLEDGEMENT OF PRINCIPAL, IF A CORPORATION

STATE OF _____) ss:

COUNTY OF _____)

On the _____ day of _____ in the year 20 __, before me personally came

_____ to me known, who, being by me duly sworn, did depose and say that (s)he resides at _____, that (s)he is the _____ of _____, the corporation described in and which executed the above instrument; and that (s)he signed her/his name thereto by order of the Board of Directors of said corporation.

Notary Public

ACKNOWLEDGEMENT OF PRINCIPAL, IF A PARTNERSHIP

STATE OF _____)ss:

COUNTY OF _____)

On the _____ day of _____ in the year 20 __, before me personally came

_____, to me known and known to me to be a member of the firm _____, described in and who executed the foregoing instrument, and (s)he duly acknowledged to me that (s)he executed the same for and in behalf of said firm for the uses and purpose mentioned therein.

Notary Public

ACKNOWLEDGEMENT OF PRINCIPAL, IF AN INDIVIDUAL

STATE OF _____) ss:

COUNTY OF _____)

On the _____ day of _____ in the year 20__, before me personally

came _____, to me known and known to me to be the person described in and who executed the foregoing instrument and (s)he duly acknowledged that (s)he executed the same.

Notary Public

ACKNOWLEDGEMENT OF SURETY

STATE OF NEW YORK)

COUNTY OF _____) ss:

On the _____ day of _____ in the year 20__, before me personally came

_____ to me known, who, being by me duly sworn, did depose and say that (s)he resides at _____, that (s)he is the _____ of _____, the corporation described in and which executed the above instrument; and that (s)he signed her/his name thereto by order of the Board of Directors of said corporation.

Notary Public

SECTION VIII.
FORM OF BID

FORM OF BID

(Contract for Total of All Materials and Labor)

**The Fashion Institute of Technology
(Owner)**

For:

The Fashion Institute of Technology is requesting Bids for the Work described in Section II. Bid Terms and Conditions, II. Summary of Scope of Work and as shown and described on the drawings and specifications provided with this document at the Fashion Institute of Technology's " _____ " located on 27th street campus. To be known from this point forward as the " _____ "

Pursuant to and in compliance with the Owner's advertisement for bids dated _____, 201 and the Contract Documents relating hereto, the undersigned hereby offers to provide all plant, labor, materials, supplies, equipment, and other facilities and things necessary or proper for or incidental to, the General Contracting and Electrical Work as required by, and in strict accordance with, the applicable provisions of the Contract Documents, as defined in the General Conditions, including changes thereto, and all of the addenda issued by the Owner and sent to the undersigned by facsimile transmission or delivered to the bidder prior to the date of opening of bids, whether received by the undersigned or not, for the total sum of

_____ Dollars
(\$ _____).

The Bid may be withdrawn at any time prior to the scheduled time for the opening of bids or any authorized postponement thereof.

If written notice of the acceptance of the Bid is sent to the undersigned by certified or registered mail or by facsimile transmission or delivered to the undersigned within ninety (90) days after the date of opening of the bids, or any time thereafter before the Bid is withdrawn, the undersigned shall, within eight (8) days after the date of such mailing, facsimile transmission, or delivery of such notice, execute and deliver a Contract in the Form of Contract included in the Contract Documents.

The undersigned hereby designates as the undersigned's office to which such notice of acceptance may be mailed, transmitted, or delivered as _____

SECTION IX.
NON-COLLUSIVE
BIDDING
CERTIFICATION

Non-collusive Bidding Certification

By submission of this bid, each bidder and each person signing on behalf of any bidder certifies, and, in the case of a joint bid, each party thereto certifies as to its own organization, under penalty of perjury, that to the best of its knowledge and belief:

1. The prices in the bid have been arrived at independently without collusion, consultation, communication or agreement, for the purpose of restricting competition, as to any matter relating to such prices with any other bidder or with any competitor;
2. Unless otherwise required by law, the prices which have been quoted in the bid have not been knowingly disclosed by the bidder and will not knowingly be disclosed by the bidder prior to opening, directly or indirectly, to any other bidder or to any competitor; and
3. No attempt has been made or will be made by the bidder to induce any other person, partnership, or corporation to submit or not to submit a bid for the purpose of restricting competition.

Firm Name _____

Address _____

By _____

(Signature and Title)

Dated: _____

Telephone (____) _____ Fax No. (____) _____

(Taxpayer ID or Social Security Number)

ACKNOWLEDGEMENT OF BIDDER, IF A CORPORATION

STATE OF NEW YORK)
COUNTY OF _____) ss:

On the ____ day of _____, 20__ , before me personally came _____
to me known, who, being by me duly sworn, did depose and say that (s)he resides at _____
_____, that (s)he is the _____ of _____
_____, the corporation described in and which executed the above instrument;
and that (s)he signed her/his name thereto by order of the Board of Directors of said corporation.

Notary Public

ACKNOWLEDGEMENT OF BIDDER, IF A PARTNERSHIP

STATE OF NEW YORK)
COUNTY OF _____) ss:

On the ____ day of _____, 20__, before me personally came _____
to me known and known to me to be a member of the firm _____
_____, described in and who executed the foregoing instrument, and (s)he duly
acknowledged to me that (s)he executed the same for and in behalf of said firm for the uses and
purposes mentioned therein.

Notary Public

ACKNOWLEDGEMENT OF BIDDER, IF AN INDIVIDUAL

STATE OF NEW YORK)
COUNTY OF _____) ss:

On the ____ day of _____, 20__, before me personally came _____
to me known and known to me to be the person described in and who executed the foregoing
instrument, and (s)he duly acknowledged that (s)he executed the same.

Notary Public

SECTION X:

SUBSTITUTION FORM REQUEST

FASHION INSTITUTE OF TECHNOLOGY

SUBSTITUTION REQUEST FORM

1.1 CONDITIONS OF SUBSTITUTIONS

- A. Substitution indicated on this Form is a proposed substitute to requirements indicated in the Contract Documents. Substitution listed has not been included in an Addendum. Submit one Form for each proposed substitution.
- B. For each proposed Substitution, state difference in price or "No Change" where Substitution is offered.
- C. Attach complete technical data, specifications, and description of substitutions.
- D. Architect reserves the right to accept or reject any or all proposed substitutions.

1.2 SUBSTITUTION REQUEST

The following information is hereby submitted for a substitution to the specified item.

Specification Section and Title: _____

Paragraph _____ Page _____ Specified Item _____

Proposed Substitution: _____

Manufacturer: _____ Address: _____ Phone: _____

Trade Name: _____ Model No: _____

Price Difference: _____ or No Change _____

The Undersigned certifies:

- A. Proposed substitution has been fully investigated and determined to be equal or superior in all respects to specified product.
- B. Same warranty will be furnished for proposed substitution as for specified product.
- C. Same maintenance service and source of replacement parts, as applicable is available.
- D. Proposed substitution will have no adverse effect on other trades and will not affect or delay progress schedule.
- E. Proposed substitution does not affect dimensions and functional clearances.
- F. Payment will be made for changes to the building design, including A/E design, detailing, and construction costs caused by the substitution.

Submitted by: _____

Signed by: _____

Firm: _____

Address: _____

Telephone: _____ FAX: _____

ARCHITECT'S REVIEW AND ACTION

- Substitution Approved – Make submittals in accordance with General Requirements
- Substitution Approved As Noted – Make submittals in accordance with General Requirements.
- Substitution Rejected – Use specified materials.
- Substitution Request Received Too Late. Use specified materials.

Signed by: _____

Supporting Data Attached: Drawings Product Data Samples Tests
 Reports Other _____

SECTION XI.
CONTRACT

TO BE SIGNED ONLY UPON AWARD

CONTRACT

This Agreement made as of the _____ day of _____ 20____, by and between the _____, hereinafter referred to as the "OWNER" and _____ hereinafter referred to as the "Contractor", for Work at _____

WITNESSETH: That the **OWNER** and the Contractor for the consideration named agree as follows:

1. The Contractor shall Provide and shall perform all Work of every kind or nature whatsoever required and all other things necessary to complete in a proper and workmanlike manner the _____
_____ in strict accordance with the Contract Documents as defined in the General Conditions (and of which a listing of specifications and drawings are attached hereto) and in strict accordance with such changes as are ordered and approved pursuant to the Contract, and shall perform all other obligations imposed on such Contractor by the Contract.
2. The Contractor agrees to perform all Work and labor required, necessary, proper for, or incidental to the Work, and to Furnish all supplies and materials required, necessary, proper for, or incidental to the Work for the total sum of _____ and 00/100 Dollars (\$ _____ .00), which sum shall be deemed to be in full consideration for the performance by the Contractor of all the duties and obligations of such Contractor under the Contract.
3. The Contractor shall commence Work on the Contract at a time to be specified in a written notice to proceed issued by the OWNER and complete the project no later than _____.

IN WITNESS WHEREOF, the parties hereto have executed this Contract the day and year first above written.

Fashion Institute of Technology

Sherry Brabham, VP of Finance

(Name of Contractor)

By _____
(Signature)

(Print Name and Title)

ACKNOWLEDGEMENT OF CONTRACTOR, IF A CORPORATION

STATE OF _____)
COUNTY OF _____) ss:

On the _____ day of _____ in the year 20 ____, before me personally came _____ to me known, who, being by me duly sworn, did depose and say that (s)he resides at _____, that (s)he is the _____ of _____, the corporation described in and which executed the above instrument; and that (s)he signed her/his name thereto by order of the Board of Directors of said corporation.

Notary Public

ACKNOWLEDGEMENT OF CONTRACTOR, IF A PARTNERSHIP

STATE OF _____)
COUNTY OF _____) ss:

On the _____ day of _____ in the year 20 ____, before me personally came _____ to me known and known to me to be a member of the firm _____, described in and who executed the foregoing instrument, and (s)he duly acknowledged to me that (s)he executed the same for and in behalf of said firm for the uses and purpose mentioned therein.

Notary Public

ACKNOWLEDGEMENT OF CONTRACTOR, IF AN INDIVIDUAL

STATE OF _____)
COUNTY OF _____) ss:

On the _____ day of _____ in the year 20 ____, before me personally came _____, to me known and known to me to be the person described in and who executed the foregoing instrument and (s)he duly acknowledged that (s)he executed the same.

Notary Public

SECTION XII.
AFFIRMATIVE ACTION FORM

MONTHLY CONTRACTOR'S COMPLIANCE REPORT FORM AAP 7.0

INSTRUCTION SHEET

ALL PAYMENT REQUISITION, CONTRACTOR AND PROJECT INFORMATION ON THE TOP PORTION OF THE FORM MUST BE COMOPLETELY FILLED OUT. PLEASE NOTE:

False statements, information or data submitted on or with application for payment may result in one or more of the following actions: Termination of Contract for cause; Disapproval of future bids, or contracts or subcontracts; Withholding of final payments on the contract; and Civil and/or criminal prosecution.

PART B- PAYMENTS TO SUBCONTRACTORS AND SUPPLIERS

- 1) ALL FIRMS THAT YOU ARE UTILIZING ON THE JOB MUST BE LISTED EACH TIME **REGARDLESS** IF THEY ARE SCHEDULED TO RECEIVE PAYMENTS OUT OF THE PROCEEDS OF THE REQUISITION FOR PAYMENT.
- 2) All relevant information for each subcontractor and/or supplier must be filled in. This includes firm's complete name, address, phone number and Federal ID #. In addition, if the firm is a **NYS CERTIFIED MBEIWBE**, please indicate as such in the appropriate box.

AS A REMINDER, ONLY THOSE FIRMS THAT HAVE NYS CERTIFICATION BY THE EMPIRE STATE DEVELOPMENT CORPORATION CAN BE COUNTED TOWARDS THE MBE/WBE GOAL ACHIEVEMENT FOR THE PROJECT.
- 3) The percentage of the job or purchases completed must be filled in and in addition, please indicate the number of change orders issued on any subcontract agreement or the number of purchase orders issued to date if purchasing supplies.
- 4) A description of the work being performed by a subcontractor or the type of supplies being purchased must be filled in.

DEFINITIONS

INTENDED PAYMENT: This is the amount of money that you intend to pay to each firm with the money that you will receive from the accompanying requisition. **This is not** the amount that you intend to pay over the life of the contract.

AMOUNT PAID TO DATE: This is the amount of money that has **ACTUALLY** been paid to date from previous requisitions submitted. It does not include the amount that you intend to pay from this requisition. THIS AMOUNT WILL BE VERIFIED BY OUR OFFICE PRIOR TO CLOSE OUT OF THE JOB BY THE RECEIPT OF COPIES OF CANCELED CHECKS OR PAID INVOICES.

CURRENT VALUE OF SUBCONTRACT: This is the total value to date of any subcontract agreement that has been issued to the firm by your company. It should be inclusive of any change orders issued to the original contract. **NOTE:** THIS LINE IS FOR SUBCONTRACTOR INFORMATION ONLY. IF THE FIRM LISTED IS A SUPPLIER THAT YOU ARE PURCHASING SUPPLIES OR MATERIAL FROM, LEAVE BLANK AND GO TO THE NEXT LINE.

TOTAL VALUE OF ALL PURCHASE ORDERS: This is the total amount of **all** purchase orders that will be issued to the firm for the entire job. The number of purchase orders issued to date should be reflected in the area indicated to the left. **NOTE:** THIS LINE IS FOR SUPPLIER INFORMATION ONLY. IF THE FIRM IS A SUBCONTRACTOR, LEAVE THIS AREA BLANK. A SUBCONTRACTOR AGREEMENT SHOULD BE ISSUED WHICH WOIULD BE REFLECTED ON THE PREVIOUS LINE.

The current form that you should be utilizing is form: AAP 7.0 Revised 1/9/08. This form must be included with each payment requisition submitted or the payment will not be processed.

If the form is not filled out according to the above instructions, your next payment requisition may be held until corrections are made. In addition, each report submitted must have an original signature and date.

MONTHLY CONTRACTOR'S COMPLIANCE REPORT

Payment Requisition Date _____
Payment Requisition Amount \$. _____
FIT Contract Number _____

CONTRACTOR INFORMATION

Name _____ Federal ID No. _____

Address _____

Contact Person _____ Telephone Number _____

PROJECT INFORMATION

Institution _____ City and Zip Code _____

Work Description _____

Part B - Payments to Subcontractors and Suppliers: Provide name, address and telephone number of ALL subcontractors to which you have awarded a subcontract or suppliers to which you have issued a purchase order. Place X in check box to indicate whether they are a New York State certified MBE or WBE or Other. In addition, for each firm listed below you must also include: the firms federal identification number; amount of intended payment to be made from proceeds of the accompanying requisition; percent complete, amount paid to date; the number of change orders or purchase orders; current value of subcontract (including change orders) or cumulative value of purchase orders; and a brief description of the work or service. All subcontractors or suppliers with whom you have an agreement should be listed below, even if they are not scheduled to receive a payment out of the proceeds of the attached requisition for payment. For further details, see Instruction Sheet

Firm _____ [] MBE [] WBE [] Other Fed. ID# _____

Address _____ Phone# _____ Intended Payment\$. _____

Address _____ Percent Complete _____ Amount Paid to Date\$ _____

No. of Change Orders. _____ Current Value of Subcontract \$ _____

No. of Purchase Orders Issued _____ Total Value of Purchase Orders \$ _____

Work Description _____

Firm _____ [] MBE [] WBE [] Other Fed. ID# _____

Address _____ Phone # _____ Intended Payment\$. _____

Address _____ Percent Complete _____ Amount Paid to Date\$ _____

No. of Change Orders. _____ Current Value of Subcontract \$ _____

No. of Purchase Orders Issued _____ Total Value of Purchase Orders \$ _____

Work Description _____

False statements, information or data submitted on or with application for payment may result in one or more of the following actions: Termination of Contract for cause; Disapproval of future bids, or contracts or subcontracts; Withholding of final payments on the contract; and Civil and/or criminal prosecution.

Name of Principal or Officer (Type or Print)

Title of Principal or Officer (Type or Print)

Signature of Principal or Officer

Date

SECTION XIII.
CHANGE ORDER FORM

CHANGE ORDER

TO:

Contractor: _____ Contract No. _____

Street: _____ Contract Date: _____

City, State, Zip: _____ Original Contract Amount: \$ _____

Phone No. _____ Total Approved Change Orders: _____

Current Contract Amount: \$ _____

You are hereby directed to perform all labor and to provide all materials necessary to carry out the Work described below:

Full consideration for this change order shall be on **INCREASE/DECREASE** of the original contract amount by:
_____ Dollars.

Labor = _____

Materials = _____

INCREASE/DECREASE of the original schedule by days. In accepting and executing this change order, the Contractor, its heirs, executors, administrators, successors, and assigns hereby release and forever discharge the Owner, its successors, and assigns from any and all actions, causes of action, claims and demands whatsoever in law or in equity which the Contractor ever had, now has, or may have against the Owner in any way arising out of this change.

Recommended by:
CONSTRUCTION MANAGER OR ARCHITECT

Name: _____

By: _____ Date: _____

Approved by:

Name: _____

By: _____ Date: _____

Accepted by:
CONTRACTOR

Name: _____

By: _____ Date: _____

OWNER

Name: _____

By: _____ Date: _____

SECTION XIV.
CONTRACTOR'S
TRADE PAYMENT BREAKDOWN

EXHIBIT A: SAFETY EHS PLAN

EXHIBIT A. SAFETY EHS PLAN

FASHION INSTITUTE OF TECHNOLOGY

**OUTLINE FOR PREPARING WORK-SPECIFIC
ENVIRONMENT, HEALTH AND SAFETY (EHS) PLAN**

Before commencing work on site at FIT, Contractor shall prepare a work-specific EHS Plan and submit the EHS Plan to both the Facilities Management and EHS Departments for review and approval. Such approval shall be given in a timely manner.

I) A work-specific EHS Plan is required in the following instances:

- A) When proposed work will:
 - 1) use regulated hazardous chemicals;
 - 2) have the potential to generate fumes, vapors or dusts;
 - 3) involve cutting torches or other spark-generating equipment (“hot” work);
 - 4) generate any waste;
 - 5) involve high-energy systems or
 - 6) require any type of air monitoring.
 - B) When work involves the removal of less than 25 linear feet, or 10 square feet, of asbestos-containing material (that is greater than 1% asbestos). For work involving more than these amounts of asbestos, Contractor must consult with the EHS Department for additional guidelines.
 - C) When work involves the use of tools and equipment in areas where FIT employees or students are present.
 - D) When work involves construction, other than minor repairs or alterations to on-campus facilities.
 - E) When work involves dangerous environments, such as confined spaces, hazardous energy, use scaffolds greater than 10 feet high, or vehicle-mounted articulated booms.
- II) Use the outline below to develop the work-specific EHS Plan. Contractor shall amend the work-specific EHS Plan as needed to accommodate work on-campus as it proceeds.**

DESCRIPTION OF CONTENTS OF WORK-SPECIFIC EHS PLAN

III) GENERAL INFORMATION – PROJECT PLANNING

- A) List primary information about Contractor’s firm and that of sub-

contractors, if any, Project Name, FIT Bid Number and Contractor's safety-related performance measurements on Table 1.

- B) Describe the scope of work and list a breakdown of its specific tasks.
- C) Provide a project schedule that, at a minimum, shows the anticipated start date of the work, the duration of each phase of the work, the anticipated date of completion of each phase, and the project completion date.
- D) List name of Contractor's on-site EHS Coordinator and the names of all OSHA-competent persons needed to carry out the scope of work on Table 2. The EHS Coordinator shall serve as the primary contact with FIT's Director of EHS Compliance during all work.

IV) WORK-SPECIFIC HAZARD ANALYSIS/RISK ASSESSMENT

- A) Describe each task associated with the work of the project.
- B) List the potential hazards, if any, associated with each task.
- C) Provide copies of Contractor's EH&S program applicable to scope of work.
- D) List the types of protective work practices or personal protective equipment (PPE) Contractor will employ to carry-out each task.
- E) Describe the types of exposure assessments that are needed to address potential hazardous exposures related to the work of the project. These include:
 - 1) Work practices and engineering controls Contractor will use to prevent exposure of Contractor's employees to hazardous chemicals or hazardous energy;
 - 2) Work practices and engineering controls Contractor will use to prevent exposure of FIT students and staff to any detectable chemical exposure;
 - 3) Contractor's use of respiratory protection and other protective equipment (PPE) and
 - 4) Qualitative or quantitative monitoring protocols, personal and area monitoring equipment, and contaminant action levels.
- F) Attach copies of certified documentation of "Hazard Assessment and Equipment Selection" required by 29 CFR 1910.132 (d)(2) that complies with 1910 Subpart I Appendix B for all tasks in the work-specific EHS Plan.
- G) Attach a copy of Contractor's written Hazard Communication Program that OSHA requires for the work-specific EHS Plan.

V) WORK-SPECIFIC ENVIRONMENTAL, HEALTH AND SAFETY ELEMENTS

- A) To address health and safety issues, the work-specific EHS Plan shall:
- 1) Describe criteria for upgrading or downgrading personal protective equipment (PPE) or modifying work practices to control hazardous exposures during the work;
 - 2) Describe criteria Contractor will use to set up exclusion zones, including physical barriers and decontamination zones, as needed to prevent spread of debris and restrict access of unauthorized persons to work areas;
 - 3) List equipment Contractor will use for routine and emergency on-site communication;
 - 4) Describe utility clearance and marking procedures to prevent damage to buried utilities, or to lines, piping, or cables located inside of walls and ceilings, if applicable;
 - 5) Describe decontamination and cleaning procedures for Contractor's employees and equipment to prevent the spread of debris. This includes procedures during work, at the end of each work day, and at the completion of the project before FIT's final inspection of the work area;
 - 6) Identify measures to manage dangerous environments, such as confined spaces, scaffold work greater than 10 feet, or articulated booms;
 - 7) List "Hot Work" procedures involved in the work of the project. This may include, but not be limited to, work such as welding, burning, open flames, tar melting or other type of melting pots, grinding that throws sparks. (See Appendix 1 - "Daily Safety Management Work Permit");
 - 8) Identify the need for air monitoring or special testing to carry out the work. Include a listing of monitoring equipment or special tests and the Action Levels that Contractor will apply to project work;
 - 9) Describe safety procedures for excavations more than four 4 feet deep and sloping or shoring procedures where excavations will exceed 5 feet deep;
 - 10) Describe fire protection and explosive hazard review;
 - 11) List the name and address of Contractor's on-contract Confined Space rescue team;
 - 12) Describe spill control procedures for chemical products Contractor will have on-campus during work. Include a listing of spill control or containment supplies that Contractor will have on-hand in case of a spill;
 - 13) Describe the need for site coordination with FIT employees, other contractors on-site and other adjacent work groups. This includes identification of hazardous energy Lock Out and Tag Out

requirements to make to work area safe and

- 14) Provide a listing of other safety equipment that Contractor will have on site during the work of the project.
- B) To address oil, chemical and waste management issues, the work-specific EHS Plan shall:
- 1) Provide estimates of the types and amounts of waste (both hazardous and non-hazardous) that Contractor anticipates the work will generate. As applicable, provide a copy of a waste analysis plan that lists the types of analysis required, the USEPA SW-846 method number and the method detection limits;
 - 2) Provide facility name, USEPA ID number, and a contact name for each facility that will transport and dispose of each of the waste streams identified above. Provide this information for any facility that will dispose of residuals from the treatment of project waste, as applicable;
 - 3) On a copy of a drawing that will be provided by FIT, identify location where Contractor proposes to accumulate waste during work, to set-up exclusion zones and to provide employee decontamination areas;
 - 4) Provide a statement that describes the methods that Contractor will use to minimize the amount of waste generated from the work of the project;
 - 5) Provide a tabular listing, along with copies of Safety Data Sheets (SDS), for any chemical products that Contractor intends to store or use on-site during the work. The listing shall include the product name, manufacturer's name, type, amounts, intended storage location on FIT site, the specific use of the chemical and identification of any NYCDEP/USEPA regulated hazardous substances that Contractor intends to store or use on-site during the work. In all cases, Contractor must submit the listing before chemical products are delivered to the FIT campus;
 - 6) On a copy of a drawing that will be provided by FIT, identify location where Contractor proposes to store chemical products on-site during work;
 - 7) Identify the need, if any, to amend existing FIT emergency contingency planning documents. Such documents include, but are not limited to: Spill Prevention Control and Countermeasure Plan, Spill Prevention Report, Right-to-Know Survey and
 - 8) List permits and Certificates of Fitness (NYCDEP, NYSDEC, USEPA, FDNY) needed to carry-out the scope of work and have copies on-site of permits and Certificates to carry-out project work.

VI) ON-SITE DOCUMENTATION

- A) Contractor shall record initial and daily safety-related procedures on Table 3. These shall include:

- 1) Before start of the work, FIT's Project Manager will conduct a FIT Hazard Communication briefing for Contractor's employees;
 - 2) Before start of the work, FIT's Project Manager and Contractor's on-site EHS Coordinator shall conduct a briefing for FIT employees in areas adjacent to work areas about proposed work;
 - 3) Review of FIT Emergency Evacuation Procedures;
 - 4) Listing of initial and ongoing project status meetings on-site with FIT Project Manager to address EHS concerns safety and health and
 - 5) Scheduled and unscheduled employee safety briefings, toolbox talks.
- B) Contractor shall provide a summary of the on-site EHS Coordinator's EHS-related training and experience relevant to the work of the project.
- C) Contractor's employees shall sign-in daily with FIT Security in the A-Building Lobby.
- D) For each work shift necessary to complete the project, Contractor's on-site EHS Coordinator shall open and fill out the "Daily Safety Management Work Permit" (See Appendix 1) at the start of each work shift and close the Permit at the end of each work shift.

VII) EMERGENCY RESPONSE PLANNING

Contractor shall review the summary of the Emergency Response Contact Names listed on Table 4 and provide the information as follows:

- A) On a site map that will be provided by FIT, identify the primary and secondary routes for the evacuation of Contractor's employees, including the "rally point" where Contractor's employees will assemble and carry-out an accountability check in case of an evacuation;
- B) List emergency response contacts with titles and telephone numbers. Contractor shall immediately call FIT Security and the FIT Project Manager in the event of a spill of oil, chemicals, waste water, or hazardous materials;
- C) Identify the name, address and route to nearest hospital or Contractor's wellness center and
- D) Provide a listing of emergency equipment for first aid, personal protection, spill response, fire protection and rescue.

TABLE 2

ON-SITE SUPERVISORY PERSONNEL of 2

Page 1

TITLE	: NAME(S) AND ON-SITE PHONE NUMBER
On-site EHS Coordinator	:
Contractor Project Managers	:
FIT's Project Manager(s)	:
<p><u>Contractor's Competent Persons</u></p>	<p>List all that Apply – Indicate not applicable areas for department /project work as “NA” For subcontractor employees, place subcontractor firm name in parenthesis after the employee's name</p>
<ul style="list-style-type: none"> • Confined Spaces 	:
<ul style="list-style-type: none"> • Excavations 	:
<ul style="list-style-type: none"> • Industrial Hygiene 	:
<ul style="list-style-type: none"> • Electrical--Lock Out/Tag Out 	:
<ul style="list-style-type: none"> • PPE, Respiratory Protection 	:
<ul style="list-style-type: none"> • Hazard Communication (Required for each department and project. Identify responsible employee for each subcontractor) 	:
<ul style="list-style-type: none"> • Fall Protection 	:
<ul style="list-style-type: none"> • Scaffolds 	:
<ul style="list-style-type: none"> • Cranes & Derricks 	:
<ul style="list-style-type: none"> • Blasting & Use of Explosives 	:

TABLE 2 (Cont'd)

ON-SITE SUPERVISORY PERSONNEL

Page 2 of 2

- Asbestos (Attach copies of Company license, supervisor and handler certificates for all employee that will perform work) :

- Lead

- Silica

- Hot Work (Complete and submit permits daily - see Appendix 1)

- FDNY Certificate of Fitness-Torch Operations

- FDNY Certificate of Fitness-Fire Guard

- FDNY Certificate of Fitness-Fire proofing

- FDNY Certificate of Fitness-Powder Activated Tools

- FDNY Certificate of Fitness-Air Compressors_____

- FDNY Certificate of Fitness-Use of LPG and Use in Tar Kettles

- FDNY REFRIGERATING SYSTEM OPERATING ENGINEER

- FDNY Certificate of Fitness-Other_____

- FDNY Certificate of Fitness-Other_____

-

-

TABLE 4

EMERGENCY CONTACT NAMES & TELEPHONE NUMBERS

1

TITLE	CONTACT NAME	EMERGENCY PHONE NUMBERS
Contractor: MAIN OFFICE		
Contractor President:		
On-site EHS Coordinator		
FIT Facilities Management	Executive Director: Allen King	Phone: 212-217-4424
FIT Environmental, Health and Safety Department	Director: Paul DeBiase paul_debiase@fitnyc.edu	Phone: 212-217-3752
	Coordinator: Kathy Caraballo kathy_caraballo@fitnyc.edu	Phone: 212-217-3754
Contractor Project Manager(s)		
FIT Public Safety	Central Control	212-217-7777, or Use Red Phone
Occupational Safety And Health Administration, – Area Director	Provide Zip Code for the location of Accident	800-321-6742
Location of nearest hospital and/or contractor’s wellness center		
Rally Point and Accountability Check Location	In case of Building Evacuation Alarm	

Note: Call FIT Central Control at 212-217-7777 in case or any emergency such as fire, chemical spills, injury requiring medical treatment, or exposure of contractor or FIT personnel to fumes, vapors, or dusts.

EXHIBIT B: PREVAILING WAGE SCHEDULE



Kathy Hochul, Governor

Roberta Reardon, Commissioner

Fashion Institute of Technolog
Sam Li, Director of Procurement
227 W27th Street
New York NY 10001

Schedule Year 2024 through 2025
Date Requested 12/20/2024
PRC# 2024015597

Location Fashion Institute of Technolog
Project ID# C1592
Project Type Provide labor, materials, tests, tools and equipment to complete the Goodman Lower Level Gallery new HVAC Unit Project.

PREVAILING WAGE SCHEDULE FOR ARTICLE 8 PUBLIC WORK PROJECT

Attached is the current schedule(s) of the prevailing wage rates and prevailing hourly supplements for the project referenced above. A unique Prevailing Rate Case Number (PRC#) has been assigned to the schedule(s) for your project.

The schedule is effective from July 2024 through June 2025. All updates, corrections, posted on the 1st business day of each month, and future copies of the annual determination are available on the Department's website www.labor.ny.gov. Updated PDF copies of your schedule can be accessed by entering your assigned PRC# at the proper location on the website.

It is the responsibility of the contracting agency or its agent to annex and make part, the attached schedule, to the specifications for this project, when it is advertised for bids and /or to forward said schedules to the successful bidder(s), immediately upon receipt, in order to insure the proper payment of wages.

Please refer to the "General Provisions of Laws Covering Workers on Public Work Contracts" provided with this schedule, for the specific details relating to other responsibilities of the Department of Jurisdiction.

Upon completion or cancellation of this project, enter the required information and mail **OR** fax this form to the office shown at the bottom of this notice, **OR** fill out the electronic version via the NYSDOL website.

NOTICE OF COMPLETION / CANCELLATION OF PROJECT

Date Completed: _____ Date Cancelled: _____

Name & Title of Representative: _____

Phone: (518) 457-5589 Fax: (518) 485-1870
W. Averell Harriman State Office Campus, Bldg. 12, Room 130, Albany, NY 12240

General Provisions of Laws Covering Workers on Article 8 Public Work Contracts

Introduction

The Labor Law requires public work contractors and subcontractors to pay laborers, workers, or mechanics employed in the performance of a public work contract not less than the prevailing rate of wage and supplements (fringe benefits) in the locality where the work is performed.

Responsibilities of the Department of Jurisdiction

A Department of Jurisdiction (Contracting Agency) includes a state department, agency, board or commission; a county, city, town or village; a school district, board of education or board of cooperative educational services; a sewer, water, fire, improvement and other district corporation; a public benefit corporation; and a public authority awarding a public work contract.

The Department of Jurisdiction (Contracting Agency) awarding a public work contract MUST obtain a Prevailing Rate Schedule listing the hourly rates of wages and supplements due the workers to be employed on a public work project. This schedule may be obtained by completing and forwarding a "Request for wage and Supplement Information" form (PW 39) to the Bureau of Public Work. The Prevailing Rate Schedule MUST be included in the specifications for the contract to be awarded and is deemed part of the public work contract.

Upon the awarding of the contract, the law requires that the Department of Jurisdiction (Contracting Agency) furnish the following information to the Bureau: the name and address of the contractor, the date the contract was let and the approximate dollar value of the contract. To facilitate compliance with this provision of the Labor Law, a copy of the Department's "Notice of Contract Award" form (PW 16) is provided with the original Prevailing Rate Schedule.

The Department of Jurisdiction (Contracting Agency) is required to notify the Bureau of the completion or cancellation of any public work project. The Department's PW 200 form is provided for that purpose.

Both the PW 16 and PW 200 forms are available for completion [online](#).

Hours

No laborer, worker, or mechanic in the employ of a contractor or subcontractor engaged in the performance of any public work project shall be permitted to work more than eight hours in any day or more than five days in any week, except in cases of extraordinary emergency. The contractor and the Department of Jurisdiction (Contracting Agency) may apply to the Bureau of Public Work for a dispensation permitting workers to work additional hours or days per week on a particular public work project.

Wages and Supplements

The wages and supplements to be paid and/or provided to laborers, workers, and mechanics employed on a public work project shall be not less than those listed in the current Prevailing Rate Schedule for the locality where the work is performed. If a prime contractor on a public work project has not been provided with a Prevailing Rate Schedule, the contractor must notify the Department of Jurisdiction (Contracting Agency) who in turn must request an original Prevailing Rate Schedule from the Bureau of Public Work. Requests may be submitted by: mail to NYSDOL, Bureau of Public Work, State Office Bldg. Campus, Bldg. 12, Rm. 130, Albany, NY 12226; Fax to Bureau of Public Work (518) 485-1870; or electronically at the NYSDOL website www.labor.ny.gov.

Upon receiving the original schedule, the Department of Jurisdiction (Contracting Agency) is REQUIRED to provide complete copies to all prime contractors who in turn MUST, by law, provide copies of all applicable county schedules to each subcontractor and obtain from each subcontractor, an affidavit certifying such schedules were received. If the original schedule expired, the contractor may obtain a copy of the new annual determination from the NYSDOL website www.labor.ny.gov.

The Commissioner of Labor makes an annual determination of the prevailing rates. This determination is in effect from July 1st through June 30th of the following year. The annual determination is available on the NYSDOL website www.labor.ny.gov.

Payrolls and Payroll Records

Every contractor and subcontractor MUST keep original payrolls or transcripts subscribed and affirmed as true under penalty of perjury. As per Article 6 of the Labor law, contractors and subcontractors are required to establish, maintain, and preserve for not less than six (6) years, contemporaneous, true, and accurate payroll records. At a minimum, payrolls must show the following information for each person employed on a public work project: Name, Address, Last 4 Digits of Social Security Number, Classification(s) in which the worker was employed, Hourly wage rate(s) paid, Supplements paid or provided, and Daily and weekly number of hours worked in each classification.

The filing of payrolls to the Department of Jurisdiction is a condition of payment. Every contractor and subcontractor shall submit to the Department of Jurisdiction (Contracting Agency), within thirty (30) days after issuance of its first payroll and every thirty (30) days thereafter, a transcript of the original payrolls, subscribed and affirmed as true under penalty of perjury. The Department of Jurisdiction (Contracting Agency) shall collect, review for facial validity, and maintain such payrolls.

In addition, the Commissioner of Labor may require contractors to furnish, with ten (10) days of a request, payroll records sworn to as their validity and accuracy for public work and private work. Payroll records include, but are not limited to time cards, work description sheets, proof that supplements were provided, cancelled payroll checks and payrolls. Failure to provide the requested information within the allotted ten (10) days will result in the withholding of up to 25% of the contract, not to exceed \$100,000.00. If the contractor or subcontractor does not maintain a place of business in New York State and the amount of the contract exceeds \$25,000.00, payroll records and certifications must be kept on the project worksite.

The prime contractor is responsible for any underpayments of prevailing wages or supplements by any subcontractor.

All contractors or their subcontractors shall provide to their subcontractors a copy of the Prevailing Rate Schedule specified in the public work contract as well as any subsequently issued schedules. A failure to provide these schedules by a contractor or subcontractor is a violation of Article 8, Section 220-a of the Labor Law.

All subcontractors engaged by a public work project contractor or its subcontractor, upon receipt of the original schedule and any subsequently issued schedules, shall provide to such contractor a verified statement attesting that the subcontractor has received the Prevailing Rate Schedule and will pay or provide the applicable rates of wages and supplements specified therein. (See NYS Labor Laws, Article 8 . Section 220-a).

Determination of Prevailing Wage and Supplement Rate Updates Applicable to All Counties

The wages and supplements contained in the annual determination become effective July 1st whether or not the new determination has been received by a given contractor. Care should be taken to review the rates for obvious errors. Any corrections should be brought to the Department's attention immediately. It is the responsibility of the public work contractor to use the proper rates. If there is a question on the proper classification to be used, please call the district office located nearest the project. Any errors in the annual determination will be corrected and posted to the NYS DOL website on the first business day of each month. Contractors are responsible for paying these updated rates as well, retroactive to July 1st.

When you review the schedule for a particular occupation, your attention should be directed to the dates above the column of rates. These are the dates for which a given set of rates is effective. To the extent possible, the Department posts rates in its possession that cover periods of time beyond the July 1st to June 30th time frame covered by a particular annual determination. Rates that extend beyond that instant time period are informational ONLY and may be updated in future annual determinations that actually cover the then appropriate July 1st to June 30th time period.

Withholding of Payments

When a complaint is filed with the Commissioner of Labor alleging the failure of a contractor or subcontractor to pay or provide the prevailing wages or supplements, or when the Commissioner of Labor believes that unpaid wages or supplements may be due, payments on the public work contract shall be withheld from the prime contractor in a sufficient amount to satisfy the alleged unpaid wages and supplements, including interest and civil penalty, pending a final determination.

When the Bureau of Public Work finds that a contractor or subcontractor on a public work project failed to pay or provide the requisite prevailing wages or supplements, the Bureau is authorized by Sections 220-b and 235.2 of the Labor Law to so notify the financial officer of the Department of Jurisdiction (Contracting Agency) that awarded the public work contract. Such officer MUST then withhold or cause to be withheld from any payment due the prime contractor on account of such contract the amount indicated by the Bureau as sufficient to satisfy the unpaid wages and supplements, including interest and any civil penalty that may be assessed by the Commissioner of Labor. The withholding continues until there is a final determination of the underpayment by the Commissioner of Labor or by the court in the event a legal proceeding is instituted for review of the determination of the Commissioner of Labor.

The Department of Jurisdiction (Contracting Agency) shall comply with this order of the Commissioner of Labor or of the court with respect to the release of the funds so withheld.

Summary of Notice Posting Requirements

The current Prevailing Rate Schedule must be posted in a prominent and accessible place on the site of the public work project. The prevailing wage schedule must be encased in, or constructed of, materials capable of withstanding adverse weather conditions and be titled "PREVAILING RATE OF WAGES" in letters no smaller than two (2) inches by two (2) inches.

The "[Public Work Project](#)" notice must be posted at the beginning of the performance of every public work contract, on each job site.

Every employer providing workers. compensation insurance and disability benefits must post notices of such coverage in the format prescribed by the Workers. Compensation Board in a conspicuous place on the jobsite.

Every employer subject to the NYS Human Rights Law must conspicuously post at its offices, places of employment, or employment training centers, notices furnished by the State Division of Human Rights.

Employers liable for contributions under the Unemployment Insurance Law must conspicuously post on the jobsite notices furnished by the NYS Department of Labor.

Apprentices

Employees cannot be paid apprentice rates unless they are individually registered in a program registered with the NYS Commissioner of Labor. The allowable ratio of apprentices to journeyworkers in any craft classification can be no greater than the statewide building trade ratios promulgated by the Department of Labor and included with the Prevailing Rate Schedule. An employee listed on a payroll as an apprentice who is not registered as above or is performing work outside the classification of work for which the apprentice is indentured, must be paid the prevailing journeyworker's wage rate for the classification of work the employee is actually performing.

NYSDOL Labor Law, Article 8, Section 220-3, require that only apprentices individually registered with the NYS Department of Labor may be paid apprenticeship rates on a public work project. No other Federal or State Agency of office registers apprentices in New York State.

Persons wishing to verify the apprentice registration of any person must do so in writing by mail, to the NYSDOL Office of Employability Development / Apprenticeship Training, State Office Bldg. Campus, Bldg. 12, Albany, NY 12226 or by Fax to NYSDOL Apprenticeship Training (518) 457-7154. All requests for verification must include the name and social security number of the person for whom the information is requested.

The only conclusive proof of individual apprentice registration is written verification from the NYSDOL Apprenticeship Training Albany Central office. Neither Federal nor State Apprenticeship Training offices outside of Albany can provide conclusive registration information.

It should be noted that the existence of a registered apprenticeship program is not conclusive proof that any person is registered in that program. Furthermore, the existence or possession of wallet cards, identification cards, or copies of state forms is not conclusive proof of the registration of any person as an apprentice.

Interest and Penalties

In the event that an underpayment of wages and/or supplements is found:

- Interest shall be assessed at the rate then in effect as prescribed by the Superintendent of Banks pursuant to section 14-a of the Banking Law, per annum from the date of underpayment to the date restitution is made.
- A Civil Penalty may also be assessed, not to exceed 25% of the total of wages, supplements, and interest due.

Debarment

Any contractor or subcontractor and/or its successor shall be ineligible to submit a bid on or be awarded any public work contract or subcontract with any state, municipal corporation or public body for a period of five (5) years when:

- Two (2) willful determinations have been rendered against that contractor or subcontractor and/or its successor within any consecutive six (6) year period.
- There is any willful determination that involves the falsification of payroll records or the kickback of wages or supplements.

Criminal Sanctions

Willful violations of the Prevailing Wage Law (Article 8 of the Labor Law) may be a felony punishable by fine or imprisonment of up to 15 years, or both.

Discrimination

No employee or applicant for employment may be discriminated against on account of age, race, creed, color, national origin, sex, disability or marital status.

No contractor, subcontractor nor any person acting on its behalf, shall by reason of race, creed, color, disability, sex or national origin discriminate against any citizen of the State of New York who is qualified and available to perform the work to which the employment relates (NYS Labor Law, Article 8, Section 220-e(a)).

No contractor, subcontractor, nor any person acting on its behalf, shall in any manner, discriminate against or intimidate any employee on account of race, creed, color, disability, sex, or national origin (NYS Labor Law, Article 8, Section 220-e(b)).

The Human Rights Law also prohibits discrimination in employment because of age, marital status, or religion.

There may be deducted from the amount payable to the contractor under the contract a penalty of \$50.00 for each calendar day during which such person was discriminated against or intimidated in violation of the provision of the contract (NYS Labor Law, Article 8, Section 220-e(c)).

The contract may be cancelled or terminated by the State or municipality. All monies due or to become due thereunder may be forfeited for a second or any subsequent violation of the terms or conditions of the anti-discrimination sections of the contract (NYS Labor Law, Article 8, Section 220-e(d)).

Every employer subject to the New York State Human Rights Law must conspicuously post at its offices, places of employment, or employment training centers notices furnished by the State Division of Human Rights.

Workers' Compensation

In accordance with Section 142 of the State Finance Law, the contractor shall maintain coverage during the life of the contract for the benefit of such employees as required by the provisions of the New York State Workers' Compensation Law.

A contractor who is awarded a public work contract must provide proof of workers' compensation coverage prior to being allowed to begin work.

The insurance policy must be issued by a company authorized to provide workers' compensation coverage in New York State. Proof of coverage must be on form C-105.2 (Certificate of Workers' Compensation Insurance) and must name this agency as a certificate holder.

If New York State coverage is added to an existing out-of-state policy, it can only be added to a policy from a company authorized to write workers' compensation coverage in this state. The coverage must be listed under item 3A of the information page.

The contractor must maintain proof that subcontractors doing work covered under this contract secured and maintained a workers' compensation policy for all employees working in New York State.

Every employer providing worker's compensation insurance and disability benefits must post notices of such coverage in the format prescribed by the Workers' Compensation Board in a conspicuous place on the jobsite.

Unemployment Insurance

Employers liable for contributions under the Unemployment Insurance Law must conspicuously post on the jobsite notices furnished by the New York State Department of Labor.



Kathy Hochul, Governor

Roberta Reardon, Commissioner

Fashion Institute of Technolog
Sam Li, Director of Procurement
227 W27th Street
New York NY 10001

Schedule Year 2024 through 2025
Date Requested 12/20/2024
PRC# 2024015597

Location Fashion Institute of Technolog
Project ID# C1592
Project Type Provide labor, materials, tests, tools and equipment to complete the Goodman Lower Level Gallery new HVAC Unit Project.

Notice of Contract Award

New York State Labor Law, Article 8, Section 220.3a requires that certain information regarding the awarding of public work contracts, be furnished to the Commissioner of Labor. One "Notice of Contract Award" (PW 16, which may be photocopied), **MUST** be completed for **EACH** prime contractor on the above referenced project.

Upon notifying the successful bidder(s) of this contract, enter the required information and mail **OR** fax this form to the office shown at the bottom of this notice, **OR** fill out the electronic version via the NYSDOL website.

Contractor Information

All information must be supplied

Federal Employer Identification Number: _____		
Name: _____		
Address: _____ _____		
City: _____	State: _____	Zip: _____
Amount of Contract: \$ _____	Contract Type:	
Approximate Starting Date: ____/____/____	<input type="checkbox"/> (01) General Construction	
Approximate Completion Date: ____/____/____	<input type="checkbox"/> (02) Heating/Ventilation	
	<input type="checkbox"/> (03) Electrical	
	<input type="checkbox"/> (04) Plumbing	
	<input type="checkbox"/> (05) Other : _____	

Phone: (518) 457-5589 Fax: (518) 485-1870
W. Averell Harriman State Office Campus, Bldg. 12, Room 130, Albany, NY 12226

Social Security Numbers on Certified Payrolls:

The Department of Labor is cognizant of the concerns of the potential for misuse or inadvertent disclosure of social security numbers. Identity theft is a growing problem and we are sympathetic to contractors' concern regarding inclusion of this information on payrolls if another identifier will suffice.

For these reasons, the substitution of the use of the last four digits of the social security number on certified payrolls submitted to contracting agencies on public work projects is now acceptable to the Department of Labor. This change does not affect the Department's ability to request and receive the entire social security number from employers during its public work/ prevailing wage investigations.

Construction Industry Fair Play Act: Required Posting for Labor Law Article 25-B § 861-d

Construction industry employers must post the "Construction Industry Fair Play Act" notice in a prominent and accessible place on the job site. Failure to post the notice can result in penalties of up to \$1,500 for a first offense and up to \$5,000 for a second offense. The posting is included as part of this wage schedule. Additional copies may be obtained from the NYS DOL website, <https://dol.ny.gov/public-work-and-prevailing-wage>

If you have any questions concerning the Fair Play Act, please call the State Labor Department toll-free at 1-866-435-1499 or email us at: dol.misclassified@labor.ny.gov .

Worker Notification: (Labor Law §220, paragraph a of subdivision 3-a)

Effective June 23, 2020

This provision is an addition to the existing wage rate law, Labor Law §220, paragraph a of subdivision 3-a. It requires contractors and subcontractors to provide written notice to all laborers, workers or mechanics of the *prevailing wage and supplement rate* for their particular job classification *on each pay stub**. It also requires contractors and subcontractors to *post a notice* at the beginning of the performance of every public work contract *on each job site* that includes the telephone number and address for the Department of Labor and a statement informing laborers, workers or mechanics of their right to contact the Department of Labor if he/she is not receiving the proper prevailing rate of wages and/or supplements for his/her job classification. The required notification will be provided with each wage schedule, may be downloaded from our website www.labor.ny.gov or be made available upon request by contacting the Bureau of Public Work at 518-457-5589. *In the event the required information will not fit on the pay stub, an accompanying sheet or attachment of the information will suffice.

(12.20)

**To all State Departments, Agency Heads and Public Benefit Corporations
IMPORTANT NOTICE REGARDING PUBLIC WORK ENFORCEMENT FUND**

Budget Policy & Reporting Manual

B-610

Public Work Enforcement Fund

effective date December 7, 2005

1. Purpose and Scope:

This Item describes the Public Work Enforcement Fund (the Fund, PWEF) and its relevance to State agencies and public benefit corporations engaged in construction or reconstruction contracts, maintenance and repair, and announces the recently-enacted increase to the percentage of the dollar value of such contracts that must be deposited into the Fund. This item also describes the roles of the following entities with respect to the Fund:

- New York State Department of Labor (DOL),
- The Office of the State of Comptroller (OSC), and
- State agencies and public benefit corporations.

2. Background and Statutory References:

DOL uses the Fund to enforce the State's Labor Law as it relates to contracts for construction or reconstruction, maintenance and repair, as defined in subdivision two of Section 220 of the Labor Law. State agencies and public benefit corporations participating in such contracts are required to make payments to the Fund.

Chapter 511 of the Laws of 1995 (as amended by Chapter 513 of the Laws of 1997, Chapter 655 of the Laws of 1999, Chapter 376 of the Laws of 2003 and Chapter 407 of the Laws of 2005) established the Fund.

3. Procedures and Agency Responsibilities:

The Fund is supported by transfers and deposits based on the value of contracts for construction and reconstruction, maintenance and repair, as defined in subdivision two of Section 220 of the Labor Law, into which all State agencies and public benefit corporations enter.

Chapter 407 of the Laws of 2005 increased the amount required to be provided to this fund to .10 of one-percent of the total cost of each such contract, to be calculated at the time agencies or public benefit corporations enter into a new contract or if a contract is amended. The provisions of this bill became effective August 2, 2005.

**To all State Departments, Agency Heads and Public Benefit Corporations
IMPORTANT NOTICE REGARDING PUBLIC WORK ENFORCEMENT FUND**

OSC will report to DOL on all construction-related ("D") contracts approved during the month, including contract amendments, and then DOL will bill agencies the appropriate assessment monthly. An agency may then make a determination if any of the billed contracts are exempt and so note on the bill submitted back to DOL. For any instance where an agency is unsure if a contract is or is not exempt, they can call the Bureau of Public Work at the number noted below for a determination. Payment by check or journal voucher is due to DOL within thirty days from the date of the billing. DOL will verify the amounts and forward them to OSC for processing.

For those contracts which are not approved or administered by the Comptroller, monthly reports and payments for deposit into the Public Work Enforcement Fund must be provided to the Administrative Finance Bureau at the DOL within 30 days of the end of each month or on a payment schedule mutually agreed upon with DOL.

Reports should contain the following information:

- Name and billing address of State agency or public benefit corporation;
- State agency or public benefit corporation contact and phone number;
- Name and address of contractor receiving the award;
- Contract number and effective dates;
- Contract amount and PWEF assessment charge (if contract amount has been amended, reflect increase or decrease to original contract and the adjustment in the PWEF charge); and
- Brief description of the work to be performed under each contract.

Checks and Journal Vouchers, payable to the "New York State Department of Labor" should be sent to:

Department of Labor
Administrative Finance Bureau-PWEF Unit
Building 12, Room 464
State Office Campus
Albany, NY 12226

Any questions regarding billing should be directed to NYSDOL's Administrative Finance Bureau-PWEF Unit at (518) 457-3624 and any questions regarding Public Work Contracts should be directed to the Bureau of Public Work at (518) 457-5589.

Required Notice under Article 25-B of the Labor Law

**Attention All Employees, Contractors and Subcontractors:
You are Covered by the Construction Industry Fair Play Act**

The law says that you are an employee unless:

- You are free from direction and control in performing your job, **and**
- You perform work that is not part of the usual work done by the business that hired you, **and**
- You have an independently established business.

Your employer cannot consider you to be an independent contractor unless all three of these facts apply to your work.

It is against the law for an employer to misclassify employees as independent contractors or pay employees off the books.

Employee Rights: If you are an employee, you are entitled to state and federal worker protections. These include:

- Unemployment Insurance benefits, if you are unemployed through no fault of your own, able to work, and otherwise qualified,
- Workers' compensation benefits for on-the-job injuries,
- Payment for wages earned, minimum wage, and overtime (under certain conditions),
- Prevailing wages on public work projects,
- The provisions of the National Labor Relations Act, and
- A safe work environment.

It is a violation of this law for employers to retaliate against anyone who asserts their rights under the law. Retaliation subjects an employer to civil penalties, a private lawsuit or both.

Independent Contractors: If you are an independent contractor, **you must pay all taxes and Unemployment Insurance contributions required by New York State and Federal Law.**

Penalties for paying workers off the books or improperly treating employees as independent contractors:

- **Civil Penalty** First offense: Up to \$2,500 per employee
 Subsequent offense(s): Up to \$5,000 per employee
- **Criminal Penalty** First offense: Misdemeanor - up to 30 days in jail, up to a \$25,000 fine and debarment from performing public work for up to one year.
 Subsequent offense(s): Misdemeanor - up to 60 days in jail or up to a \$50,000 fine and debarment from performing public work for up to 5 years.

If you have questions about your employment status or believe that your employer may have violated your rights and you want to file a complaint, call the Department of Labor at (866) 435-1499 or send an email to dol.misclassified@labor.ny.gov. All complaints of fraud and violations are taken seriously. You can remain anonymous.

Employer Name:

IA 999 (09/16)



Attention Employees

THIS IS A: **PUBLIC WORK PROJECT**

If you are employed on this project as a **worker, laborer, or mechanic** you are entitled to receive the **prevailing wage and supplements rate** for the classification at which you are working.

Your pay stub and wage notice received upon hire must clearly state your wage rate and supplement rate.

Chapter 629 of the Labor Laws of 2007:

These wages are set by law and must be posted at the work site. They can also be found at:
<https://dol.ny.gov/bureau-public-work>



If you feel that you have not received proper wages or benefits, please call our nearest office.*

Albany	(518) 457-2744	Patchogue	(631) 687-4882
Binghamton	(607) 721-8005	Rochester	(585) 258-4505
Buffalo	(716) 847-7159	Syracuse	(315) 428-4056
Garden City	(516) 228-3915	Utica	(315) 793-2314
New York City	(212) 932-2419	White Plains	(914) 997-9507
Newburgh	(845) 568-5287		

* For New York City government agency construction projects, please contact the Office of the NYC Comptroller at (212) 669-4443, or www.comptroller.nyc.gov – click on Bureau of Labor Law.

Contractor Name: _____

Project Location: _____

Requirements for OSHA 10 Compliance

Article 8 §220-h requires that when the advertised specifications, for every contract for public work, is \$250,000.00 or more the contract must contain a provision requiring that every worker employed in the performance of a public work contract shall be certified as having completed an OSHA 10 safety training course. The clear intent of this provision is to require that all employees of public work contractors, required to be paid prevailing rates, receive such training "prior to the performing any work on the project."

The Bureau will enforce the statute as follows:

All contractors and sub contractors must attach a copy of proof of completion of the OSHA 10 course to the first certified payroll submitted to the contracting agency and on each succeeding payroll where any new or additional employee is first listed.

Proof of completion may include but is not limited to:

- Copies of bona fide course completion card (*Note: Completion cards do not have an expiration date.*)
- Training roster, attendance record or other documentation from the certified trainer pending the issuance of the card.
- Other valid proof

**A certification by the employer attesting that all employees have completed such a course is not sufficient proof that the course has been completed.

Any questions regarding this statute may be directed to the New York State Department of Labor, Bureau of Public Work at 518-457-5589.

WICKS

Public work projects are subject to the Wicks Law requiring separate specifications and bidding for the plumbing, heating and electrical work, when the total project's threshold is \$3 million in Bronx, Kings, New York, Queens and, Richmond counties; \$1.5 million in Nassau, Suffolk and Westchester counties; and \$500,000 in all other counties.

For projects below the monetary threshold, bidders must submit a sealed list naming each subcontractor for the plumbing, HVAC and electrical and the amount to be paid to each. The list may not be changed unless the public owner finds a legitimate construction need, including a change in specifications or costs or the use of a Project Labor Agreement (PLA), and must be open to public inspection.

Allows the state and local agencies and authorities to waive the Wicks Law and use a PLA if it will provide the best work at the lowest possible price. If a PLA is used, all contractors shall participate in apprentice training programs in the trades of work it employs that have been approved by the Department of Labor (DOL) for not less than three years. They shall also have at least one graduate in the last three years and use affirmative efforts to retain minority apprentices. PLA's would be exempt from Wicks, but deemed to be public work subject to prevailing wage enforcement.

The Commissioner of Labor shall have the power to enforce separate specification requirements on projects, and may issue stop-bid orders against public owners for non-compliance.

Other new monetary thresholds, and similar sealed bidding for non-Wicks projects, would apply to certain public authorities including municipal housing authorities, NYC Construction Fund, Yonkers Educational Construction Fund, NYC Municipal Water Finance Authority, Buffalo Municipal Water Finance Authority, Westchester County Health Care Association, Nassau County Health Care Corp., Clifton-Fine Health Care Corp., Erie County Medical Center Corp., NYC Solid Waste Management Facilities, and the Dormitory Authority.

Contractors must pay subcontractors within a 7 days period.

(07.19)

Introduction to the Prevailing Rate Schedule

Information About Prevailing Rate Schedule

This information is provided to assist you in the interpretation of particular requirements for each classification of worker contained in the attached Schedule of Prevailing Rates.

Classification

It is the duty of the Commissioner of Labor to make the proper classification of workers taking into account whether the work is heavy and highway, building, sewer and water, tunnel work, or residential, and to make a determination of wages and supplements to be paid or provided. It is the responsibility of the public work contractor to use the proper rate. If there is a question on the proper classification to be used, please call the district office located nearest the project. District office locations and phone numbers are listed below.

Prevailing Wage Schedules are issued separately for "General Construction Projects" and "Residential Construction Projects" on a county-by-county basis.

General Construction Rates apply to projects such as: Buildings, Heavy & Highway, and Tunnel and Water & Sewer rates.

Residential Construction Rates generally apply to construction, reconstruction, repair, alteration, or demolition of one family, two family, row housing, or rental type units intended for residential use.

Some rates listed in the Residential Construction Rate Schedule have a very limited applicability listed along with the rate. Rates for occupations or locations not shown on the residential schedule must be obtained from the General Construction Rate Schedule. Please contact the local Bureau of Public Work office before using Residential Rate Schedules, to ensure that the project meets the required criteria.

Payrolls and Payroll Records

Contractors and subcontractors are required to establish, maintain, and preserve for not less than six (6) years, contemporaneous, true, and accurate payroll records.

Every contractor and subcontractor shall submit to the Department of Jurisdiction (Contracting Agency), within thirty (30) days after issuance of its first payroll and every thirty (30) days thereafter, a transcript of the original payrolls, subscribed and affirmed as true under penalty of perjury.

Paid Holidays

Paid Holidays are days for which an eligible employee receives a regular day's pay, but is not required to perform work. If an employee works on a day listed as a paid holiday, this remuneration is in addition to payment of the required prevailing rate for the work actually performed.

Overtime

At a minimum, all work performed on a public work project in excess of eight hours in any one day or more than five days in any workweek is overtime. However, the specific overtime requirements for each trade or occupation on a public work project may differ. Specific overtime requirements for each trade or occupation are contained in the prevailing rate schedules.

Overtime holiday pay is the premium pay that is required for work performed on specified holidays. It is only required where the employee actually performs work on such holidays.

The applicable holidays are listed under HOLIDAYS: OVERTIME. The required rate of pay for these covered holidays can be found in the OVERTIME PAY section listings for each classification.

Supplemental Benefits

Particular attention should be given to the supplemental benefit requirements. Although in most cases the payment or provision of supplements is straight time for all hours worked, some classifications require the payment or provision of supplements, or a portion of the supplements, to be paid or provided at a premium rate for premium hours worked. Supplements may also be required to be paid or provided on paid holidays, regardless of whether the day is worked. The Overtime Codes and Notes listed on the particular wage classification will indicate these conditions as required.

Effective Dates

When you review the schedule for a particular occupation, your attention should be directed to the dates above the column of rates. These are the dates for which a given set of rates is effective. The rate listed is valid until the next effective rate change or until the new annual determination which takes effect on July 1 of each year. All contractors and subcontractors are required to pay the current prevailing rates of wages and supplements. If you have any questions please contact the Bureau of Public Work or visit the New York State Department of Labor website (www.labor.ny.gov) for current wage rate information.

Apprentice Training Ratios

The following are the allowable ratios of registered Apprentices to Journey-workers.

For example, the ratio 1:1,1:3 indicates the allowable initial ratio is one Apprentice to one Journeyworker. The Journeyworker must be in place on the project before an Apprentice is allowed. Then three additional Journeyworkers are needed before a second Apprentice is allowed. The last ratio repeats indefinitely. Therefore, three more Journeyworkers must be present before a third Apprentice can be hired, and so on.

Please call Apprentice Training Central Office at (518) 457-6820 if you have any questions.

Title (Trade)	Ratio
Boilermaker (Construction)	1:1,1:4
Boilermaker (Shop)	1:1,1:3
Carpenter (Bldg.,H&H, Pile Driver/Dockbuilder)	1:1,1:4
Carpenter (Residential)	1:1,1:3
Electrical (Outside) Lineman	1:1,1:2
Electrician (Inside)	1:1,1:3
Elevator/Escalator Construction & Modernizer	1:1,1:2
Glazier	1:1,1:3
Insulation & Asbestos Worker	1:1,1:3
Iron Worker	1:1,1:4
Laborer	1:1,1:3
Mason	1:1,1:4
Millwright	1:1,1:4
Op Engineer	1:1,1:5
Painter	1:1,1:3
Plumber & Steamfitter	1:1,1:3
Roofer	1:1,1:2
Sheet Metal Worker	1:1,1:3
Sprinkler Fitter	1:1,1:2

If you have any questions concerning the attached schedule or would like additional information, please contact the nearest BUREAU of PUBLIC WORK District Office or write to:

New York State Department of Labor
Bureau of Public Work
State Office Campus, Bldg. 12
Albany, NY 12226

District Office Locations:	Telephone #	FAX #
Bureau of Public Work - Albany	518-457-2744	518-485-0240
Bureau of Public Work - Binghamton	607-721-8005	607-721-8004
Bureau of Public Work - Buffalo	716-847-7159	716-847-7650
Bureau of Public Work - Garden City	516-228-3915	516-794-3518
Bureau of Public Work - Newburgh	845-568-5287	845-568-5332
Bureau of Public Work - New York City	212-932-2419	212-775-3579
Bureau of Public Work - Patchogue	631-687-4882	631-687-4902
Bureau of Public Work - Rochester	585-258-4505	585-258-4708
Bureau of Public Work - Syracuse	315-428-4056	315-428-4671
Bureau of Public Work - Utica	315-793-2314	315-793-2514
Bureau of Public Work - White Plains	914-997-9507	914-997-9523
Bureau of Public Work - Central Office	518-457-5589	518-485-1870

New York County General Construction

Asbestos Worker **12/01/2024**

JOB DESCRIPTION Asbestos Worker **DISTRICT 4**

ENTIRE COUNTIES
 Bronx, Kings, Nassau, New York, Queens, Richmond, Suffolk

WAGES
 Per Hour: 07/01/2024

Asbestos Worker \$ 47.25
 Removal & Abatement Only*

NOTE: *On Mechanical Systems that are NOT to be SCRAPPED.

SUPPLEMENTAL BENEFITS
 Per Hour:

Asbestos Worker \$ 13.65
 Removal & Abatement Only

OVERTIME PAY
 See (B, B2, *E, J) on OVERTIME PAGE
 *Hours worked on Saturdays are paid at time and one half only if forty hours have been worked during the week.

HOLIDAY
 Paid: See (1) on HOLIDAY PAGE
 Overtime: See (5, 6, 8) on HOLIDAY PAGE

REGISTERED APPRENTICES
 Apprentice Removal & Abatement Only:
 1000 hour terms at the following percentage of Journeyman's rates.

1st	2nd	3rd	4th
78%	80%	83%	89%

SUPPLEMENTAL BENEFIT
 Per Hour:

Apprentice Removal & Abatement \$ 13.65

4-12a - Removal Only

Boilermaker **12/01/2024**

JOB DESCRIPTION Boilermaker **DISTRICT 4**

ENTIRE COUNTIES
 Bronx, Dutchess, Kings, Nassau, New York, Orange, Putnam, Queens, Richmond, Rockland, Suffolk, Sullivan, Ulster, Westchester

WAGES
 Per Hour: 07/01/2024 01/01/2025

Boilermaker \$ 67.38 \$ 68.88

Repairs & Renovations 67.38 68.88

Repairs & Renovation: Includes Repairing, Renovating replacement of parts to an existing unit(s).

SUPPLEMENTAL BENEFITS
 Per Hour:

Boilermaker	33.5% of hourly	33.5% of Hourly
Repair & Renovations	Wage Paid	Wage Paid
	+ \$ 26.85	+ \$26.85

NOTE: "Hourly Wage Paid" shall include any and all premium(s) pay.

Repairs & Renovation Includes replacement of parts and repairs & renovation of existing unit.

OVERTIME PAY
 See (*B, O, **U) on OVERTIME PAGE
 Note:* Includes 9th & 10th hours, double for 11th or more.
 ** Labor Day ONLY, if worked.

Repairs & Renovation see (B,E,Q) on OT Page

HOLIDAY

Paid: See (1) on HOLIDAY PAGE
 Overtime: See (5, 6, 11, 12, 15, 25, 26, 29) on HOLIDAY PAGE

REGISTERED APPRENTICES

Wage per hour:
 (1/2) Year Terms at the following percentage of Boilermaker's Wage

1st	2nd	3rd	4th	5th	6th	7th
65%	70%	75%	80%	85%	90%	95%

Supplemental Benefits Per Hour:

	33.5% of Hourly Wage Paid Plus Amount Below	33.5% of Hourly Wage Paid Plus Amount Below
1st Term	\$ 20.36	\$ 20.36
2nd Term	21.28	21.28
3rd Term	22.22	22.22
4th Term	23.12	23.12
5th Term	24.07	24.07
6th Term	25.00	25.00
7th Term	25.93	25.93

NOTE: "Hourly Wage Paid" shall include any and all premium(s)

4-5

Broadband **12/01/2024**

JOB DESCRIPTION Broadband **DISTRICT 4**

ENTIRE COUNTIES
 Bronx, Kings, Nassau, New York, Queens, Richmond, Suffolk

WAGES

Per Hour:	07/01/2024	06/29/2025
Field Tech	\$ 52.40	\$ 53.97
Install/Repair		

For outside work (excluding installation on building construction/alteration/renovation projects), stopping at first point of attachment (demarcation), installing/maintaining/repairing broadband internet service.

SUPPLEMENTAL BENEFITS

Per Hour: \$ 23.24

OVERTIME PAY

See (B, K, *R) on OVERTIME PAGE
 Note: *Two and one half times the hourly rate after the 8th hour

HOLIDAY

Paid: See (5, 6, 7, 11, 12) on HOLIDAY PAGE

4-CWA-Dist1

Carpenter **12/01/2024**

JOB DESCRIPTION Carpenter **DISTRICT 8**

ENTIRE COUNTIES
 Bronx, Kings, Nassau, New York, Putnam, Queens, Richmond, Rockland, Suffolk, Westchester

WAGES

Per hour:	07/01/2024
Piledriver	\$ 60.59 + 10.00*
Dockbuilder	\$ 60.59 + 10.00*

*This portion of the benefit is NOT subject to the SAME PREMIUM as shown for overtime.

SUPPLEMENTAL BENEFITS

Per hour:

Journeyworker \$ 45.79

OVERTIME PAY

See (B, E2, O) on OVERTIME PAGE

HOLIDAY

Paid: See (1) on HOLIDAY PAGE.

Paid: for 1st & 2nd yr.

Apprentices See (5,6,11,13,25)

Overtime: See (5,6,11,13,25) on HOLIDAY PAGE.

REGISTERED APPRENTICES

Wages per hour

(1)year terms:

	1st	2nd	3rd	4th
	\$26.98	\$32.58	\$40.96	\$49.35
	+ 5.50*	+ 5.50*	+ 5.50*	+ 5.50*

*This portion of the benefit is NOT subject to the SAME PREMIUM as shown for overtime.

Supplemental benefits per hour:

All Terms: \$ 32.34

8-1556 Db

Carpenter

12/01/2024

JOB DESCRIPTION Carpenter

DISTRICT 8

ENTIRE COUNTIES

Bronx, Kings, Nassau, New York, Queens, Richmond, Rockland, Suffolk, Westchester

WAGES

Per hour: 07/01/2024

Carpet/Resilient

Floor Coverer \$ 55.05
+ 8.25*

*This portion of the benefit is NOT subject to the SAME PREMIUM as shown for overtime.

INCLUDES HANDLING & INSTALLATION OF ARTIFICIAL TURF AND SIMILAR TURF INDOORS/OUTDOORS.

SUPPLEMENTAL BENEFITS

Per hour:

\$ 39.45

OVERTIME PAY

See (B, E, Q) on OVERTIME PAGE

HOLIDAY

Paid: See (18, 19) on HOLIDAY PAGE.

Paid for 1st & 2nd yr.

Apprentices See (5,6,11,13,16,18,19,25)

Overtime: See (5,6,11,13,16,18,19,25) on HOLIDAY PAGE.

REGISTERED APPRENTICES

Wage per hour - (1) year terms:

	1st	2nd	3rd	4th
	\$ 25.20	\$ 28.20	\$ 32.45	\$ 40.33
	+ 1.85*	+ 2.35*	+ 2.85*	+ 3.85*

*This portion of the benefit is NOT subject to the SAME PREMIUM as shown for overtime.

Supplemental benefits per hour:

1st	2nd	3rd	4th
\$ 15.22	\$ 16.22	\$ 19.32	\$ 20.32

8-2287

Carpenter **12/01/2024**

JOB DESCRIPTION Carpenter **DISTRICT 8**

ENTIRE COUNTIES
 Bronx, Dutchess, Kings, Nassau, New York, Orange, Putnam, Queens, Richmond, Rockland, Suffolk, Westchester

WAGES

Per Hour: 07/01/2024

Marine Construction:

Marine Diver \$ 75.46
 + 10.00*

Marine Tender \$ 55.00
 + 10.00*

*This portion of the benefit is NOT subject to the SAME PREMIUM as shown for overtime

SUPPLEMENTAL BENEFITS

Per Hour:

Journeyworker \$ 45.65

OVERTIME PAY

See (B, E, E2, Q) on OVERTIME PAGE

HOLIDAY

Paid: See (18, 19) on HOLIDAY PAGE

Overtime: See (5, 6, 11, 13, 16, 18, 19, 25) on HOLIDAY PAGE

REGISTERED APPRENTICES

Wages per hour:

One (1) year terms.

1st year	\$ 26.98 + 5.50*
2nd year	32.58 + 5.50*
3rd year	40.96 + 5.50*
4th year	49.35 + 5.50*

*This portion of the benefit is NOT subject to the SAME PREMIUM as shown for overtime.

Supplemental Benefits

Per Hour:

All terms \$ 32.20

8-1456MC

Carpenter **12/01/2024**

JOB DESCRIPTION Carpenter **DISTRICT 8**

ENTIRE COUNTIES
 Bronx, Kings, Nassau, New York, Putnam, Queens, Richmond, Rockland, Suffolk, Westchester

WAGES

Per hour: 07/01/2024

Building
 Millwright \$ 59.35
 + 13.12*

*This portion of the benefit is NOT subject to the SAME PREMIUM as shown for overtime.

SUPPLEMENTAL BENEFITS

Per hour:

Millwright \$ 45.41

OVERTIME PAY

See (B, E, Q) on OVERTIME PAGE

HOLIDAY

Paid: See (18, 19) on HOLIDAY PAGE

Paid: See (18,19) on HOLIDAY PAGE.

Overtime See (5,6,8,11,13,18,19,25) on HOLIDAY PAGE.

REGISTERED APPRENTICES

Wages per hour:

One (1) year terms:

1st.	2nd.	3rd.	4th.
\$ 32.16	\$ 37.61	\$ 43.06	\$ 53.96
+ 7.08*	+ 8.25*	+ 9.42*	+ 11.76*

*This portion of the benefit is NOT subject to the SAME PREMIUM as shown for overtime.

Supplemental benefits per hour:

One (1) year terms:

1st.	2nd.	3rd.	4th.
\$ 30.56	\$ 33.09	\$ 36.27	\$ 40.69

8-740.1

Carpenter

12/01/2024

JOB DESCRIPTION Carpenter

DISTRICT 8

ENTIRE COUNTIES

Bronx, Kings, Nassau, New York, Queens, Richmond, Suffolk, Westchester

WAGES

Per Hour:

07/01/2024

Timberman \$ 55.59
 + 10.26*

*This portion of the benefit is NOT subject to the SAME PREMIUM as shown for overtime.

SUPPLEMENTAL BENEFITS

Per Hour:

07/01/2024

\$ 44.96

OVERTIME PAY

See (B, E, E2, Q) on OVERTIME PAGE

HOLIDAY

Overtime: See (5, 6, 11, 13, 25) on HOLIDAY PAGE

Paid: See (1) on HOLIDAY PAGE.

Paid: for 1st & 2nd yr.

Apprentices See (5,6,11,13,25)

Overtime: See (5,6,11,13,25) on HOLIDAY PAGE.

REGISTERED APPRENTICES

Wages per hour:

One (1) year terms:

1st	2nd	3rd	4th
\$24.96	\$30.07	\$37.72	\$45.38
+ 5.55*	+ 5.55*	+ 5.55*	+ 5.55*

*This portion of the benefit is NOT subject to the SAME PREMIUM as shown for overtime.

Supplemental benefits per hour:

All terms \$ 31.95

Carpenter **12/01/2024**

JOB DESCRIPTION Carpenter **DISTRICT 8**

ENTIRE COUNTIES

Bronx, Kings, Nassau, New York, Queens, Richmond, Rockland, Westchester

PARTIAL COUNTIES

Orange: South of but including the following, Waterloo Mills, Slate Hill, New Hampton, Goshen, Blooming Grove, Mountainville, east to the Hudson River.

Putnam: South of but including the following, Cold Spring, TompkinsCorner, Mahopac, Croton Falls, east to Connecticut border.

Suffolk: West of Port Jefferson and Patchogue Road to Route 112 to the Atlantic Ocean.

WAGES

Per hour: 07/01/2024

Core Drilling:

Driller \$ 46.25
+ 3.25*

Driller Helper \$ 36.28
+ 3.25*

Note: Hazardous Waste Pay Differential:

For Level C, an additional 15% above wage rate per hour

For Level B, an additional 15% above wage rate per hour

For Level A, an additional 15% above wage rate per hour

Note: When required to work on water: an additional \$ 3.00 per hour.

*This portion of the benefit is NOT subject to the SAME PREMIUM as shown for overtime.

SUPPLEMENTAL BENEFITS

Per hour:

Driller and Helper \$ 30.24

OVERTIME PAY

See (B, G, P) on OVERTIME PAGE

HOLIDAY

Paid: See (5, 6) on HOLIDAY PAGE

Overtime: See (5, 6) on HOLIDAY PAGE

8-1536-CoreDriller

Carpenter **12/01/2024**

JOB DESCRIPTION Carpenter **DISTRICT 8**

ENTIRE COUNTIES

Bronx, Kings, New York, Putnam, Queens, Richmond

PARTIAL COUNTIES

Nassau: The portion of the county that lies west of Seaford Creek and south of the Southern State Parkway.

WAGES

Per hour: 07/01/2024

Show Exhibit \$ 55.75
+ 9.80**

Bldg. Carpenter* \$57.05
+ 8.39**

* Not applicable in Putnam County

**This portion of the benefit is NOT subject to the SAME PREMIUM as shown for overtime.

SUPPLEMENTAL BENEFITS

Per hour worked:

Show Exhibit \$ 45.20
Bldg. Carpenter 39.75

OVERTIME PAY

See (B, E, Q) on OVERTIME PAGE

HOLIDAY

Paid: See (18, 19) on HOLIDAY PAGE

Paid: for 1st & 2nd yr.

Apprentices See (5,6,11,13,16,18,19,25)

Overtime: See (5,6,11,13,16,18,19,25) on HOLIDAY PAGE.

REGISTERED APPRENTICES

Wages per hour: Show Exhibit

(1) year terms:

1st.	2nd.	3rd.	4th.
\$22.30	\$27.88	\$36.24	\$44.60
+ 4.90*	+ 4.90*	+ 4.90*	+ 4.90*

*This portion is not subject to overtime premiums

Supplemental benefits per hour:

All terms \$ 30.25

Wages per hour: Bldg. Carpenter

(1) year terms:

1st	2nd	3rd	4th
\$ 22.20	\$ 25.20	\$ 29.45	\$ 37.33
+ 2.14*	+ 2.59*	+ 3.09*	+ 4.09*

*This portion of the benefit is NOT subject to the SAME PREMIUM as shown for overtime.

Supplemental benefits per hour:

1st	2nd	3rd	4th
\$ 15.37	\$ 16.42	\$ 19.52	\$ 20.52

8-EXHIB

Carpenter - Heavy&Highway

12/01/2024

JOB DESCRIPTION Carpenter - Heavy&Highway

DISTRICT 8

ENTIRE COUNTIES

Bronx, Kings, New York, Queens, Richmond

PARTIAL COUNTIES

Nassau: That portion of the county that lies West of Seaford Creek and South of the Southern State Parkway.

WAGES

Per hour:

07/01/2024

Heavy & Highway

Carpenter

\$ 60.59
 + 10.00*

*This portion of the benefit is NOT subject to the SAME PREMIUM as shown for overtime.

SUPPLEMENTAL BENEFITS

Per hour worked:

Heavy & Highway

Carpenter

\$ 45.70

OVERTIME PAY

See (B, E2, Q) on OVERTIME PAGE

HOLIDAY

Paid: See (1) on HOLIDAY PAGE

Overtime: See (5, 6, 11, 13, 25) on HOLIDAY PAGE

Paid : for 1st & 2nd yr

Apprentices See (5, 6, 11, 13, 25)

REGISTERED APPRENTICES

Wage per hour:

One (1) year terms:

	1st	2nd	3rd	4th
Heavy & Highway	\$ 26.98	\$ 32.58	\$ 40.96	\$ 49.35

+ 5.50* + 5.50* + 5.50* + 5.50*

*This portion of the benefit is NOT subject to the SAME PREMIUM as shown for overtime.

Supplemental Benefits:
 Per Hour:

All terms
 \$ 32.25

8-NYC H/H

Electrician **12/01/2024**

JOB DESCRIPTION Electrician **DISTRICT 9**

ENTIRE COUNTIES
 Bronx, Kings, New York, Queens, Richmond

WAGES
 Per hour: 07/01/2024

Tree Trimmer \$ 35.24
 Ground Person 20.69

Applies to line clearance, tree work, and right-of-way preparation on all new or existing overhead, electrical, telephone, and CATV lines.

SUPPLEMENTAL BENEFITS
 Per hour:

Tree Trimmer \$ 13.20
 Ground Person 7.75

OVERTIME PAY
 See (B, *H, Q) on OVERTIME PAGE

*Worked performed on Sundays & Holidays outside of 7.00am - 4.00pm shall be paid at double time, in addition to the holiday pay if applicable.

HOLIDAY
 Paid: See (5, 6, 10, 11, 15, 16, 26) on HOLIDAY PAGE
 Overtime: See (5, 6, 10, 11, 15, 16, 26) on HOLIDAY PAGE
 (An additional floating holiday after four years service)

9-3T

Electrician **12/01/2024**

JOB DESCRIPTION Electrician **DISTRICT 9**

ENTIRE COUNTIES
 Bronx, Kings, New York, Queens, Richmond

WAGES
 Per hour: 07/01/2024

Electrician \$ 32.00
 Telephone 32.00

Maintenance and Jobbing-Electrical and teledata work of limited duration and scope, consisting of repairs and/or replacement of electrical and teledata equipment.

- Includes all work necessary to retrofit, service, maintain and repair all kinds of lighting fixtures and local lighting controls and washing and cleaning of foregoing fixtures.

SUPPLEMENTAL BENEFITS
 Journeyworker:

07/01/2024
 \$ 27.20
 29.23*

* Applies to overtime hours

OVERTIME PAY
 See (B, H) on OVERTIME PAGE

HOLIDAY
 Paid: See (1) on HOLIDAY PAGE

Overtime: See (5, 6, 11, 15, 16, 25, 26) on HOLIDAY PAGE

9-3m

Electrician

12/01/2024

JOB DESCRIPTION Electrician

DISTRICT 9

ENTIRE COUNTIES

Bronx, Kings, New York, Queens, Richmond, Westchester

WAGES

Per hour: 07/01/2024

Service Technician \$ 37.40

Service and Maintenance on Alarm and Security Systems.

Maintenance, repair and /or replacement of defective (or damaged) equipment on, but not limited to, Burglar - Fire - Security - CCTV - Card Access - Life Safety Systems and associated devices. (Whether by service contract of T&M by customer request.)

SUPPLEMENTAL BENEFITS

Per hour:

Journeyworker: \$ 21.85

OVERTIME PAY

See (B, E, Q) on OVERTIME PAGE

HOLIDAY

Paid: See (5, 6, 11, 15, 16, 17, 25, 26) on HOLIDAY PAGE

Overtime: See (5, 6, 11, 15, 16, 17, 25, 26) on HOLIDAY PAGE

9-3H

Electrician

12/01/2024

JOB DESCRIPTION Electrician

DISTRICT 9

ENTIRE COUNTIES

Bronx, Kings, New York, Queens, Richmond

WAGES

Per Hour: 07/01/2024

Electrician
Audio/Sound and
Temporary Light/
Power \$ 62.00

Solar-Photovoltaic Systems

Group 1 62.00

All tasks not listed in Group 2

Group 2 32.00

D.C portion and associated mechanical equipment related to solar systems,
(excluding battery storage and its associated equipment) including work related to
Weather Stations and Data Acquisitions/Monitoring Systems on solar photovoltaic systems.

Mounting of PV modules.

Mounting of DC optimizers to back of modules if the installation calls for this equipment.

Mounting of microinverters to back of modules and install trunk cabling on racking if called for.

Module to module connection of PV modules to adjacent modules. If racking manufacturer provides integrated inter-row cable management, install string jumper to complete the string in full in same sub-array.

If racking manufacturer does not provide integrated inter-row cable management, run conduit between rows, bond it and run string jumper to complete string in full in same sub-array.

Installation of weather stations and other weather station relevant sensors as specified.

Installation of data acquisition system (DAS) for PV system monitoring.

SHIFT WORK

Evening (Swing Shift):

Electrician

Audio/Sound and
 Temporary Light/
 Power \$ 72.75

Night (Graveyard Shift):
 Electrician
 Audio/Sound and
 Temporary Light \$ 81.49

SUPPLEMENTAL BENEFITS

Per Hour:

Electrician \$ 66.09
 70.01*

Swing Shift: 75.07
 79.66*

Graveyard Shift: 82.66
 87.81*

Temporary Light/Power: 30.33
 33.64*

Group 1: 66.09
 70.01*

Group 2: 27.21
 29.23*

* Applies when premium (OT) wages are paid.

Temporary Light and Power benefit rate applies for three or less workers.

Reduce benefit rate by 6.2% for any employee who has accumulated wages of \$168,600 for the same employer.

OVERTIME PAY

See (A, H) on OVERTIME PAGE

See (B) for Temporary Light and Power

HOLIDAY

Overtime: See (5, 6, 11, 15, 16, 25, 26) on HOLIDAY PAGE

REGISTERED APPRENTICES

Wages Per Hour:

One (1) year terms
 First term: 07/01/2024
 0-6 mos. \$ 18.00
 7-12 mos. 18.50
 Second term:
 0-6 mos. 19.50
 7-12 mos. 20.50
 Third term
 0-6 mos. 21.50
 7-12 mos. 22.50
 Fourth term:
 0-6 mos. 23.50
 7-12 mos. 25.50
 Fifth term/MLJ:
 0-12 mos. 27.50
 13-18 mos. 32.00

Supplemental Benefits per hour:

One (1) year terms:

First Term:	Regular	Overtime
0-6 mos.	\$ 17.18	\$ 18.38
7-12 mos.	17.44	18.67

Second Term:		
0-6 mos.	17.97	19.26
7-12 mos.	18.49	19.85
Third Term:		
0-6 mos.	19.02	20.44
7-12 mos.	19.54	21.03
Fourth Term:		
0-6 mos.	20.06	21.62
7-12 mos.	21.11	22.80
Fifth Term/MIJ:		
1-12 mos.	24.79	26.52
13-18 mos.	27.21	29.23

9-3

Electrician - Highway and Street Lighting, Traffic Signals and Controls	12/01/2024
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JOB DESCRIPTION Electrician - Highway and Street Lighting, Traffic Signals and Controls **DISTRICT** 9

ENTIRE COUNTIES
 Bronx, Kings, New York, Queens, Richmond

WAGES

Per hour:

	07/01/2024
Electro Pole Electrician	\$ 62.00
Electro Pole Foundation Installer	47.66
Electro Pole Maintainer	41.61

SUPPLEMENTAL BENEFITS

Per Hour:

	07/01/2024
Electro Pole Electrician	\$ 68.20 72.12*
Electro Pole Foundation Installer	51.68 54.69*
Electro Pole Maintainer	47.03 49.66*

*Applies when premium wages are paid

Note: Reduce benefit rate by 6.2% for any employee who has accumulated wages in \$168,600 for the same employer.

OVERTIME PAY

See (A, B, E4, F, K) on OVERTIME PAGE
 B - Applies to Electro Pole Foundation Installer
 E4 - Applies to Electro Pole Maintainer

HOLIDAY

Paid: See (1) on HOLIDAY PAGE
 Overtime: See (5, 6, 11, 15, 16, 25, 26) on HOLIDAY PAGE

9-3J

Elevator Constructor	12/01/2024
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JOB DESCRIPTION Elevator Constructor **DISTRICT** 4

ENTIRE COUNTIES
 Bronx, Kings, Nassau, New York, Queens, Richmond, Suffolk

PARTIAL COUNTIES

Rockland: Entire County except for the Township of Stony Point

Westchester: Entire County except for the Townships of Bedford, Lewisboro, Cortland, Mt. Kisco, North Salem, Pound Ridge, Somers and Yorktown.

WAGES

Per hour:	07/01/2024	03/17/2025
Elevator Constructor	\$ 80.35	\$ 83.37
Modernization & Service/Repair	63.16	65.54

SUPPLEMENTAL BENEFITS

Per Hour:		
Elevator Constructor	\$ 46.367	\$ 47.654
Modernization & Service/Repairs	45.217	46.470

OVERTIME PAY

Constructor See (D, M, T) on OVERTIME PAGE.

Modern/Service See (B, F, S) on OVERTIME PAGE.

HOLIDAY

Paid: See (5, 6, 8, 11, 15, 16, 25) on HOLIDAY PAGE
 Overtime: See (5, 6, 8, 11, 15, 16, 25) on HOLIDAY PAGE

REGISTERED APPRENTICES

WAGES PER HOUR:

6 MONTH TERMS:

1st Term* 50%	2nd & 3rd Term* 50%	4th & 5th Term 55%	6th & 7th Term 65%	8th & 9th Term 75%
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* Note: 1st, 2nd, 3rd Terms are based on Average of the Constructor, the Modernization and the Service/Repair wage.
 Terms 4 thru 9 Based on Journeyman's wage of classification Working in.

SUPPLEMENTAL BENEFITS:

	07/01/2024	03/17/2025
Elevator Constructor		
1st Term	\$ 0.00	\$ 0.00
2nd & 3rd Term	36.15	36.90
4th & 5th Term	37.19	37.99
6th & 7th Term	38.80	39.70
8th & 9th Term	40.41	41.40
Modernization & Service/Repair		
1st Term	\$ 0.00	\$ 0.00
2nd & 3rd Term	36.15	36.90
4th & 5th Term	37.19	37.99
6th & 7th Term	38.80	39.70
8th & 9th Term	40.41	41.40

Glazier

12/01/2024

JOB DESCRIPTION Glazier

DISTRICT 8

ENTIRE COUNTIES

Bronx, Dutchess, Kings, Nassau, New York, Orange, Putnam, Queens, Richmond, Rockland, Suffolk, Sullivan, Ulster, Westchester

WAGES

Per hour:	07/01/2024	05/01/2025
Glazier, Glass Tinting and Window Film	\$ 63.28	Additional \$ 1.11***
Scaffolding, including swing scaffold	67.28	

*Mechanical Equipment	64.28
**Repair & Maintenance	30.76

*Mechanical equipment, scissor jacks, man lifts, booms & buckets 30' or more, but not pipe scaffolding.

**Repair & Maintenance- All repair & maintenance work on a particular building whenever performed, where the total cumulative Repair & Maintenance contract value is under \$193,000.

***To be allocated at a later date.

SUPPLEMENTAL BENEFITS

Per hour: 7/01/2024

Glazier, Glass Tinting Window Film, Scaffolding and Mechanical Equipment	\$ 42.13
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Repair & Maintenance	24.62
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OVERTIME PAY

See (B, E, Q, V) on OVERTIME PAGE

For 'Repair & Maintenance' see (B, B2, I, S) on overtime page.

HOLIDAY

Paid: See (5, 6, 16, 25) on HOLIDAY PAGE

Overtime: See (5, 6, 16, 25) on HOLIDAY PAGE

For 'Repair & Maintenance'

Paid: See(5, 6, 16, 25)

Overtime: See(5, 6, 16, 25)

REGISTERED APPRENTICES

Wage per hour:

(1) year terms at the following wage rates:

7/01/2024

1st term	\$ 22.34
2nd term	30.64
3rd term	40.87
4th term	50.14

Supplemental Benefits:

(Per hour)

1st term	\$ 19.27
2nd term	27.34
3rd term	32.85
4th term	36.01

8-1087 (DC9 NYC)

Insulator - Heat & Frost

12/01/2024

JOB DESCRIPTION Insulator - Heat & Frost

DISTRICT 4

ENTIRE COUNTIES

Bronx, Kings, Nassau, New York, Queens, Richmond, Suffolk, Westchester

WAGES

Per Hour: 07/01/2024

Insulators Heat & Frost	\$ 71.01
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SUPPLEMENTAL BENEFITS

Per Hour:

Insulators Heat & Frost	\$ 36.76
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OVERTIME PAY

See (B, E, *Q, V) on OVERTIME PAGE

* Triple time for Labor Day (If worked)

HOLIDAY

Paid: See (1) on HOLIDAY PAGE

Overtime: See (5, 6, 11, 15, 16, 25, 26) on HOLIDAY PAGE

REGISTERED APPRENTICES

Wages:

1 year terms.

Wages Per Hour:

	1st	2nd	3rd	4th
	\$ 31.96	\$ 39.06	\$ 46.16	\$ 53.26

Supplemental Benefits:

	\$ 16.56	\$ 20.23	\$ 23.91	\$ 27.06
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4-12

Ironworker

12/01/2024

JOB DESCRIPTION Ironworker

DISTRICT 9

ENTIRE COUNTIES

Bronx, Kings, Nassau, New York, Queens, Richmond, Suffolk, Westchester

WAGES

Per Hour:	07/01/2024	01/01/2025
Stone Derrickmen Rigger	\$ 75.40	Additional \$ 1.64*
Stone Handset Derrickman	72.55	1.11*

*To be allocated at a later date.

SUPPLEMENTAL BENEFITS

Per hour:

Stone Derrickmen Rigger	\$ 45.52
Stone Handset Derrickman	44.76

OVERTIME PAY

See (B, D1, *E, Q, **V) on OVERTIME PAGE

*Time and one-half shall be paid for all work on Saturday up to eight (8) hours and double time shall be paid for all work thereafter.

** Benefits same premium as wages on Holidays only

HOLIDAY

Paid: See (18) on HOLIDAY PAGE

Overtime: See (5, 6, 8, 25) on HOLIDAY PAGE

Work stops at schedule lunch break with full day's pay.

REGISTERED APPRENTICES

Wage per hour:

Stone Derrickmen Rigger:

	1st	2nd	3rd	4th
07/01/2024	\$ 37.20	\$ 53.28	\$ 59.32	\$ 65.36

Supplemental Benefits:

Per hour:				
07/01/2024	23.27	34.39	34.39	34.39

Stone Handset:

1/2 year terms at the following hourly wage rate:

	1st	2nd	3rd	4th
07/01/2024	\$ 35.78	\$ 51.04	\$ 56.79	\$ 62.55

Supplemental Benefits:

Per hour:				
07/01/2024	22.95	34.08	34.08	34.08

9-197D/R

Ironworker

12/01/2024

JOB DESCRIPTION Ironworker

DISTRICT 4

ENTIRE COUNTIES

Bronx, Kings, Nassau, New York, Queens, Richmond, Suffolk, Westchester

WAGES

Per Hour:	07/01/2024	01/01/2025
Ornamental	\$ 47.65	Additional
Chain Link Fence	47.65	\$ 1.25/hr*
Guide Rail	47.65	

(*)To be allocated at a later date.

SUPPLEMENTAL BENEFITS

Per hour:	
Journeyworker:	\$ 66.29

OVERTIME PAY

See (B, B1, Q, V) on OVERTIME PAGE

HOLIDAY

Paid:	See (1) on HOLIDAY PAGE
Overtime:	See (5, 6, 25) on HOLIDAY PAGE

REGISTERED APPRENTICES

1 year terms	07/01/2024
1st Term	\$ 25.98
2nd Term	28.45
3rd Term	30.80
4th Term	34.39

Supplemental Benefits per hour:

1st Term	\$ 16.29
2nd Term	18.29
3rd Term	19.29
4th Term	20.29

4-580-Or

Ironworker

12/01/2024

JOB DESCRIPTION Ironworker

DISTRICT 4

ENTIRE COUNTIES

Bronx, Kings, Nassau, New York, Queens, Richmond, Suffolk, Westchester

WAGES

PER HOUR:	07/01/2024	01/01/2025
Ironworker:		Additional
Structural	\$ 57.20	\$ 1.75/Hr.*
Bridges		
Machinery		

(*)To be allocated at a later date.

SUPPLEMENTAL BENEFITS

PER HOUR PAID:	
Journeyman	\$ 89.85

OVERTIME PAY

See (B, B1, Q, *V) on OVERTIME PAGE

*NOTE: Benefits are calculated for every hour paid.

HOLIDAY

Paid:	See (1) on HOLIDAY PAGE
Overtime:	See (5, 6, 18, 19) on HOLIDAY PAGE

REGISTERED APPRENTICES

WAGES PER HOUR:

6 month terms at the following rate:

1st	\$ 30.23
2nd	30.83
3rd - 6th	31.44

Supplemental Benefits
 PER HOUR PAID: 62.47

4-40/361-Str

Ironworker

12/01/2024

JOB DESCRIPTION Ironworker

DISTRICT 4

ENTIRE COUNTIES

Bronx, Kings, Nassau, New York, Queens, Richmond, Suffolk, Westchester

PARTIAL COUNTIES

Rockland: Southern section - south of Convent Road and east of Blue Hills Road.

WAGES

Per hour: 07/01/2024

Reinforcing &
 Metal Lathing \$ 56.95

"Base" Wage 55.20
 plus \$ 1.75

"Base" Wage is used to calculate overtime hours only.

SUPPLEMENTAL BENEFITS

Per hour:
 Reinforcing & Metal Lathing \$ 44.63

OVERTIME PAY

See (B, E, Q, *X) on OVERTIME PAGE

*Only \$23.50 per Hour for non worked hours

Supplemental Benefit Premiums for Overtime Hours worked:

Time & One Half \$ 51.13
 Double Time 57.63

HOLIDAY

Paid: See (1) on HOLIDAY PAGE
 Overtime: See (5, 6, 11, 13, *18, **19, 25) on HOLIDAY PAGE

REGISTERED APPRENTICES

(1) year terms at the following wage rates:

Prior to 01/01/2020:

1st term	2nd term	3rd term	4th Term
Wage Per Hour: \$ 22.55	\$ 28.38	\$ 34.68	\$ 37.18
"Base" Wage \$21.00	\$26.80	\$33.10	\$35.60
plus \$1.55	plus \$1.58	plus \$1.58	plus \$1.58

"Base" Wage is used to calculate overtime hours ONLY.

SUPPLEMENTAL BENIFITS

Per Hour:

1st term	2nd term	3rd term	4th Term
\$18.17	\$21.34	\$22.00	\$22.50

After 01/01/2020:

1st term	2nd term	3rd term	4th Term
Wage Per Hour: \$ 22.55	\$ 23.60	\$ 24.60	\$ 25.65
"Base" Wage			

\$21.00 plus \$1.55	\$22.00 plus \$1.60	\$23.00 plus \$1.60	\$24.00 plus \$1.65
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"Base" Wage is used to calculate overtime hours ONLY.

SUPPLEMENTAL BENEFITS

Per Hour:

1st term \$18.40	2nd term \$17.40	3rd term \$16.45	4th Term \$15.45
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4-46Reinf

Laborer **12/01/2024**

JOB DESCRIPTION Laborer

DISTRICT 9

ENTIRE COUNTIES

Bronx, Kings, New York, Queens, Richmond

WAGES

Per hour:

Striper (Highway/streets):	07/01/2024	07/01/2025
Striping-Machine Operator	\$ 41.00	Additional \$ 3.05**
Striping Thermoplastic	45.00	
Flagger - Traffic Safety*	39.00	

Note: * Includes but is not limited to: Positioning of cones and directing of traffic using handheld devices. Excludes the Driver/Operator of equipment used in protection of traffic safety.

** To be allocated at a later date.

SUPPLEMENTAL BENEFITS

Per hour paid:

Journeyworker	\$ 19.27
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OVERTIME PAY

See (B, H) on OVERTIME PAGE

HOLIDAY

Paid: See (5, 6, 8, 13) on HOLIDAY PAGE

Overtime: See (5, 6, 8, 13) on HOLIDAY PAGE

REGISTERED APPRENTICES

Wages per hour:

1st Term (1-2000 hours)	\$ 31.36
2nd Term (2001-4000 hours)	33.00

Supplemental Benefits per hour:

All Terms	19.27
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9-1010-LS

Laborer **12/01/2024**

JOB DESCRIPTION Laborer

DISTRICT 9

ENTIRE COUNTIES

Bronx, Kings, New York, Queens, Richmond

WAGES

Per hour: 07/01/2024

Laborer/Excavation

**Asbestos and Lead Abatement &

Removal, Hazardous Waste Removal

(including soil) \$ 45.00

Basic 45.00

Flagman 45.00

Pipelayer 45.00

*Tree Work, *Landscape 45.00

*Includes trimming, cutting, planting and/or removal of trees.

** Applies to Heavy & Highway projects

SUPPLEMENTAL BENEFITS

Per hour:

Journeyworker: \$ 54.03

Note: No payment of Supplemental Benefits is required on paid holidays, when employees do not work.

OVERTIME PAY

See (B, E, Q) on OVERTIME PAGE

When an observed holiday falls on a Saturday, work done shall be paid at double time.

HOLIDAY

Paid: See (2, 20) on HOLIDAY PAGE

Overtime: See (2, 5, 6, 11, 20) on HOLIDAY PAGE

REGISTERED APPRENTICES

Wage per hour:

1000 hour terms at the following hourly wage rate.

07/01/2024

1st	0 - 1000	\$ 22.50
2nd	1001-2000	27.00
3rd	2001-3000	33.75
4th	3001-4000	40.50

Supplemental Benefits per hour:

All Apprentices 54.03

9-731Ex

Laborer

12/01/2024

JOB DESCRIPTION Laborer

DISTRICT 9

ENTIRE COUNTIES

Bronx, Kings, New York, Queens, Richmond

WAGES

Per hour:

GROUP 14: Blasters.

GROUP 16: Tunnel workers - including Miners, Drill Runners, Iron Men, Maintenance Men, Conveyor Men, Safety Miners, Riggers, Block Layers, Cement Finishers, Rod Men, Caulkers, Powder Carriers, Miners' Helpers, Chuck Tenders, Track Men, Nippers, Brake Men, Derail Men, Form Men, Bottom Bell, Top Bell or Signal men, Form Workers, Movers, Concrete Workers, Shaft Men, Tunnel Laborers and Caulkers' Helpers.

GROUP 17: All others including: Powder Watchmen, Top Laborers and Changehouse Attendants.

Wages: (per hour) 07/01/2024

Laborer (Tunnel)-FREE AIR:

Group 14	\$ 77.13
Group 16	73.75
Group 17*	68.18

Small Bore Micro Tunnel Machines 80% of rates above

For Repairs on Existing Water Tunnels 90% of rates above

For Repairs of Sewer & Drainage Tunnels 85% of rates above

For Repair & Maintenance

of all Subway & Vehicular Tunnels 80% of rates above

*An additional \$3.00 per day when using an air spade, jack hammer or pavement breaker.

Note: Employer shall pay \$10.00 per day for each half mile starting at a point 500 feet from the bottom of the shaft.

SUPPLEMENTAL BENEFITS

Per hour:

GROUP 14 \$ 55.32
 GROUP 16 53.06
 GROUP 17 49.11

Small Bore Micro Tunnel Machines 80% of rates above

For Repairs on Existing Water Tunnels 90% of rates above

For Repairs of Sewer & Drainage Tunnels 85% of rates above

For Repair & Maintenance of all Subway & Vehicular Tunnels 80% of rates above

OVERTIME PAY

OVERTIME: For Laborer (Free Air) See (D, M, R*) on OVERTIME PAGE.
 For Repair Categories See (B, F, R*) on OVERTIME PAGE.
 & Micro Tunneling
 * Straight time first 8 hours, double time after 8 hours.

HOLIDAY

Paid: See (5, 6, 9, 11, 12, 15, 16, 25) on HOLIDAY PAGE
 Overtime: See (5, 6, 9, 11, 12, 15, 16, 25) on HOLIDAY PAGE
 Good Friday may be exchanged for one of the holidays listed.

9-147Tnl/Free

Laborer - Building 12/01/2024

JOB DESCRIPTION Laborer - Building **DISTRICT 9**

ENTIRE COUNTIES
 Bronx, Kings, New York, Queens, Richmond

WAGES
 Per hour: 07/01/2024 01/01/2025
 Additional
 Basic Laborer and Mason Tender \$ 44.70* \$ 1.25**

*Before calculating premium wage deduct \$3.25

** To be allocated at a later date.

SUPPLEMENTAL BENEFITS

Per hour:

Basic Laborer and Mason Tender \$ 29.99

OVERTIME PAY

See (B, B2, E, E2, Q, R) on OVERTIME PAGE

HOLIDAY

Paid: See (1) on HOLIDAY PAGE
 Overtime: See (5, 6, 25) on HOLIDAY PAGE

REGISTERED APPRENTICES

Wage per hour:

1000 hour terms at the following wage rate:

Term:	1st	2nd	3rd	4th
Basic Laborer and Mason Tender 07/01/2024	\$ 22.05*	\$ 23.80*	\$ 25.30*	\$ 27.80*

*Before calculating premium wage deduct \$0.50

Supplemental Benefits per hour:

All Terms 07/01/2024	\$ 10.77	9-MTDC(79)
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Laborer - Building **12/01/2024**

JOB DESCRIPTION Laborer - Building **DISTRICT 9**

ENTIRE COUNTIES
 Bronx, Kings, New York, Queens, Richmond

WAGES

Per hour:	07/01/2024	07/01/2025 Additional
Skilled Interior Demolition Laborer:	\$ 39.70*	\$ 0.75***
General Interior Demolition Laborer:	28.89**	

* Before calculating overtime wages deduct \$1.70

**General Demolition Laborer performs manual work and work incidental to demolition, such as loading and carting of debris from work site to an area where it can be loaded into trucks for removal. Also performs clean-up of the site when demolition is complete.

***To be allocated at a later date.

SUPPLEMENTAL BENEFITS

Per Hour:	
Skilled Interior Demolition Laborer:	24.84
General Interior Demolition Laborer:	19.16

OVERTIME PAY

See (B, B2, I, R) on OVERTIME PAGE

HOLIDAY

Paid: See (1) on HOLIDAY PAGE
 Overtime: See (5, 6, 25) on HOLIDAY PAGE

REGISTERED APPRENTICES

Wage Per Hour:

1000 hour terms at the following wage rate:				
	1st	2nd	3rd	4th
	\$ 21.80*	\$ 23.55*	\$ 25.05*	\$ 27.55*

* Before calculating overtime wages deduct \$0.50

Supplemental Benefits Per Hour:

All Terms:	10.47	9-MTDC (79-ID)
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Laborer - Building **12/01/2024**

JOB DESCRIPTION Laborer - Building **DISTRICT 9**

ENTIRE COUNTIES
 Bronx, Kings, New York, Queens, Richmond

WAGES

Per hour:	07/01/2024
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Laborer:

Laborer-Concrete
 (including flag person) \$ 42.53
 + 8.00*

* This portion is not subjected to overtime premiums.

SUPPLEMENTAL BENEFITS

Per Hour \$ 20.20
 + 9.00**

** This portion subjected to overtime premiums only on codes (E,Q)

OVERTIME PAY

OVERTIME: See (A,E,Q) on OVERTIME PAGE attached.
 See (B,E,Q,) for work below street level to top of foundation.

HOLIDAY

Paid: See (1) on HOLIDAY PAGE
 Overtime: See (5, 6, 8, 11, 13, 25) on HOLIDAY PAGE

REGISTERED APPRENTICES

Wages per hour:

Terms based on hours listed:

1st	2nd	3rd
0-1334	1334-2668	2669-4000
\$ 15.35 + 2.49*	\$ 20.15 + 7.32*	\$ 20.95 + 7.80*

* This portion is not subjected to overtime premiums.

Supplemental Benefits:

Per hour:		
\$ 12.70 + 2.65*	\$ 16.70 + 3.45*	\$ 16.70 + 4.25*

Journeyworker rate applies after 4000 hours

*This portion subjected to same premium as wages.

9-6A/18A/20-C

Laborer - Building 12/01/2024

JOB DESCRIPTION Laborer - Building

DISTRICT 9

ENTIRE COUNTIES

Bronx, Kings, New York, Queens, Richmond

WAGES

Per hour: 07/01/2024 01/01/2025
 Building: Additional

Plasterer Tender and \$ 44.70* \$ 1.25**
 Spray Fireproofing Tender

* Before calculating overtime wages deduct \$3.25

**To be allocated at a later date.

SUPPLEMENTAL BENEFITS

Per hour: Journeyworker \$ 29.99

OVERTIME PAY

See (B, B2, E, E2, Q, R) on OVERTIME PAGE

HOLIDAY

Paid: See (1) on HOLIDAY PAGE
 Overtime: See (5, 6, 25) on HOLIDAY PAGE

REGISTERED APPRENTICES

Wage per hour:

1000 hours terms at the following wage.

	1st	2nd	3rd	4th
01/01/2024	\$22.05*	\$23.80*	\$25.30*	\$27.80*

* Before calculating overtime wages deduct \$ 0.50

Supplemental Benefits per hour:

All Terms:
 07/01/2024

\$ 10.77

9-30 (79)

Laborer - Building **12/01/2024**

JOB DESCRIPTION Laborer - Building

DISTRICT 4

ENTIRE COUNTIES

Bronx, Kings, Nassau, New York, Queens, Richmond, Suffolk

WAGES

Per Hour: 07/01/2024 01/06/2025

Asbestos, Lead and Hazardous Material Abatement Laborer	\$ 39.00	Additional \$ 1.50/Hr.*
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(*)To be allocated at a later date.

(Re-Roofing Removal See Roofer)

NOTE: Asbestos removed from Mechanical Systems not to be scrapped
 See Asbestos Worker

SUPPLEMENTAL BENEFITS

Per Hour:

Laborer \$ 20.10

OVERTIME PAY

See (B, B2, I) on OVERTIME PAGE

*Calculate at \$39.00 per hour then add \$1.55

HOLIDAY

Paid: See (1) on HOLIDAY PAGE
 Overtime: See (5, 6, 8, 28) on HOLIDAY PAGE

REGISTERED APPRENTICES

1000 hour terms at the following:

Per Hour:

1st Term	\$ 20.00*
2nd Term	21.00**
3rd Term	24.00***
4th Term	26.00****

SUPPLEMENTAL BENEFIT

Per Hour:

All Terms \$ 14.35

OVERTIME PAY:

- *Calculate at \$20.00 per hour then add \$1.00
- **Calculate at \$21.00 per hour then add \$1.00
- ***Calculate at \$24.00 per hour then add \$1.00
- ****Calculate at \$26.00 per hour then add \$1.00

4-NYDC(78)

Laborer - Building **12/01/2024**

JOB DESCRIPTION Laborer - Building

DISTRICT 9

ENTIRE COUNTIES

Bronx, Kings, New York, Queens, Richmond

WAGES

Per hour:	07/01/2024	01/01/2025 Additional
Skilled Demolition Laborer:	\$ 42.48*	\$ 0.50***
General Demolition Laborer:	31.06**	

*Before calculating overtime wages deduct \$3.00
 **Before calculating overtime wages deduct \$2.35
 ***To be allocated at a later date.

**General Demolition Laborer performs manual work and work incidental to demolition, such as loading and carting of debris from work site to an area where it can be loaded into trucks for removal. Also performs clean-up of the site when demolition is complete.

NOTE: Total Demolition Only: Demolition shall be the complete demolition (wrecking) or dismantling of entire buildings or structures. Also may include the removal of all or any portion of a roof in which structural change is to occur. Structural change is defined as the removal of structural slabs, steel members, concrete members and penetration through the structural slab.

SUPPLEMENTAL BENEFITS

Per hour:
 Journeyworker:

Skilled Demolition Laborer:	\$ 28.92
General Demolition Laborer:	21.98

OVERTIME PAY

See (B, E, E2, Q) on OVERTIME PAGE

HOLIDAY

Paid: See (1) on HOLIDAY PAGE
 Overtime: See (5, 6, 25) on HOLIDAY PAGE

REGISTERED APPRENTICES

Wage per hour:
 (1) year terms at the following wage.

07/01/2024	1st	2nd	3rd	4th
	\$ 22.05*	\$ 23.80*	\$ 25.30*	\$ 27.80*

*Before calculating overtime wages deduct \$0.50

Supplemental Benefits per hour:

All Terms:	
07/01/2024	\$ 10.77

9-79/95

Laborer - Concrete & Asphalt Paving **12/01/2024**

JOB DESCRIPTION Laborer - Concrete & Asphalt Paving **DISTRICT 9**

ENTIRE COUNTIES
 Bronx, Kings, New York, Queens, Richmond

WAGES

Group 1: Slurry Seal Coater, Maintenance Safety Surface, Small Power Tool Operator, Play Equipment Installer, Temporary Fence Installer & Repairs, Laborer.

Group 2: Production Paving Work: Shoveler, small equipment operator.

Per hour:	07/01/2024
Concrete Formsetter	\$ 49.35 + \$ 8.00*
Asphalt Screeperson/Micro Paver	49.95 + \$ 8.00*
Asphalt Raker	49.35 + \$ 8.00*
Group 1	45.48 + \$ 8.00*
Group 2	45.48 + \$ 8.00*

* This portion is not subjected to overtime premiums.

SUPPLEMENTAL BENEFITS

Per hour:

Journeyworker: \$ 45.55

Note: No payment of supplemental benefits is required on paid holidays, when employees do not work.

OVERTIME PAY

See (B, E, Q) on OVERTIME PAGE

Note: Saturday premium rate applies from 7:00 am on Saturday to 6:59 am Sunday

Note: Sunday premium rate applies from Sunday 7:00 am to Monday 6:59 am.

HOLIDAY

Paid: See (5, *11, 20) on HOLIDAY PAGE

HOLIDAY:

Overtime: See (21,22)** on HOLIDAY PAGE.

Note: See (5,20) Holiday pay -at the single time pay rate-shall be prorated based on 25% of a day's wages and benefits for each day worked during that calendar week.

**New Year's Day and Christmas Day: If an employee is performing work on these (2) days the employee will receive the single rate plus 25%.

* Columbus Day shall be an unpaid holiday. In the event work is performed on Columbus Day, wages shall be paid on a double time basis.

Note-When Independence day falls on Saturday, it will be observed on that Saturday, however, when it occurs on a Sunday, it will be observed on the Monday.

REGISTERED APPRENTICES

Wage per hour:

2000 hours term:

1st term	2nd term
1-1999	2000-4000
\$ 31.36 + \$ 8.00*	\$ 33.00 + \$ 8.00*

* This portion is not subjected to overtime premiums.

Supplemental Benefits per hour:

2000 hours term:

1st term	2nd term
1-1999	2000-4000
\$ 18.67	\$ 18.67

9-1010H/H

Laborer - Trac Drill

12/01/2024

JOB DESCRIPTION Laborer - Trac Drill

DISTRICT 9

ENTIRE COUNTIES

Bronx, Kings, New York, Queens, Richmond

WAGES

Group 1:Chipper/Jackhammer, Powder Carrier, Hydraulic Chuck tender, Chuck Tender and Nipper, Magazine Keeper

Group 2: Hydraulic Trac Drill

Group 3: Air Trac, Wagon and Quarry bar

Group 4: Blaster

Per Hour: 07/01/2024

Group 1	\$ 45.00
Group 2	52.35
Group 3	51.52
Group 4	58.21

SUPPLEMENTAL BENEFITS

Per Hour:

All Classifications: 54.03

OVERTIME PAY

See (B, E, Q) on OVERTIME PAGE

When an observed holiday falls on a Saturday, work done shall be paid at double time.

HOLIDAY

Paid: See (2, 20) on HOLIDAY PAGE

Overtime: See (2, 5, 6, 11, 20) on HOLIDAY PAGE

REGISTERED APPRENTICES

Wage per hour:

1000 hour terms at the following hourly wage rate.

07/01/2024

1st	0 - 1000	\$ 22.50
2nd	1001-2000	27.00
3rd	2001-3000	33.75
4th	3001-4000	40.50

Supplemental Benefits per hour:

All Apprentices 54.03

9-731/29

Laborer - Tunnel

12/01/2024

JOB DESCRIPTION Laborer - Tunnel

DISTRICT 9

ENTIRE COUNTIES

Bronx, Kings, New York, Queens, Richmond

WAGES

GROUP 5: Blasters and Mucking Machine Operators

GROUP 6: Tunnel Workers*(including Miners, Drill Runners, Iron Men, Maintenance Men, Inside Muck Lock Tender, Pumpmen, Electricians, Cement Finishers, Rod Men, Caulkers, Carpenters, Hydraulic Men, Shield Drivers, Monorail Operators, Motor Men, Conveyor Men, Safety Miners, Powder Carriers, Pan Men, Riggers, Miner's Helpers, Chuck Tenders, Track Men, Nippers, Brake Men, Form Workers, Concrete Workers, Tunnel Laborers, Caulker's Helpers), Hose Men, Grout Men, Gravel Men, Derail Men and Cable Men.

GROUP 7: Top Nipper

GROUP 8,9: Outside Man Lock Tender, Outside Muck Lock Tender, Shaft Men, Gauge Tender and Signal Men.

GROUP 10: Powder Watchmen, Top Laborers and Changehouse Attendants.

WAGES: (per hour)

07/01/2024

Laborer (Compressed Air):

GROUP 5	\$ 80.82
GROUP 6	77.95
GROUP 7	76.65
GROUP 8,9	75.10
GROUP 10	66.18

Note: Employer shall pay \$10.00 per day for each one half (1/2) mile or fraction starting from a point 500 feet from the shaft.

SUPPLEMENTAL BENEFITS

SUPPLEMENTAL BENEFITS:

per hour:

GROUP 5	\$ 57.61
GROUP 6	55.81
GROUP 7	54.68
GROUP 8,9	53.84

GROUP 10 50.85

OVERTIME PAY

See (D, M, *R) on OVERTIME PAGE

NOTE: Time and one-half to be paid for all overtime repair-maintenance work on existing equipment and facilities.

* Straight time first 8 hours, double time after 8 hours.

HOLIDAY

Paid: See (5, 6, 9, 11, 12, 15, 16, 25) on HOLIDAY PAGE

Overtime: See (5, 6, 9, 11, 12, 15, 16, 25) on HOLIDAY PAGE

Good Friday may be exchanged for one of the holidays listed.

9-147Tnl/Comp Air

Mason

12/01/2024

JOB DESCRIPTION Mason

DISTRICT 4

ENTIRE COUNTIES

Bronx, Kings, Nassau, New York, Queens, Richmond, Suffolk

WAGES

Per Hour: 07/01/2024

Brick/Block Layer \$ 67.14

Base Wage for OT Calculation \$ 55.93

SUPPLEMENTAL BENEFITS

Per Hour:

Brick/Block Layer \$ 34.90

OVERTIME PAY

See (A, E, E2, Q) on OVERTIME PAGE

Note: OT Calculated on Base Wage plus \$ 11.21/hr.

HOLIDAY

Paid: See (1) on HOLIDAY PAGE

Overtime: See (5, 6, 25) on HOLIDAY PAGE

REGISTERED APPRENTICES

(800 hour) Terms at the following Percentage of Journey workers "Base Wage" plus \$ 5.94/hr.:

1st	2nd	3rd	4th	5th
50%	60%	70%	80%	90%

Supplemental Benefits per hour:

All Apprentices \$ 24.70

4-1Brk

Mason - Building

12/01/2024

JOB DESCRIPTION Mason - Building

DISTRICT 9

ENTIRE COUNTIES

Bronx, Kings, Nassau, New York, Queens, Richmond, Suffolk, Westchester

WAGES

Building

Wages per hour: 07/01/2024 01/01/2025
 Additional

Mosaic & Terrazzo Mechanic \$ 60.98 \$ 1.06*

Mosaic & Terrazzo Finisher 58.96

*To be allocated at a later date.

SUPPLEMENTAL BENEFITS

Per hour:

Mosaic & Terrazzo Mechanic \$ 31.36*
 + \$9.78

Mosaic & Terrazzo Finisher \$ 31.36*
 + \$9.77

*This portion of benefits subject to same premium rate as shown for overtime wages.

OVERTIME PAY

See (A, E, Q) on OVERTIME PAGE

07/01/2024- Deduct \$7.00 from hourly wages before calculating overtime.

HOLIDAY

Paid: See (1) on HOLIDAY PAGE

Overtime: See (5, 6, 8, 11, 15, 16, 25) on HOLIDAY PAGE

Easter Sunday is an observed holiday. Holidays falling on a Saturday will be observed on that Saturday. Holidays falling on a Sunday will be celebrated on the Monday.

REGISTERED APPRENTICES

Wages Per hour:

	1st 0- 1500	2nd 1501- 3000	3rd 3001- 3750	4th 3751- 4500	5th 4501- 5250	6th 5251- 6000
07/01/2024	\$ 25.19	\$ 32.39	\$ 38.18	\$ 40.78	\$ 49.00	\$ 55.75

Supplemental Benefits per hour:

07/01/2024	\$7.12* + 3.43	\$9.16* + 4.40	\$17.22* + 5.87	\$23.86* + 6.84	\$24.86* + 7.83	\$27.36* + 8.80
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*This portion of benefits subject to same premium rate as shown for overtime wages.

9-7/3

Mason - Building

12/01/2024

JOB DESCRIPTION Mason - Building

DISTRICT 9

ENTIRE COUNTIES

Bronx, Kings, New York, Queens, Richmond

WAGES

Per hour:	07/01/2024	12/02/2024 Additional
Tile Setters	\$ 64.40	\$ 0.72*

*To be allocated at a later date.

SUPPLEMENTAL BENEFITS

Per Hour:	\$ 28.51* + 8.52
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*This portion of benefits subject to same premium rate as shown for overtime wages.

OVERTIME PAY

See (B, *E, Q, V) on OVERTIME PAGE

Work beyond 10 hours on Saturday shall be paid at double the hourly wage rate.

HOLIDAY

Paid: See (1) on HOLIDAY PAGE

Overtime: See (5, 6, 11, 15, 16, 25) on HOLIDAY PAGE

REGISTERED APPRENTICES

Wage per hour:

750 hour terms at the following wage rate:

	1st 1- 750	2nd 751- 1500	3rd 1501- 2250	4th 2251- 3000	5th 3001- 3750	6th 3751- 4500	7th 4501- 5250	8th 5251- 6000	9th 6001- 6750	10th 6501- 7000
07/01/2024	\$22.19	\$27.21	\$34.45	\$39.46	\$43.07	\$46.58	\$50.23	\$55.24	\$57.71	\$62.00

Supplemental Benefits per hour:

	1st	2nd	3rd	4th	5th	6th	7th	8th	9th	10th
07/01/2024	\$12.55*	\$12.55*	\$15.36*	\$15.36*	\$16.36*	\$17.86*	\$18.86*	\$18.86*	\$18.86*	\$24.11*
	+\$.76	+\$.81	+\$.91	+\$.96	+\$1.43	+\$1.48	+\$1.91	+\$1.97	+\$4.57	+\$5.18

*This portion of benefits subject to same premium rate as shown for overtime wages.

9-7/52

Mason - Building **12/01/2024**

JOB DESCRIPTION Mason - Building **DISTRICT 9**

ENTIRE COUNTIES
 Bronx, Kings, Nassau, New York, Queens, Richmond, Suffolk, Westchester

WAGES
 Per hour: 07/01/2024 01/06/2025
Additional

Building-Marble Restoration:
 Marble, Stone & \$ 47.72 \$ 0.57*

Terrazzo Polisher

*To be allocated at a later date.

SUPPLEMENTAL BENEFITS
 Per Hour:
 Journeyworker:

 Building-Marble Restoration:
 Marble, Stone &
 Polisher \$ 31.50

OVERTIME PAY
 See (B, *E, Q, V) on OVERTIME PAGE
 * On Saturdays, 8th hour and successive hours paid at double hourly rate.

HOLIDAY
 Paid: See (1) on HOLIDAY PAGE
 Overtime: See (5, 6, 8, 11, 15, 25) on HOLIDAY PAGE

REGISTERED APPRENTICES
 WAGES per hour:

900 hour term at the following wage:

1st	2nd	3rd	4th
1-900	901-1800	1801-2700	2701
\$ 33.40	\$ 38.18	\$ 42.94	\$ 47.72

Supplemental Benefits Per Hour:
29.06 29.87 30.69 31.50

9-7/24-MP

Mason - Building **12/01/2024**

JOB DESCRIPTION Mason - Building **DISTRICT 9**

ENTIRE COUNTIES
 Bronx, Dutchess, Kings, Nassau, New York, Orange, Putnam, Queens, Richmond, Rockland, Suffolk, Sullivan, Ulster, Westchester

WAGES
 Per Hour:
07/01/2024 01/06/2025
Additional
 Marble Cutters & Setters \$ 63.92 \$ 0.75*

*To be allocated at a later date.

SUPPLEMENTAL BENEFITS

Per Hour:

Journeyworker \$ 40.05

OVERTIME PAY

See (B, E, Q, V) on OVERTIME PAGE

HOLIDAY

Paid: See (1) on HOLIDAY PAGE

Overtime: See (5, 6, 8, 11, 15, 16, 25) on HOLIDAY PAGE

REGISTERED APPRENTICES

Wage Per Hour:

07/01/2024

750 hour terms at the following wage

1st	2nd	3rd	4th	5th	6th	7th	8th
0-3000	3001-3750	3751-4500	4501-5250	5251-6000	6001-6750	6751-7500	7500+
\$ 27.01	\$ 40.52	\$ 43.88	\$ 47.26	\$ 50.64	\$ 54.32	\$ 60.71	\$ 63.92

Supplemental Benefits per hour:

07/01/2024

1st	2nd	3rd	4th	5th	6th	7th	8th
\$ 26.42	\$ 29.76	\$ 30.61	\$ 31.44	\$ 32.28	\$ 37.55	\$ 39.23	\$ 40.05

9-7/4

Mason - Building

12/01/2024

JOB DESCRIPTION Mason - Building

DISTRICT 9

ENTIRE COUNTIES

Bronx, Kings, New York, Queens, Richmond

WAGES

Per hour: 07/01/2024 12/02/2024

Tile Finisher \$ 49.46 \$ 49.59

*To be allocated at a later date.

SUPPLEMENTAL BENEFITS

Per Hour:

\$ 25.36* \$ 25.81*
 + \$8.33 + \$8.34

* This portion of benefits is subject to same premium rate as shown for overtime wages.

OVERTIME PAY

See (A, *E, Q) on OVERTIME PAGE

Double time rate after 10 hours on Saturdays

HOLIDAY

Paid: See (1) on HOLIDAY PAGE

Overtime: See (5, 6, 11, 15, 16, 25) on HOLIDAY PAGE

9-7/88-tf

Mason - Building

12/01/2024

JOB DESCRIPTION Mason - Building

DISTRICT 9

ENTIRE COUNTIES

Bronx, Kings, Nassau, New York, Queens, Richmond, Suffolk, Westchester

WAGES

Per hour: 07/01/2024 01/06/2025

Marble, Stone, Maintenance Finishers: \$ 27.72 Additional \$ 0.41*

Note 1: An additional \$2.00 per hour for time spent grinding floor using "60 grit" and below.

Note 2: Flaming equipment operator shall be paid an additional \$25.00 per day.

*To be allocated at a later date.

SUPPLEMENTAL BENEFITS

Per Hour:

Marble, Stone
 Maintenance Finishers: \$ 15.74

OVERTIME PAY

See (B, *E, Q, V) on OVERTIME PAGE

*Double hourly rate after 8 hours on Saturday

HOLIDAY

Paid: See (5, 6, 8, 11, 15, 25) on HOLIDAY PAGE

Overtime: See (5, 6, 8, 11, 15, 25) on HOLIDAY PAGE

1st term apprentice gets paid for all observed holidays.

REGISTERED APPRENTICES

WAGES per hour:

07/01/2024

0-750	\$ 22.32
751-1500	23.04
1501-2250	23.75
2251-3000	24.48
3001-3750	25.56
3751-4500	27.00
4501+	27.72

Supplemental Benefits:
 Per hour:

0-750	12.69
751-1500	13.10
1501-2250	13.51
2251-3000	13.91
3001-3750	14.52
3751-4500	15.33
4501+	15.74

9-7/24M-MF

Mason - Building / Heavy&Highway

12/01/2024

JOB DESCRIPTION Mason - Building / Heavy&Highway

DISTRICT 9

ENTIRE COUNTIES

Bronx, Kings, Nassau, New York, Queens, Richmond, Suffolk, Westchester

WAGES

Per hour: 07/01/2024 01/06/2025
 Additional

Marble-Finisher \$ 49.99 \$ 0.53*

*To be allocated at a later date.

SUPPLEMENTAL BENEFITS

Journeyworker:
 Per hour

Marble- Finisher \$ 37.39

OVERTIME PAY

See (B, E, Q, V) on OVERTIME PAGE

Work beyond 8 hours on a Saturday shall be paid at double the rate.

HOLIDAY

Overtime: See (5, 6, 8, 11, 15, 16, 25) on HOLIDAY PAGE

When an observed holiday falls on a Sunday, it will be observed the next day.

9-7/20-MF

Mason - Building / Heavy&Highway **12/01/2024**

JOB DESCRIPTION Mason - Building / Heavy&Highway **DISTRICT 4**

ENTIRE COUNTIES
 Bronx, Kings, Nassau, New York, Queens, Richmond, Suffolk

WAGES
 Per Hour: 07/01/2024

Cement Mason \$ 57.72

SUPPLEMENTAL BENEFITS

Per Hour:
 Cement Mason \$ 34.66
 1.5 X overtime rate \$ 62.95
 2 X overtime rate \$ 69.32

OVERTIME PAY
 See (B1, Q) on OVERTIME PAGE

HOLIDAY
 Paid: See (1) on HOLIDAY PAGE
 Overtime: See (5, 6, 8, 11, 13, 25) on HOLIDAY PAGE

REGISTERED APPRENTICES
 (1) year terms at the following wage:

1st Term \$ 23.39
 2nd Term \$ 28.29
 3rd Term \$ 33.69

Supplement Benefits per hour paid:

	ST	1.5X OT	2X OT
1st Term	\$ 14.86	\$ 22.30	\$ 29.72
2nd Term	\$ 15.16	\$ 22.75	\$ 30.32
3rd Term	\$ 15.27	\$ 22.91	\$ 30.54

4-780

Mason - Building / Heavy&Highway **12/01/2024**

JOB DESCRIPTION Mason - Building / Heavy&Highway **DISTRICT 4**

ENTIRE COUNTIES
 Bronx, Kings, Nassau, New York, Queens, Richmond, Suffolk

WAGES
 NOTE: Shall include but not limited to Precast concrete slabs (London Walks) Marble and Granite pavers 2'x 2' or larger.
 Per Hour:

	07/01/2024	05/01/2025
Stone Setter	\$ 69.91	Additional
Base Rate	53.84*	\$ 3.42/Hr+
Stone Tender	\$51.82	
Base Rate	44.54*	

(+)To be allocated at a later date for all classes.

SUPPLEMENTAL BENEFITS

Per Hour:
 Stone Setter \$ 42.52
 Stone Tender 23.15

OVERTIME PAY
 See (*C, **E, Q) on OVERTIME PAGE

* Base Rates are used to Calculate Overtime Premiums then adding in: \$15.81/Hr. for Stone Setter or \$7.28/Hr. for Stone Tender.

** On weekdays the eighth (8th) and ninth (9th) hours are time and one-half all work thereafter is paid at double the hourly rate.

*** The first nine (9) hours on Saturday is paid at time and one-half all work thereafter is paid at double the hourly rate.

HOLIDAY

Paid: See (*18) on HOLIDAY PAGE
 Overtime: See (5, 6, 10) on HOLIDAY PAGE
 Paid: * Must work first 1/2 of day.

REGISTERED APPRENTICES

Per Hour:

Stone Setter(800 hour) terms at the following Percentage of Stone Setters Base wage rate per hour plus \$7.32:

1st	2nd	3rd	4th	5th	6th
50%	60%	70%	80%	90%	100%

Supplemental Benefits:

All Apprentices \$ 25.85

4-1Stn

Mason - Heavy&Highway

12/01/2024

JOB DESCRIPTION Mason - Heavy&Highway

DISTRICT 4

ENTIRE COUNTIES

Bronx, Kings, Nassau, New York, Queens, Richmond, Suffolk

WAGES

Per Hour: 07/01/2024

Pointer, Caulkers & Cleaners \$ 63.69

SUPPLEMENTAL BENEFITS

Per Hour:

Pointer, Cleaners & Caulkers \$ 31.90

OVERTIME PAY

See (B, E2, H) on OVERTIME PAGE

HOLIDAY

Paid: See (1) on HOLIDAY PAGE
 Overtime: See (5, 6, 25, 26) on HOLIDAY PAGE

REGISTERED APPRENTICES

Wages per hour:

One (1) year terms at the following wage rates.

1st	2nd	3rd	4th
\$ 32.76	\$ 37.09	\$ 42.97	\$ 51.60

Apprentices Supplemental Benefits:
 (per hour paid)

\$ 15.40	\$ 21.70	\$ 24.45	\$ 25.45
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4-1PCC

Operating Engineer - Building

12/01/2024

JOB DESCRIPTION Operating Engineer - Building

DISTRICT 9

ENTIRE COUNTIES

Bronx, Kings, New York, Putnam, Queens, Richmond, Westchester

PARTIAL COUNTIES

Dutchess: that part of Dutchess County lying south of the North City Line of the City of Poughkeepsie.

WAGES

NOTE: Construction surveying
 Party Chief--One who directs a survey party
 Instrument Man--One who runs the instrument and assists Party Chief.
 Rodman--One who holds the rod and assists the Survey Crew

Wages:(Per Hour) 07/01/2024

Building Construction:

Party Chief \$ 79.99
 Instrument Man 60.36
 Rodman 40.45

Steel Erection:

Party Chief 83.13
 Instrument Man 64.21
 Rodman 44.33

Heavy Construction-NYC counties only:
 (Foundation, Excavation.)

Party Chief 88.06
 Instrument man 65.66
 Rodman 55.70

SUPPLEMENTAL BENEFITS

Per Hour: 07/01/2024

Building Construction \$ 28.63* +\$ 7.65

Steel Erection 29.23* + 7.65

Heavy Construction 30.04* + 7.64

* This portion subject to SAME premium as wages

Non-Worked Holiday Supplemental Benefit:

21.83

OVERTIME PAY

See (A, B, E, Q) on OVERTIME PAGE

Code "A" applies to Building Construction and has double the rate after 7 hours on Saturdays.

Code "B" applies to Heavy Construction and Steel Erection and had double the rate after 8 hours on Saturdays.

HOLIDAY

Paid: See (5, 6, 9, 11, 15, 16, 25) on HOLIDAY PAGE

Overtime: See (5, 6, 9, 11, 15, 16, 25) on HOLIDAY PAGE

9-15Db

Operating Engineer - Building, Maintenance, Steel Erection & Heavy Construction

12/01/2024

JOB DESCRIPTION Operating Engineer - Building, Maintenance, Steel Erection & Heavy Construction

DISTRICT 9

ENTIRE COUNTIES

Bronx, Kings, New York, Queens, Richmond

WAGES

STEEL ERECTION:

Group 1: Derrick, travelers, tower, crawler tower & climbing cranes

Group 2: Oiler (Truck Crane)

Group 3: Oiler (Crawler Crane)

BUILDING CONSTRUCTION:

Group 1: Installing, repairing, maintaining, dismantling of all equipment including Steel cutting & bending machines, mechanical heaters, mine hoists, climbing cranes, tower cranes, Linden Peine, Lorain, Liebherr, Mannes and machines of a similar nature; Well Point system, Deep Well pumps, Concrete mixers with loading devices, Concrete plants, motor generators (When used for temporary power and lights)(Driving maintenance trucks and mounted-welded machines)-All Pumps(excluding River Cofferdam Pumps and Well Point Pumps), Motorized Concrete Buggies(When three or more are on job site), Skid-Steer and similar machines

Group 2: Maintenance of: Pumps, Generators, Mixers, Heaters

Group 3: Oilers of all gasoline, electric, diesel or air operated Gradalls; Concrete Pumps, Overhead Cranes in Power Houses, Assist in oiling, greasing and repairing of all machines, including: Driving Truck Cranes, Driving and operating Fuel and Grease Trucks, Cherry Pickers(Hydraulic Cranes) over 70,000 GVW and machines of a similar nature

Group 4: Oiler on Crawler Cranes, Backhoes, Trenching Machines, Guniting Machines, Compressors(3 or more in battery)

Group 5: Maintenance on Radiant Mechanical Heaters

HEAVY CONSTRUCTION (Excavation, Foundations, etc)

Group 1: Maintenance of: Generators, Light Towers

Group 2: Maintenance of: Pumps, Mixers including mudsucking

Group 3: Base Mounted Tower Cranes

Group 4: Installing, repairing, maintaining, dismantling(of all equipment including Steel cutting & Bending machines, Fusion Coupling Machines, Vermeer Trenching machines, on-site crushing plant, mechanical heaters(1 through 7), Mine hoists, Tower Cranes, Linden Peine, Lorraine, Liebherr, Mannes or machines of a similar nature, Wellpoints)-Driving maintenance trucks and truck mounted welding machines, burning, welding-operating of accumulator for shield-driven tunnels, in addition to the performance of other duties: Handling, installation, jointing, coupling of all permanent steel and plastic pipe. RIDE UPON MOLES-tunnel boring machines-MICRO TUNNELING SYSTEMS, All temporary pipefitting; When three or more motorized concrete buggies(Ride type) are utilized on the jobsite they shall be serviced, maintained and repaired by the maintenance engineer. The Operating Engineer on autogrades(C.M.I.) is to be assisted by the maintenance engineer who shall in addition perform other duties.

WAGES:

Per hour: 07/01/2024

Steel Erection:

Group 1	\$ 81.43
Group 2	76.58
Group 3	58.22

Building Construction:

Group 1	\$ 72.41
Group 2	57.36
Group 3	69.09
Group 4	52.62
Group 5	46.07

Heavy Construction:

Group 1	\$ 57.43
Group 2	58.68
Group 3	108.95
Group 4	84.24

SUPPLEMENTAL BENEFITS

Per Hour: 07/01/2024

Building Construction	\$ 30.52* + \$7.40
Steel Erection & Heavy	31.02* + \$7.40

* This portion of benefits is subject to same OT premium as wages.

Non-Worked Holiday Supplemental Benefits:

21.87

OVERTIME PAY

See (D, O) on OVERTIME PAGE

HOLIDAY

Paid: See (5, 6, 9, 11, 15, 16, 25) on HOLIDAY PAGE
Overtime: See (5, 6, 9, 11, 15, 16, 25) on HOLIDAY PAGE

REGISTERED APPRENTICES

Wages Per Hour:

(1) year terms at the following wage rates:

1st	2nd	3rd	4th.
\$ 38.52	\$ 45.23	\$ 48.70	\$ 52.17

Supplemental Benefits:

Per Hour:

All Terms \$ 16.52* + 7.40

* This portion of benefits is subject to same OT premium as wages.

9-15Ab

Operating Engineer - Building / Heavy&Highway

12/01/2024

JOB DESCRIPTION Operating Engineer - Building / Heavy&Highway

DISTRICT 9

ENTIRE COUNTIES

Bronx, Kings, New York, Queens, Richmond

WAGES

EQUIPMENT COVERED: Jet-Rodder/Vacuum Truck, Flusher, Sewer Rodder, Stetco Hoist and similar, Sewer Winch/Tugger Hoist and similar, Vacall/Vactor, Closed Circuit Television Inspection Equipment, Chemical Grouting Equipment and similar, John Beame, Meyers and similar.

Per Hour: 07/01/2024

Maintenance Engineer \$ 84.24
(Sewer Systems)

SUPPLEMENTAL BENEFITS

Per Hour:

Journeyman \$ 31.02*
+ \$ 7.40

*This portion of benefits subject to SAME premium as OT wages.

Non-Worked Holiday Supplemental Benefits:

\$ 21.87

OVERTIME PAY

See (D, O) on OVERTIME PAGE

HOLIDAY

Paid: See (5, 6, 7, 11, 16) on HOLIDAY PAGE

Overtime: See (5, 6, 7, 11, 16) on HOLIDAY PAGE

REGISTERED APPRENTICES

Per Hour:

(1) year terms at the following wage rates.

1st	2nd	3rd	4th
\$38.52	\$45.23	\$48.70	\$52.17

Supplemental Benefits:

Per Hour:

All Apprentices: \$ 16.52* + \$ 7.40

* This portion of benefits subject to the SAME premium as OT wages

9-15Sewer

Operating Engineer - Building / Heavy&Highway

12/01/2024

JOB DESCRIPTION Operating Engineer - Building / Heavy&Highway

DISTRICT 4

ENTIRE COUNTIES

Bronx, Kings, Nassau, New York, Queens, Richmond, Suffolk

WAGES

Per Hour: 07/01/2024 08/01/2024

Well Driller	\$ 41.85	\$ 43.11
Well Driller Helper	\$ 36.26	\$ 37.35
Hazardous Waste Differential Added to Hourly Wage:		
Level A	\$ 3.00	
Level B	\$ 2.00	
Level C	\$ 1.00	

Monitoring Well Work Add to Hourly Wage:		
Level A	\$ 3.00	
Level B	\$ 2.00	

SUPPLEMENTAL BENEFITS

Per Hour:

Well Driller & Helper	10% of straight time rate plus \$ 13.50
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Additional \$ 4.25/Hr. for Premium Time Hours Worked

OVERTIME PAY

See (B2, P, S) on OVERTIME PAGE

HOLIDAY

Paid: See (5, 6, 16, 23) on HOLIDAY PAGE
 Overtime: See (5, 6, 16, 23) on HOLIDAY PAGE

REGISTERED APPRENTICES

Apprentices at 12 Month Terms

Wages Per Hour:

1st Term	\$ 28.00
2nd Term	\$ 29.00
3rd Term	\$ 30.00

SUPPLEMENTAL BENEFITS

Per Hour:

All Terms	10% of Wage + \$ 13.50
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Additional \$4.25/Hr. for premium time hours worked.

4-138well

Operating Engineer - Building & Steel Erection

12/01/2024

JOB DESCRIPTION Operating Engineer - Building & Steel Erection

DISTRICT 9

ENTIRE COUNTIES

Bronx, Kings, New York, Queens, Richmond

WAGES

Per Hour: 07/01/2024

STEEL ERECTION:

Three Drum Derricks	\$ 107.16
Cranes, Two Drum Derricks, Hydraulic Cranes & Fork Lifts, Boom Trucks	103.28
Compressors, Welding Machines	63.36
Compressors (not combined with welding machines)	60.71

BUILDING CONSTRUCTION:

Cranes, Stone Derrick, Boom Trucks, Hydraulic Cranes,	103.62
Double Drum	98.28
4 Pole Hoists and Single Drum Hoists	87.78

Fork Lifts, Plaster(Platform Machine)Plaster Bucket, Concrete Pumps and all other equipment used for hoisting	80.54
*House Cars and Rack & Pinion	71.35
*House Cars (New Projects)	58.47
Erecting and dismantling Cranes	88.64

Compressors, Welding Machines(Cutting Concrete-Tank Work),
 Paint Spraying, Sand Blasting, Pumps(With the exclusion of
 concrete pumps), House Car (Settlement basis only), All
 Engines irrespective of power(Power-Vac)used to drive
 auxiliary equipment Air, Hydraulic, etc., Boilers, Jacking System
 62.20

APPLICABLE TO BUILDING CATEGORY:

CRANES: Crawler Or Truck

	In Addition To Above Crane Rates
100' to 149' Boom	\$ 1.75/hr
150' to 249' "	\$ 2.00/hr
250' to 349' "	\$ 2.25/hr
350' to 450' "	\$ 2.75/hr
Tower Crane	\$ 2.00/hr

APPLICABLE TO STEEL CATEGORY:

CRANES: Crawler Or Truck

	In Addition To Above Crane Rates
100' to 149' Boom	\$ 2.25/hr
150' to 249' "	\$ 2.50/hr
250' to 349' "	\$ 2.75/hr
350' to 450' "	\$ 3.25/hr
Tower Crane	\$ 2.50/hr

SUPPLEMENTAL BENEFITS

Per Hour: 07/01/2024

All Operator Classes \$ 26.15*
 plus \$ 6.30

* This portion of the benefits is subject to the same premium as shown for overtime wages.

OVERTIME PAY

See (*B, **C, ***D, O) on OVERTIME PAGE

*Applies to House Cars and Rack & Pinion after 8 hours worked in a day, Saturday, Sunday and Holidays

**Applies to Building Construction category

***Applies to Steel Erection

HOLIDAY

Paid: See (5, 6, 8, 11, 12, 15, 16, 25, 26) on HOLIDAY PAGE

Overtime: See (5, 6, 8, 11, 12, 15, 16, 25, 26) on HOLIDAY PAGE

Codes 8 and 12 apply ONLY to Steel Erection

Code 16 applies ONLY to Building Construction

REGISTERED APPRENTICES

Wage Per Hour:

Apprentices (1) year terms at the following rates:

	1st	2nd	3rd
07/01/2024	\$ 44.92	\$ 54.40	\$ 63.88

Supplemental Benefits Per Hour:

07/01/2024

Straight Time \$ 15.65*
 plus \$ 6.30

* This portion of benefits subject to the same premium as shown for overtime wages.

JOB DESCRIPTION Operating Engineer - Heavy Construction 1

DISTRICT 9

ENTIRE COUNTIES

Bronx, Kings, New York, Queens, Richmond

WAGES

(For Groups 23 - 28, see Operating Engineer - Heavy Construction 2)

- Group 1: Tower Crane/Climbing Crane
- Group 2: Backhoes (Including all track and rubber tire backhoes over 37,000 lbs), Power Shovels, Steel Erection: Hydraulic Clam Shells, Moles and machines of a similar nature
- Group 3: Mine Hoists, Cranes, etc, used as Mine Hoists
- Group 4: Gradalls, Keystones, Cranes (With digging buckets), Bridge Cranes, Trenching Machines, Vermeer Cutter and machines of a similar nature
- Group 5: Pile Drivers and Rigs (Employing Dock-Builders Foreman), Derrick Boats, Tunnel Shovels,
- Group 6: All Drills and machines of a similar nature
- Group 7: Back-Filling Machines and Cranes, Mucking Machines, Dual Drum Pavers
- Group 8: Mixers (Concrete with loading attachment), Concrete Pavers, Cableways, Land Derricks, Power House (Low pressure units)
- Group 9: Concrete Pumps, Concrete Plant, Stone Crushers, Double Drum Hoists, Power Houses (Other than above)
- Group 10: Concrete Mixer
- Group 11: Elevators
- Group 12: Concrete Breaking Machines, Single Drum Hoists, Load Masters, Locomotives and Dinkies (Over 10 tons), Hydraulic Crane-Second Engineer
- Group 13: On-Site Concrete Plant Engineers, On-Site Asphalt Plant Engineer and Vibratory Console
- Group 14: Barrier Mover, Barrier Transport and machines of a similar nature
- Group 15: Compressors (Portable, 3 or more), Truck Compressor (Engineer Driver), Tugger Machines, Well Point Pumps, Chum Drill
- Group 16: Boilers(High pressure),Compressors, Pumps(River Cofferdam) and Welding Machines(except where arc is operated by another Operating Engineer) Push Button Machines, All Engines, irrespective of power(Power Pac) used to drive auxiliary equipment, Air, Hydraulic, etc.
- Group 17: Utility-Horizontal Boring Rig
- Group 18: Utility Compressors
- Group 19: Paving-Asphalt Spreader, Autogrades (C.M.I.), Roto-Mill
- Group 20: Paving-Asphalt Roller
- Group 21 Paving-Asphalt Plant
- Group 22: Roller (non paving, all sizes)

WAGES:(per hour) 07/01/2024

Group 1	\$ 123.06
Group 2	102.98
Group 3	106.03
Group 4	103.66
Group 5	101.78
Group 6	98.05
Group 7	99.74
Group 8	97.10
Group 9	95.24
Group 10	91.40
Group 11	85.94
Group 12	87.66
Group 13	88.24
Group 14	80.02
Group 15	68.59
Group 16	64.34
Group 17	92.77
Group 18	63.97
Group 19	97.10
Group 20	94.83
Group 21	81.44
Group 22	94.83

Cranes: Crawler or Truck

100' to 149'	\$0.50 per hour additional to above Crane Rates
150' to 249'	\$0.75 per hour additional to above Crane Rates
250' to 349'	\$1.00 per hour additional to above crane Rates
350' to 450'	\$1.50 per hour additional to above crane Rates

SUPPLEMENTAL BENEFITS

Per Hour:
Groups 1-22

Regular Time \$ 26.15* plus \$ 6.30

* This portion of benefits subject to the same premium as shown for wages.

Non-Worked Holiday Supplemental Benefits:
 \$ 20.80

OVERTIME PAY
 See (D, O) on OVERTIME PAGE

HOLIDAY
 Paid: See (5, 6, 11, 15, 16, 25, 26) on HOLIDAY PAGE
 Overtime: See (5, 6, 11, 15, 16, 25, 26) on HOLIDAY PAGE

REGISTERED APPRENTICES
 Per Hour:
 (1) year terms at the following wage rates:

Groups 1-22	1st	2nd	3rd
	\$ 44.92	\$ 54.40	\$ 63.88

Supplemental Benefits:

Groups 1-22	
Regular Time	\$ 15.65* plus \$ 6.30

* This portion of benefits is subject to the SAME PREMIUM as shown for overtime wages

9-14 HC

Operating Engineer - Heavy Construction 2 **12/01/2024**

JOB DESCRIPTION Operating Engineer - Heavy Construction 2 **DISTRICT 9**

ENTIRE COUNTIES
 Bronx, Kings, New York, Queens, Richmond

WAGES
 (For Groups 1 - 22, see Operating Engineer - Heavy Construction 1)

Group 23: Cherry Picker (Over 20 tons), Loader (Over 6 yards)

Group 24: Backhoes and Loaders (Up to 37,000lbs), Bulldozers, Scrapers, Turn-A-Pulls, Tugger Hoists, Tractors, Hysters, Roustabout Cranes, Conveyors, Ballast Regulators (Ride On), Track Removal Machine or similar, Motor Graders, Locomotives (10 tons and under), Curb & Gutter Pavers and machines of a similar nature

Group 25: Post Hole Digger, Ditch Winch, Road Finishing Machines, Rollers (5 tons and under, Dual Purpose Trucks, Forklifts, Dempsey Dumpsters, Fireman

Group 26: Service Engineer (Gradalls, Concrete Pumps, Cold Planers Grader)

Group 27: Service Mechanic (Shovels, Draglines, Crawler Cranes, Backhoes, Trenching Machines, Compressors (3 or more in battery)

Group 28: Steam Equipment Operator (Water rigs, steam shovels, power boilers, derrick boats)

WAGES:(per hour) 07/01/2024

Group 23	\$ 87.05
Group 24	84.62
Group 25	80.57
Group 26	76.47
Group 27	54.57
Group 28	80.57

Cranes: Crawler or Truck
 100' to 149' \$0.50 per hour additional to above Crane Rates
 150' to 249' \$0.75 per hour additional to above Crane Rates
 250' to 349' \$1.00 per hour additional to above crane Rates
 350' to 450' \$1.50 per hour additional to above crane Rates

SUPPLEMENTAL BENEFITS
 Per Hour:

Groups 23-28
 Regular Time 31.02* + \$7.40

* This portion of benefits subject to the same OT premium as wages.

Non-Worked Holiday Supplemental Benefits:
 21.87

OVERTIME PAY
 See (D, O) on OVERTIME PAGE

HOLIDAY
 Paid: See (5, 6, 7, 11, 16) on HOLIDAY PAGE
 Overtime: See (5, 6, 7, 11, 16) on HOLIDAY PAGE

REGISTERED APPRENTICES

Per Hour:
 (1) year terms at the following wage rates:

	1st	2nd	3rd	4th
Groups 23-28	\$38.52	\$45.23	\$48.70	\$52.17

Supplemental Benefits:
 Regular Time \$ 16.52* + \$ 7.40

* This portion of benefits subject to same OT premium as wages.

9-15 HC

Operating Engineer - Marine Dredging **12/01/2024**

JOB DESCRIPTION Operating Engineer - Marine Dredging

DISTRICT 4

ENTIRE COUNTIES

Albany, Bronx, Cayuga, Clinton, Columbia, Dutchess, Essex, Franklin, Greene, Jefferson, Kings, Monroe, Nassau, New York, Orange, Oswego, Putnam, Queens, Rensselaer, Richmond, Rockland, St. Lawrence, Suffolk, Ulster, Washington, Wayne, Westchester

WAGES

These wages do not apply to Operating Engineers on land based construction projects. For those projects, please see the Operating Engineer Heavy/Highway Rates. The wage rates below for all equipment and operators are only for marine dredging work in navigable waters found in the counties listed above.

Per Hour:	07/01/2024
CLASS A1 Deck Captain, Leverman, Mechanical Dredge Operator, Licensed Tug Operator 1000HP or more.	\$ 45.26
CLASS A2 Crane Operator (360 swing)	40.33
CLASS B Dozer, Front Loader Operator on Land	To conform to Operating Engineer Prevailing Wage in locality where work is being performed including benefits.
CLASS B1 Derrick Operator (180 swing) Spider/Spill Barge Operator Operator II, Fill Placer, Engineer Chief Mate, Electrician, Chief Welder, Maintenance Engineer, Licensed Boat, Crew Boat Operator	39.14
CLASS B2 Certified Welder	36.84
CLASS C1 Drag Barge Operator, Steward, Mate, Assistant Fill Placer	35.83
CLASS C2	34.68

Boat Operator

CLASS D 28.81
 Shoreman, Deckhand, Oiler,
 Rodman, Scowman, Cook,
 Messman, Porter/Janitor

SUPPLEMENTAL BENEFITS

Per Hour:
 THE FOLLOWING SUPPLEMENTAL BENEFITS APPLY TO ALL CATEGORIES

All Classes A & B \$ 12.00 plus 7%
 of straight time
 wage, Overtime hours
 add \$ 0.63

All Class C & D \$ 11.75 plus 7%
 of straight time
 wage, Overtime hours
 add \$ 0.50

OVERTIME PAY

See (B2, F, R) on OVERTIME PAGE

HOLIDAY

Paid: See (1) on HOLIDAY PAGE
 Overtime: See (5, 6, 8, 15, 26) on HOLIDAY PAGE

4-25a-MarDredge

Operating Engineer - Survey Crew - Consulting Engineer 12/01/2024

JOB DESCRIPTION Operating Engineer - Survey Crew - Consulting Engineer **DISTRICT 9**

ENTIRE COUNTIES
 Bronx, Kings, Nassau, New York, Putnam, Queens, Richmond, Suffolk, Westchester

PARTIAL COUNTIES
 Dutchess: That part in Dutchess County lying South of the North City line of Poughkeepsie.

WAGES
 Feasibility and preliminary design surveying, any line and grade surveying for inspection or supervision of construction.

Per hour: 07/01/2024
 Survey Classifications

Party Chief \$ 49.39
 Instrument Man 40.96
 Rodman 35.63

SUPPLEMENTAL BENEFITS

Per Hour:
 All Crew Members: \$ 23.75

OVERTIME PAY

OVERTIME:.... See (B, E*, Q, V) ON OVERTIME PAGE.
 *Double-time paid on the 9th hour on Saturday.

HOLIDAY

Paid: See (5, 6, 7, 11, 16) on HOLIDAY PAGE
 Overtime: See (5, 6, 7, 11, 16) on HOLIDAY PAGE

9-15dconsult

Painter 12/01/2024

JOB DESCRIPTION Painter **DISTRICT 8**

ENTIRE COUNTIES
 Bronx, Kings, Nassau, New York, Putnam, Queens, Richmond, Suffolk, Westchester

WAGES
 Per hour: 07/01/2024 05/01/2025
 Additional

Brush 52.86* \$ 2.62**

Abatement/Removal of lead based or lead containing paint on materials to be repainted.	52.86*
Spray & Scaffold	\$ 55.86*
Fire Escape	55.86*
Decorator	55.86*
Paperhanger/Wall Coverer	55.09*

*Subtract \$ 0.10 to calculate premium rate.

** To be allocated at a later date.

SHIFT WORK

Counties of Bronx, Kings, Nassau, New York, Putnam, Queens, Richmond, Suffolk, and Westchester; Agency/Government mandated off-shift work to be paid at time and one-half the hourly wage.

SUPPLEMENTAL BENEFITS

Per hour:

Paperhanger	\$ 36.73
All others	34.31
Premium	38.28**

**Applies only to "All others" category, not paperhanger journeyworker.

OVERTIME PAY

See (A, E, R) on OVERTIME PAGE

HOLIDAY

Paid: See (1) on HOLIDAY PAGE
 Overtime: See (5, 6, 16, 25) on HOLIDAY PAGE

REGISTERED APPRENTICES

One (1) year terms at the following wage rate.

Per hour:	07/01/2024
Appr 1st term...	\$ 20.22*
Appr 2nd term...	25.93*
Appr 3rd term...	31.61*
Appr 4th term...	42.40*

*Subtract \$ 0.10 to calculate premium rate.

Supplemental benefits:

Per Hour:	
Appr 1st term...	\$ 16.89
Appr 2nd term...	20.95
Appr 3rd term...	24.10
Appr 4th term...	30.57

8-NYDC9-B/S

Painter

12/01/2024

JOB DESCRIPTION Painter

DISTRICT 8

ENTIRE COUNTIES

Bronx, Kings, New York, Queens, Richmond

PARTIAL COUNTIES

Nassau: Atlantic Beach, Ceaderhurst, East Rockaway, Hewlett, Hewlett Bay, Hewlett Neck, Hewlett Park, Inwood, Lawrence, Lido Beach, Long Beach, parts of Lynbrook, parts of Oceanside, parts of Valley Stream, and Woodmere. Starting on South side of Sunrise Hwy in Valley Stream running east to Windsor and Rockaway Ave, Rockville is the boundary line up to Lawson Blvd, turning right going west all the above territory. Starting at Union Turnpike & Lakeville Rd going north to northern Blvd. the west side of Lakeville Rd to Northern Blvd. At Northern Blvd doing east the district north of Northern blvd to Port Washington blvd. West of Port Washington blvd to St. Francis Hospital then north of first traffic light to Port Washington & Sands Point, Manor Haven, & Harbour Acres.

WAGES

Per hour:	07/01/2024
Drywall Taper	\$ 57.44

SUPPLEMENTAL BENEFITS

Per Hour:	
Journeyworker:	\$ 25.29

OVERTIME PAY

See (A, E, Q) on OVERTIME PAGE

HOLIDAY

Paid: See (1) on HOLIDAY PAGE
Overtime: See (4, 6, 8, 11, 18, 19, 25, 26) on HOLIDAY PAGE

REGISTERED APPRENTICES

Wage per hour:

1st term	\$ 22.30
2nd term	28.99
3rd term	34.67
4th term	46.05

Supplemental Benefits per hour:

1st term	\$ 14.35
2nd term	19.83
3rd term	20.93
4th term	23.12

8-NYC9-1974-DWT

Painter - Bridge & Structural Steel

12/01/2024

JOB DESCRIPTION Painter - Bridge & Structural Steel

DISTRICT 8

ENTIRE COUNTIES

Albany, Bronx, Clinton, Columbia, Dutchess, Essex, Franklin, Fulton, Greene, Hamilton, Kings, Montgomery, Nassau, New York, Orange, Putnam, Queens, Rensselaer, Richmond, Rockland, Saratoga, Schenectady, Schoharie, Suffolk, Sullivan, Ulster, Warren, Washington, Westchester

WAGES

Per Hour:

STEEL:

Bridge Painting: 07/01/2024
\$ 56.00
+ 10.35*

ADDITIONAL \$7.00 per hour for POWER TOOL/SPRAY, whether straight time or overtime.

NOTE: All premium wages are to be calculated on base rate per hour only.

* For the period of May 1st to November 15th, this amount is payable up to 40 hours. For the period of Nov 16th to April 30th, this amount is payable up to 50 hours. EXCEPTION: First and last week of employment, and for the weeks of Memorial Day, Independence Day and Labor Day, where the amount is paid for the actual number of hours worked (50 hour cap).

NOTE: Generally, for Bridge Painting Contracts, ALL WORKERS on and off the bridge (including Flagmen) are to be paid Painter's Rate; the contract must be ONLY for Bridge Painting.

SHIFT WORK

When directly specified in public agency or authority contract documents for an employer to work a second shift and works the second shift with employees other than from the first shift, all employees who work the second shift will be paid 10% of the base wage shift differential in lieu of overtime for the first eight (8) hours worked after which the employees shall be paid at time and one half of the regular wage rate. When a single irregular work shift is mandated in the job specifications or by the contracting agency, wages shall be paid at time and one half for single shifts between the hours of 3pm-11pm or 11pm-7am.

SUPPLEMENTAL BENEFITS

Per Hour:

Journeyworker:

\$ 12.43
+ 31.55*

* For the period of May 1st to November 15th, this amount is payable up to 40 hours. For the period of Nov 16th to April 30th, this amount is payable up to 50 hours. EXCEPTION: First and last week of employment, and for the weeks of Memorial Day, Independence Day and Labor Day, where the amount is paid for the actual number of hours worked (50 hour cap).

OVERTIME PAY

See (B, F, R) on OVERTIME PAGE

HOLIDAY

Paid: See (1) on HOLIDAY PAGE
Overtime: See (4, 6) on HOLIDAY PAGE

REGISTERED APPRENTICES

Wage - Per hour:

Apprentices: (1) year terms.

1st year \$ 22.40
 + 4.14

2nd year \$ 33.60
 + 6.21

3rd year \$ 44.80
 + 8.28

Supplemental Benefits - Per hour:

1st year \$ 1.16
 + 12.62

2nd year \$ 7.46
 + 18.93

3rd year \$ 9.94
 + 25.24

NOTE: All premium wages are to be calculated on base rate per hour only.

8-DC-9/806/155-BrSS

Painter - Metal Polisher

12/01/2024

JOB DESCRIPTION Painter - Metal Polisher

DISTRICT 8

ENTIRE COUNTIES

Albany, Allegany, Bronx, Broome, Cattaraugus, Cayuga, Chautauqua, Chemung, Chenango, Clinton, Columbia, Cortland, Delaware, Dutchess, Erie, Essex, Franklin, Fulton, Genesee, Greene, Hamilton, Herkimer, Jefferson, Kings, Lewis, Livingston, Madison, Monroe, Montgomery, Nassau, New York, Niagara, Oneida, Onondaga, Ontario, Orange, Orleans, Oswego, Otsego, Putnam, Queens, Rensselaer, Richmond, Rockland, Saratoga, Schenectady, Schoharie, Schuylar, Seneca, St. Lawrence, Steuben, Suffolk, Sullivan, Tioga, Tompkins, Ulster, Warren, Washington, Wayne, Westchester, Wyoming, Yates

WAGES

07/01/2024
 Metal Polisher \$ 39.33
 Metal Polisher* 40.43
 Metal Polisher** 43.33

*Note: Applies on New Construction & complete renovation

** Note: Applies when working on scaffolds over 34 feet.

SUPPLEMENTAL BENEFITS

Per Hour: 07/01/2024

Journeyworker:

All classification \$ 12.79

OVERTIME PAY

See (B, E, P, T) on OVERTIME PAGE

HOLIDAY

Paid: See (5, 6, 11, 15, 16, 25, 26) on HOLIDAY PAGE

Overtime: See (5, 6, 11, 15, 16, 25, 26) on HOLIDAY PAGE

REGISTERED APPRENTICES

Wages per hour:

One (1) year term at the following wage rates:

07/01/2024

1st year \$ 19.67
 2nd year 21.63
 3rd year 23.60

1st year* \$ 22.06
 2nd year* 22.07
 3rd year* 24.14

1st year**	\$ 22.17
2nd year**	24.13
3rd year**	26.10

*Note: Applies on New Construction & complete renovation

** Note: Applies when working on scaffolds over 34 feet.

Supplemental benefits:

Per hour:

1st year	\$ 8.69
2nd year	8.69
3rd year	8.69

8-8A/28A-MP

Plasterer

12/01/2024

JOB DESCRIPTION Plasterer

DISTRICT 9

ENTIRE COUNTIES

Bronx, Kings, Nassau, New York, Queens, Richmond, Suffolk

WAGES

Per hour:

	07/01/2024	08/01/2024
Building:		
Plasterer/Traditional & Spraying Fireproofing	\$ 47.72 + \$5.00*	\$ 47.99 + \$5.62*

SUPPLEMENTAL BENEFITS

Per hour:

Journeyworker	\$ 25.35	\$ 26.10
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OVERTIME PAY

See (B, E, Q) on OVERTIME PAGE

*This portion is not subjected to OT premiums.

HOLIDAY

Paid: See (1) on HOLIDAY PAGE

Overtime: See (5, 6, 25) on HOLIDAY PAGE

REGISTERED APPRENTICES

	07/01/2024	08/01/2024
Wages:		
(Per hour)		
800 hours term:		
1st term	\$ 19.30 + 0.68*	\$ 19.44+ 0.68*
2nd term	22.53 + 0.81*	22.69+ 0.81*
3rd term	25.79 + 0.95*	25.98+ 0.95*

*This portion is not subjected to OT premiums.

Supplemental Benefits:

(Per hour):

(800) hours term:

1st term	\$ 11.59	\$ 11.95
2nd term	12.02	12.44
3rd term	12.52	13.08

9-262

Plumber

12/01/2024

JOB DESCRIPTION Plumber

DISTRICT 9

ENTIRE COUNTIES

Bronx, Kings, New York, Queens, Richmond

WAGES

Per hour:

07/01/2024

Plumber \$ 74.95

Temporary Service** \$ 60.04

** Temporary Service- Includes Maintenance of cooling & heating apparatus, maintenance work on pneumatic systems during the construction period, and work on temporary heat. All hours paid at straight time, including holidays.

**THERE ARE NO HELPERS UNDER THIS CLASSIFICATION.

On tower work, bridges, elevated highway, or buildings, where pipe is being installed, fifty (50) or more feet vertically in a free drop from its base, an additional \$1.00 per hour.

SHIFT WORK

Shift work, when directly specified in public agency or authority contract documents, and continues for a period of not less than ten (10) consecutive work days. A shift shall consist of seven(7) hours with one-half (1/2) hour for lunch after the first four (4) hours of each shift. A premium of thirty percent (30%) for wages and supplemental benefits on shift work performed Monday through Friday on the 4 P.M. and midnight shifts.

For shift work performed on weekends the shift premium shall be fifty percent (50%) of wages and supplemental benefits.

For shift work performed on holidays designated below, double time wages and supplemental benefits shall be paid. Also noted that the normal workday Monday through Friday 8:00 A.M. to 3:00 P.M. is not considered shift work, and therefore not subject to shift premium.

SUPPLEMENTAL BENEFITS

Per hour:

Plumber \$ 43.00

Temporary Service \$ 34.32

OVERTIME PAY

See (C, *D, O, V) on OVERTIME PAGE

*Where the plumbing contract price is one and one half million dollars (\$1,500,000.00) or less, code D applies.

HOLIDAY

Plumber
 Overtime: See (5, 6, 11, 15, 16, 25) on HOLIDAY PAGE.
 Repairs & Maintenance
 Paid: See (1) on HOLIDAY PAGE.
 Overtime: See (5, 6, 25) on HOLIDAY PAGE.

REGISTERED APPRENTICES

Wages per hour:

(1/2) year terms at the following wage:

1st	2nd	3rd&4th	5th&6th	7th&8th	9th	10th
\$ 19.00	\$ 21.00	\$ 30.22	\$ 32.32	\$ 35.17	\$ 36.57	\$ 48.64

Supplemental Benefits:

(1/2) year term at the following dollar amount:

1st	2nd	3rd-10th
\$ 5.43	\$ 6.43	\$ 22.73

9-1 Const

Plumber - Pump & Tank: Oil Trades Installation & Maintenance

12/01/2024

JOB DESCRIPTION Plumber - Pump & Tank: Oil Trades Installation & Maintenance

DISTRICT 9

ENTIRE COUNTIES

Bronx, Kings, New York, Queens, Richmond

WAGES

Per hour:

07/01/2024

Pump & Tank \$ 73.00

SUPPLEMENTAL BENEFITS

Per hour:

Plumber \$ 32.81

OVERTIME PAY

Pump & Tank See (B, F, H) on OVERTIME PAGE.

HOLIDAY

Paid: See (1) on HOLIDAY PAGE.

Overtime: See (5, 6, 10, 11, 12, 16, 25) on HOLIDAY PAGE.

9-1-P&T

Plumber - Repairs & Maintenance

12/01/2024

JOB DESCRIPTION Plumber - Repairs & Maintenance

DISTRICT 9

ENTIRE COUNTIES

Bronx, Kings, New York, Queens, Richmond

WAGES

Per hour:

Repairs & Maintenance 07/01/2024
\$ 48.20

*Repair & Maintenance work is any repair and/or replacement of present plumbing system that does not change existing roughing or water supply lines. Projects regardless of work type which have approved plans and specifications wherein the plumbing exceeds \$725,000 are excluded.

SUPPLEMENTAL BENEFITS

Per hour:

Repair \$ 21.36
Maintenance

OVERTIME PAY

Repairs & Maintenance See (B, H) on OVERTIME PAGE.

HOLIDAY

Repairs & Maintenance

Paid: See (1) on HOLIDAY PAGE.

Overtime: See (5, 6, 25) on HOLIDAY PAGE.

REGISTERED APPRENTICES

Note: The Repairs & Maintenance Category has NO Apprentices.

9-1 R&M

Roofer

12/01/2024

JOB DESCRIPTION Roofer

DISTRICT 9

ENTIRE COUNTIES

Bronx, Dutchess, Kings, New York, Orange, Putnam, Queens, Richmond, Rockland, Sullivan, Ulster, Westchester

WAGES

Per Hour: 07/01/2024

Roofer/Waterproofer \$ 48.50
+ \$7.00*

* This portion is not subjected to overtime premiums.

Note: Abatement/Removal of Asbestos containing roofs and roofing material is classified as Roofer.

SUPPLEMENTAL BENEFITS

Per Hour: \$ 31.87

OVERTIME PAY

See (B, H) on OVERTIME PAGE

Note: An observed holiday that falls on a Sunday will be observed the following Monday.

HOLIDAY

Overtime: See (5, 6) on HOLIDAY PAGE

REGISTERED APPRENTICES

(1) year term apprentices indentured prior to 01/01/2023

	1st	2nd	3rd	4th
	\$ 16.97	\$ 24.25	\$ 29.10	\$ 36.37
		+ 3.50*	+ 4.20*	+ 5.26*

Supplements:

1st	2nd	3rd	4th
\$ 4.10	\$ 16.17	\$ 19.31	\$ 24.02

* This portion is not subjected to overtime premiums.

(1) year term apprentices indentured after 01/01/2023

1st	2nd	3rd	4th	5th
\$ 18.43	\$ 21.82	\$ 24.25	\$ 29.10	\$ 36.37
	+ 3.16*	+ 3.50*	+ 4.20*	+ 5.26

Supplements:

1st	2nd	3rd	4th	5th
\$ 7.73	\$ 14.59	\$ 16.17	\$ 19.31	\$ 24.02

* This portion is not subjected to overtime premiums.

9-8R

Sheetmetal Worker **12/01/2024**

JOB DESCRIPTION Sheetmetal Worker

DISTRICT 4

ENTIRE COUNTIES

Bronx, Kings, Nassau, New York, Queens, Richmond, Rockland, Suffolk, Westchester

WAGES

Per Hour:

07/01/2024	08/01/2024
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Sign Erector	\$ 58.00	\$ 60.00
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NOTE: Structurally Supported Overhead Highway Signs(See STRUCTURAL IRON WORKER CLASS)

SUPPLEMENTAL BENEFITS

Per Hour:

07/01/2024	08/01/2024
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Sign Erector	\$ 57.12	\$ 58.31
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OVERTIME PAY

See (B, F, S) on OVERTIME PAGE

HOLIDAY

Paid: See (5, 6, 10, 11, 12, 16, 25) on HOLIDAY PAGE

Overtime: See (5, 6, 10, 11, 12, 16, 25) on HOLIDAY PAGE

REGISTERED APPRENTICES

Per Hour:

6 month Terms at the following percentage of Sign Erectors wage rate:

1st	2nd	3rd	4th	5th	6th	7th	8th	9th	10th
35%	40%	45%	50%	55%	60%	65%	70%	75%	80%

SUPPLEMENTAL BENEFITS

Per Hour:

07/01/2024

1st	2nd	3rd	4th	5th	6th	7th	8th	9th	10th
\$ 18.27	\$ 20.75	\$ 25.22	\$ 25.70	\$ 34.66	\$ 37.74	\$ 41.65	\$ 44.78	\$ 47.93	\$ 51.04

08/01/2024

\$ 18.65	\$ 21.16	\$ 23.69	\$ 26.22	\$35.39	\$ 38.52	\$ 42.55	\$ 45.75	\$ 48.96	\$ 52.15 4-137-SE
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Sheetmetal Worker **12/01/2024**

JOB DESCRIPTION Sheetmetal Worker

DISTRICT 4

ENTIRE COUNTIES

Bronx, Kings, Nassau, New York, Queens, Richmond, Suffolk

WAGES

Per Hour:

07/01/2024

Sheetmetal Worker	\$ 61.09
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Maintenance of Fans 48.87
 Temporary Operation

SUPPLEMENTAL BENEFITS

Per Hour:

Sheetmetal Worker \$ 53.25

Maintenance Worker 53.25

OVERTIME PAY

See (B, E, E2, Q, V) on OVERTIME PAGE

For Maintenance See Codes B,E, Q & V

HOLIDAY

Paid: See (1) on HOLIDAY PAGE

Overtime: See (5, 6, 11, 15, 16, 25, 26) on HOLIDAY PAGE

REGISTERED APPRENTICES

Per Hour:Wages

Six(6) Month Terms As Follows:

1st & 2nd Term \$ 21.26
 3rd & 4th Term 27.39
 5th & 6th Term 33.52
 7th & 8th Term 42.75
 9th Term 48.55

Per Hour: Supplemental Benefits

1st & 2nd Term \$ 19.66
 3rd & 4th Term 26.73
 5th & 6th Term 31.57
 7th & 8th Term 38.78
 9th Term 43.62

4-28

Steamfitter

12/01/2024

JOB DESCRIPTION Steamfitter

DISTRICT 4

ENTIRE COUNTIES

Bronx, Kings, Nassau, New York, Queens, Richmond, Suffolk

WAGES

Per Hour: 07/01/2024 01/01/2025

AC Service/Heat Service \$ 46.10 Additional
 & Refrigeration \$1.25/Hr.*

(*)To be allocated at a later date.

Refrigeration, A/C, Oil Burner and Stoker Service and Repair.

NOTE: Refrigeration Compressor installation. (Not to exceed 5 Hp combined on any one project).

NOTE: Air / Heating Compressor installation.(Not to exceed 15 tons combined on any one project).

SUPPLEMENTAL BENEFITS

Per Hour Worked:

AC Service/Heat Service \$ 20.96
 & Refrigeration

Per hour Paid: \$ 17.65

OVERTIME PAY

See (B, E, Q) on OVERTIME PAGE

HOLIDAY

Overtime: See (5, 6, 11, 15, 25, 26) on HOLIDAY PAGE

REGISTERED APPRENTICES

1 year terms
 Wages per hour:

1st Term	\$ 22.31
2nd Term	26.94
3rd Term	31.38
4th Term	37.90

Benefits per hour worked:

1st Term	\$ 14.44
2nd Term	16.78
3rd Term	17.41
4th Term	19.44

Benefits per hour paid:

1st Term	\$ 11.38
2nd Term	13.72
3rd Term	14.35
4th Term	16.38

4-638B-StmFtrRef

Steamfitter

12/01/2024

JOB DESCRIPTION Steamfitter

DISTRICT 4

ENTIRE COUNTIES

Bronx, Kings, Nassau, New York, Queens, Richmond, Suffolk

WAGES

Per Hour:	07/01/2024	10/1/2024	03/31/2025
Sprinkler/Steam AC/Heat Fitter	\$ 69.11	Additional \$0.75/Hr*	Additional \$0.75/Hr*
Temporary Heat & AC Fitter	52.54	Additional \$0.75/Hr*	Additional \$0.75/Hr*

(*)To be allocated at a later date.

SHIFT WORK

Add 15% to Hourly Wage for "Contracting Agency" Mandated Off Shift Work.

Add 15% to Hourly Supplemental Benefit for "Contracting Agency" Mandated Off Shift Work.

SUPPLEMENTAL BENEFITS

Per Hour:

Sprinkler/Steam Fitter	\$ 53.49
Temporary Heat & AC Fitter	43.67

OVERTIME PAY

Note: The posted overtime rates are applicable after 8 hours plus Saturday, Sunday and Holidays:

Per Hour:

Sprinkler/Steam	WAGES \$ 138.22	SUPPLEMENTAL BENEFIT \$ 105.99
Temp Heat/AC	WAGES \$ 105.08	SUPPLEMENTAL BENEFIT \$ 85.35

HOLIDAY

Paid: See (1) on HOLIDAY PAGE
 Overtime: See (5, 6, 11, 16, 25) on HOLIDAY PAGE

REGISTERED APPRENTICES

1 year Terms at the Following:

WAGES per hour:

1st Term	2nd Term	3rd Term	4th Term	5th Term
\$ 27.98	\$ 34.96	\$ 41.94	\$ 48.92	\$ 55.90
SUPPLEMENTAL BENEFIT per hour:				
1st Term	2nd Term	3rd Term	4th Term	5th Term
\$ 21.80	\$ 27.05	\$ 32.28	\$ 37.53	\$ 42.76
Premium Time SUPPLEMENTAL BENEFIT Amounts:				
\$ 43.60	\$ 54.10	\$ 64.56	\$ 75.06	\$ 85.52

4-638A-StmSpFtr

Teamster - Heavy Construction **12/01/2024**

JOB DESCRIPTION Teamster - Heavy Construction

DISTRICT 4

ENTIRE COUNTIES

Bronx, Kings, New York, Queens, Richmond

WAGES

Per Hour:

Dump Trucks/Drivers (Debris Removal, Street Level and below)
 07/01/2024

Dump Trucks	\$ 44.165
Tractor Trailers	47.315
Euclid/Turnapull	47.88

SUPPLEMENTAL BENEFITS

Per Hour:

Dump Trucks	\$ 59.1525
All Others	56.9025
Up to 40 Hours Worked	

OVERTIME PAY

See (B, E, Q) on OVERTIME PAGE

HOLIDAY

Paid: See (5, 6, 11, 15, 16, 25) on HOLIDAY PAGE

Note: Employees receive 2 hours of Holiday Pay for each day worked in holiday week (not to exceed 8 hours)

Note: Employees receive 5 1/3 hours of Holiday Pay for each day worked in Thanksgiving Holiday Week.

4-282

Welder **12/01/2024**

JOB DESCRIPTION Welder

DISTRICT 1

ENTIRE COUNTIES

Albany, Allegany, Bronx, Broome, Cattaraugus, Cayuga, Chautauqua, Chemung, Chenango, Clinton, Columbia, Cortland, Delaware, Dutchess, Erie, Essex, Franklin, Fulton, Genesee, Greene, Hamilton, Herkimer, Jefferson, Kings, Lewis, Livingston, Madison, Monroe, Montgomery, Nassau, New York, Niagara, Oneida, Onondaga, Ontario, Orange, Orleans, Oswego, Otsego, Putnam, Queens, Rensselaer, Richmond, Rockland, Saratoga, Schenectady, Schoharie, Schuylar, Seneca, St. Lawrence, Steuben, Suffolk, Sullivan, Tioga, Tompkins, Ulster, Warren, Washington, Wayne, Westchester, Wyoming, Yates

WAGES

Per hour 07/01/2024

Welder: To be paid the same rate of the mechanic performing the work.*

*EXCEPTION: If a specific welder certification is required, then the 'Certified Welder' rate in that trade tag will be paid.

OVERTIME PAY

HOLIDAY

1-As Per Trade

Overtime Codes

Following is an explanation of the code(s) listed in the OVERTIME section of each classification contained in the attached schedule. Additional requirements may also be listed in the HOLIDAY section.

NOTE: Supplemental Benefits are 'Per hour worked' (for each hour worked) unless otherwise noted

- (AA) Time and one half of the hourly rate after 7 and one half hours per day
- (A) Time and one half of the hourly rate after 7 hours per day
- (B) Time and one half of the hourly rate after 8 hours per day
- (B1) Time and one half of the hourly rate for the 9th & 10th hours week days and the 1st 8 hours on Saturday.
Double the hourly rate for all additional hours
- (B2) Time and one half of the hourly rate after 40 hours per week
- (B3) Time and one half of the hourly rate after 40 straight hours per week
- (C) Double the hourly rate after 7 hours per day
- (C1) Double the hourly rate after 7 and one half hours per day
- (D) Double the hourly rate after 8 hours per day
- (D1) Double the hourly rate after 9 hours per day
- (E) Time and one half of the hourly rate on Saturday
- (E1) Time and one half 1st 4 hours on Saturday; Double the hourly rate all additional Saturday hours
- (E2) Saturday may be used as a make-up day at straight time when a day is lost during that week due to inclement weather
- (E3) Between November 1st and March 3rd Saturday may be used as a make-up day at straight time when a day is lost during that week due to inclement weather, provided a given employee has worked between 16 and 32 hours that week
- (E4) Saturday and Sunday may be used as a make-up day at straight time when a day is lost during that week due to inclement weather
- (E5) Double time after 8 hours on Saturdays
- (F) Time and one half of the hourly rate on Saturday and Sunday
- (G) Time and one half of the hourly rate on Saturday and Holidays
- (H) Time and one half of the hourly rate on Saturday, Sunday, and Holidays
- (I) Time and one half of the hourly rate on Sunday
- (J) Time and one half of the hourly rate on Sunday and Holidays
- (K) Time and one half of the hourly rate on Holidays
- (L) Double the hourly rate on Saturday
- (M) Double the hourly rate on Saturday and Sunday
- (N) Double the hourly rate on Saturday and Holidays
- (O) Double the hourly rate on Saturday, Sunday, and Holidays
- (P) Double the hourly rate on Sunday
- (Q) Double the hourly rate on Sunday and Holidays
- (R) Double the hourly rate on Holidays

- (S) Two and one half times the hourly rate for Holidays
- (S1) Two and one half times the hourly rate the first 8 hours on Sunday or Holidays One and one half times the hourly rate all additional hours.
- (T) Triple the hourly rate for Holidays
- (U) Four times the hourly rate for Holidays
- (V) Including benefits at SAME PREMIUM as shown for overtime
- (W) Time and one half for benefits on all overtime hours.
- (X) Benefits payable on Paid Holiday at straight time. If worked, additional benefit amount will be required for worked hours. (Refer to other codes listed.)

Holiday Codes

PAID Holidays:

Paid Holidays are days for which an eligible employee receives a regular day's pay, but is not required to perform work. If an employee works on a day listed as a paid holiday, this remuneration is in addition to payment of the required prevailing rate for the work actually performed.

OVERTIME Holiday Pay:

Overtime holiday pay is the premium pay that is required for work performed on specified holidays. It is only required where the employee actually performs work on such holidays. The applicable holidays are listed under HOLIDAYS: OVERTIME. The required rate of pay for these covered holidays can be found in the OVERTIME PAY section listings for each classification.

Following is an explanation of the code(s) listed in the HOLIDAY section of each classification contained in the attached schedule. The Holidays as listed below are to be paid at the wage rates at which the employee is normally classified.

- (1) None
- (2) Labor Day
- (3) Memorial Day and Labor Day
- (4) Memorial Day and July 4th
- (5) Memorial Day, July 4th, and Labor Day
- (6) New Year's, Thanksgiving, and Christmas
- (7) Lincoln's Birthday, Washington's Birthday, and Veterans Day
- (8) Good Friday
- (9) Lincoln's Birthday
- (10) Washington's Birthday
- (11) Columbus Day
- (12) Election Day
- (13) Presidential Election Day
- (14) 1/2 Day on Presidential Election Day
- (15) Veterans Day
- (16) Day after Thanksgiving
- (17) July 4th
- (18) 1/2 Day before Christmas
- (19) 1/2 Day before New Years
- (20) Thanksgiving
- (21) New Year's Day
- (22) Christmas
- (23) Day before Christmas
- (24) Day before New Year's
- (25) Presidents' Day
- (26) Martin Luther King, Jr. Day
- (27) Memorial Day
- (28) Easter Sunday

(29) Juneteenth

**New York State Department of Labor - Bureau of Public Work
State Office Building Campus
Building 12 - Room 130
Albany, New York 12226**

REQUEST FOR WAGE AND SUPPLEMENT INFORMATION

As Required by Articles 8 and 9 of the NYS Labor Law

Fax (518) 485-1870 or mail this form for new schedules or for determination for additional occupations.

This Form Must Be Typed

Submitted By:

(Check Only One)

Contracting Agency

Architect or Engineering Firm

Public Work District Office

Date:

A. Public Work Contract to be let by: (Enter Data Pertaining to Contracting/Public Agency)

1. Name and complete address (Check if new or change)

Telephone

Fax

E-Mail:

2. NY State Units (see Item 5).

01 DOT

02 OGS

03 Dormitory Authority

04 State University
Construction Fund

05 Mental Hygiene
Facilities Corp.

06 OTHER N.Y. STATE UNIT

07 City

08 Local School District

09 Special Local District, i.e.,
Fire, Sewer, Water District

10 Village

11 Town

12 County

13 Other Non-N.Y. State
(Describe)

3. SEND REPLY TO (check if new or change)
Name and complete address:

Telephone

Fax

E-Mail:

4. SERVICE REQUIRED. Check appropriate box and provide project information.

New Schedule of Wages and Supplements.

APPROXIMATE BID DATE :

Additional Occupation and/or Redetermination

PRC NUMBER ISSUED PREVIOUSLY FOR
THIS PROJECT :

OFFICE USE ONLY

B. PROJECT PARTICULARS

5. Project Title _____

Description of Work _____

Contract Identification Number _____

Note: For NYS units, the OSC Contract No. _____

6. Location of Project:

Location on Site _____

Route No/Street Address _____

Village or City _____

Town _____

County _____

7. Nature of Project - Check One:

1. New Building
2. Addition to Existing Structure
3. Heavy and Highway Construction (New and Repair)
4. New Sewer or Waterline
5. Other New Construction (Explain)
6. Other Reconstruction, Maintenance, Repair or Alteration
7. Demolition
8. Building Service Contract

8. OCCUPATION FOR PROJECT :

- Construction (Building, Heavy
Highway/Sewer/Water)
- Tunnel
- Residential
- Landscape Maintenance
- Elevator maintenance
- Exterminators, Fumigators
- Fire Safety Director, NYC Only
- Fuel Delivery
- Guards, Watchmen
- Janitors, Porters, Cleaners,
Elevator Operators
- Moving furniture and
equipment
- Trash and refuse removal
- Window cleaners
- Other (Describe)

9. Does this project comply with the Wicks Law involving separate bidding? YES NO

10. Name and Title of Requester

Signature



NEW YORK STATE DEPARTMENT OF LABOR
Bureau of Public Work - Debarment List

**LIST OF EMPLOYERS INELIGIBLE TO BID ON OR BE
AWARDED ANY PUBLIC WORK CONTRACT**

Under Article 8 and Article 9 of the NYS Labor Law, a contractor, sub-contractor and/or its successor shall be debarred and ineligible to submit a bid on or be awarded any public work or public building service contract/sub-contract with the state, any municipal corporation or public body for a period of five (5) years from the date of debarment when:

- Two (2) final determinations have been rendered within any consecutive six-year (6) period determining that such contractor, sub-contractor and/or its successor has WILLFULLY failed to pay the prevailing wage and/or supplements;
- One (1) final determination involves falsification of payroll records or the kickback of wages and/or supplements.

The agency issuing the determination and providing the information, is denoted under the heading 'Fiscal Officer'. DOL = New York State Department of Labor; NYC = New York City Comptroller's Office; AG = New York State Attorney General's Office; DA = County District Attorney's Office.

Debarment Database: To search for contractors, sub-contractors and/or their successors debarred from bidding or being awarded any public work contract or subcontract under NYS Labor Law Articles 8 and 9, or under NYS Workers' Compensation Law Section 141-b, access the database at this link: <https://apps.labor.ny.gov/EDList/searchPage.do>

For inquiries please call 518-457-5589.

NYS DOL Bureau of Public Work Debarment List 12/20/2024

Article 8

AGENCY	Fiscal Officer	FEIN	EMPLOYER NAME	EMPLOYER DBA NAME	ADDRESS	DEBARMENT START DATE	DEBARMENT END DATE
DOL	DOL	****5754	0369 CONTRACTORS, LLC		515 WEST AVE UNIT PH 13NORWALK CT 06850	05/12/2021	05/12/2026
DOL	DOL	****5784	A.J.M. TRUCKING, INC.		PO BOX 2064 MONROE NY 10950	02/12/2024	02/12/2029
DOL	DOL		AKHLAQ OULAKH		4307 28TH AVE ASTORIA NY 11103	10/11/2024	10/11/2029
DOL	NYC		ALL COUNTY SEWER & DRAIN, INC.		7 GREENFIELD DR WARWICK NY 10990	03/25/2022	03/25/2027
DOL	DOL	****8387	AMERICAN PAVING & MASONRY, CORP.		8 FOREST AVE GLEN COVE NY 11542	05/24/2024	05/24/2029
DOL	DOL	****8654	AMERICAN PAVING, INC.		8 FORREST AVE. GLEN COVE NY 11542	05/24/2024	05/24/2029
DOL	NYC		AMJED PARVEZ		401 HANOVER AVENUE STATEN ISLAND NY 10304	01/11/2021	01/11/2026
DOL	DOL		ANGELO F COKER		2610 SOUTH SALINA STREET SUITE 14SYRACUSE NY 13205	09/17/2020	09/17/2025
DOL	DOL		ANGELO GARCIA		515 WEST AVE UNIT PH 13NORWALK CT 06850	05/12/2021	05/12/2026
DOL	DOL		ANGELO STANCO		8 FOREST AVE. GLEN COVE NY 11542	05/24/2024	05/24/2029
DOL	DOL		ANGELO TONDO		449 WEST MOMBSHA ROAD MONROE NY 10950	06/06/2022	06/06/2027
DOL	DOL	****4231	ANKER'S ELECTRIC SERVICE, INC.		10 SOUTH 5TH ST LOCUST VALLEY NY 11560	09/26/2022	09/26/2027
DOL	DOL		ANTHONY MONGELLI		PO BOX 2064 MONROE NY 10950	02/12/2024	02/12/2029
DOL	NYC		ARADCO CONSTRUCTION CORP		115-46 132RD ST SOUTH OZONE PARK NY 11420	09/17/2020	09/17/2025
DOL	DOL		ARNOLD A. PAOLINI		1250 BROADWAY ST BUFFALO NY 14212	02/03/2020	02/03/2025
DOL	NYC		AVM CONSTRUCTION CORP		117-72 123RD ST SOUTH OZONE PARK NY 11420	09/17/2020	09/17/2025
DOL	NYC		AZIDABEGUM		524 MCDONALD AVENUE BROOKLYN NY 11218	09/17/2020	09/17/2025
DOL	DOL	****8421	B & B DRYWALL, INC		206 WARREN AVE APT 1WHITE PLAINS NY 10603	12/14/2021	12/14/2026
DOL	DOL		B&L RENOVATION CO.		618 OCEAN PARKWAY APT A6BROOKLYN NY 11230	09/17/2020	09/17/2025
DOL	NYC	****2113	BHW CONTRACTING, INC.		401 HANOVER AVENUE STATEN ISLAND NY 10304	01/11/2021	01/11/2026
DOL	DOL	****5078	BLACK RIVER TREE REMOVAL, LLC		29807 ANDREWS ROAD BLACK RIVER NY 13032	10/17/2023	10/17/2028
DOL	DOL		BRADLEY J SCHUKA		4 BROTHERS ROAD WAPPINGERS FALLS NY 12590	10/20/2020	10/20/2025
DOL	DOL	****9383	C.C. PAVING AND EXCAVATING, INC.		2610 SOUTH SALINA ST SUITE 12SYRACUSE NY 13205	09/17/2020	09/17/2025
DOL	DOL	****4083	C.P.D. ENTERPRISES, INC		P.O BOX 281 WALDEN NY 12586	03/03/2020	03/03/2025
DOL	DOL	****5161	CALADRI DEVELOPMENT CORP.		1223 PARK ST. PEEKSKILL NY 10566	05/17/2021	05/17/2026
DOL	DOL	****3391	CALI ENTERPRISES, INC.		1223 PARK STREET PEEKSKILL NY 10566	05/17/2021	05/17/2026
DOL	DOL	****4155	CASA BUILDERS, INC.	FRIEDLANDER CONSTRUCTI ON	64 N PUTT CONNERS ROAD NEW PALTZ NY 12561	05/10/2023	05/10/2028
DOL	AG	****7247	CENTURY CONCRETE CORP		2375 RAYNOR ST RONKONKOMA NY 11779	08/04/2021	08/04/2026
DOL	DOL	****0026	CHANTICLEER CONSTRUCTION LLC		4 BROTHERS ROAD WAPPINGERS FALLS NY 12590	10/20/2020	10/20/2025
DOL	NYC	****2117	CHARAN ELECTRICAL ENTERPRISES		9-11 40TH AVENUE LONG ISLAND CITY NY 11101	09/26/2023	09/26/2028
DOL	NYC		CHARLES ZAHRAKKA		863 WASHINGTON STREET FRANKLIN SQUARE NY 11010	03/10/2020	03/10/2025
DOL	DOL		CHRISTOPHER GRECO		26 NORTH MYRTLE AVENUE SPRING VALLEY NY 10956	02/18/2021	02/18/2026
DOL	DOL	****2281	CORRAO TRUCKING, INC.		PO BOX 393 NANUET NY 10954	09/17/2024	09/17/2029
DOL	DOL		CRAIG JOHANSEN		10 SOUTH 5TH ST LOCUST VALLEY NY 11560	09/26/2022	09/26/2027

NYS DOL Bureau of Public Work Debarment List 12/20/2024

Article 8

DOL	DOL	****3228	CROSS-COUNTY LANDSCAPING AND TREE SERVICE, INC.	ROCKLAND TREE SERVICE	26 NORTH MYRTLE AVENUE SPRING VALLEY NY 10956	02/18/2021	02/18/2026
DOL	DOL	****7619	DANCO CONSTRUCTION UNLIMITED INC.		485 RAFT AVENUE HOLBROOK NY 11741	10/19/2021	10/19/2026
DOL	DOL		DANIEL ROBERT MCNALLY		7 GREENFIELD DRIVE WARWICK NY 10990	03/25/2022	03/25/2027
DOL	DOL		DARIAN L COKER		2610 SOUTH SALINA ST SUITE 2CSYRACUSE NY 13205	09/17/2020	09/17/2025
DOL	DOL		DARWIN PEGUESE		6400 BALTIMORE NATIONAL SUITE 602CANTONSVILLE NY 21228	10/24/2024	10/24/2029
DOL	DOL		DAVID FRIEDLANDER		64 NORTH PUTT CORNERS RD NEW PALTZ NY 12561	05/10/2023	05/10/2028
DOL	DOL		DINA TAYLOR		64 N PUTT CONNERS RD NEW PALTZ NY 12561	05/10/2023	05/10/2028
DOL	DOL	****5175	EAGLE MECHANICAL AND GENERAL CONSTRUCTION LLC		11371 RIDGE RD WOLCOTT NY 14590	02/03/2020	02/03/2025
DOL	AG		EDWIN HUTZLER		23 NORTH HOWELLS RD BELLPORT NY 11713	08/04/2021	08/04/2026
DOL	DA		EDWIN HUTZLER		2375 RAYNOR STREET RONKONKOMA NY 11779	08/04/2021	08/04/2026
DOL	DOL	****0780	EMES HEATING & PLUMBING CONTR		5 EMES LANE MONSEY NY 10952	01/20/2002	01/20/3002
DOL	DOL		EMIL KISZKO		84 DIAMOND ST BROOKLYN NY 11222	07/18/2024	07/18/2029
DOL	DOL	****3298	EMJACK CONSTRUCTION CORP.		84 DIAMOND ST BROOKLYN NY 11222	07/18/2024	07/18/2029
DOL	DOL	****3298	EMJACK CONSTRUCTION LLC		4192 SIR ANDREW CIRCLE DOYLESTOWN PA 18902	07/18/2024	07/18/2029
DOL	DOL		EUGENIUSZ "GINO" KUCHAR		195 KINGSLAND AVE BROOKLYN NY 11222	12/22/2023	12/22/2028
DOL	DA		FREDERICK HUTZLER		2375 RAYNOR STREET RONKONKOMA NY 11779	08/04/2021	08/04/2026
DOL	DOL	****2998	G.E.M. AMERICAN CONSTRUCTION CORP.		195 KINGSLAND AVE BROOKLYN NY 11222	12/22/2023	12/22/2028
DOL	NYC		GAYATRI MANGRU		21 DAREWOOD LANE VALLEY STREAM NY 11581	09/17/2020	09/17/2025
DOL	DA		GEORGE LUCEY		150 KINGS STREET BROOKLYN NY 11231	01/19/1998	01/19/2998
DOL	DA		GIOVANNA TRAVALJA		3735 9TH ST LONG ISLAND CITY NY 11101	01/05/2023	01/05/2028
DOL	DA		GIOVANNI NAPOLITANO		2501 BAYVIEW AVENUE WANTAGH NY 11793	02/21/2024	02/21/2029
DOL	DA	****0213	GORILLA CONTRACTING GROUP, LLC		505 MANHATTAN AVE WEST BABYLON NY 11704	10/05/2023	10/05/2028
DOL	DA	****4760	GTX CONSTRUCTION ASSOCIATES, CORP		2501 BAYVIEW AVE WANTAGH NY 11793	02/21/2024	02/21/2029
DOL	DOL		HANS RATH		24 ELDOR AVENUE NEW CITY NY 10956	02/03/2020	02/03/2025
DOL	DOL		HERBERT CLEMEN		42 FOWLER AVENUE CORTLAND MANOR NY 10567	01/24/2023	01/24/2028
DOL	DOL		HERBERT CLEMEN		42 FOWLER AVENUE CORTLAND MANOR NY 10567	10/25/2022	10/25/2027
DOL	DOL	****2397	ISLAND BREEZE MARINE, INC.		6400 BALTIMORE NATIONAL CANTONSVILLE MD 21228	10/24/2024	10/24/2029
DOL	DOL	****9211	J. WASE CONSTRUCTION CORP.		8545 RT 9W ATHENS NY 12015	03/09/2021	03/09/2026
DOL	DOL		J.M.J CONSTRUCTION		151 OSTRANDER AVENUE SYRACUSE NY 13205	11/21/2022	11/21/2027
DOL	DOL		J.R. NELSON CONSTRUCTION		531 THIRD STREET ALBANY NY 12206	11/07/2023	11/07/2028
DOL	DOL		J.R. NELSON CONSTRUCTION		531 THIRD STREET ALBANY NY 12206	12/22/2022	12/22/2027
DOL	DOL		J.R. NELSON CONSTRUCTION		531 THIRD STREET ALBANY NY 12206	10/25/2022	10/25/2027
DOL	DOL		J.R. NELSON, LLC		531 THIRD STREET ALBANY NY 12206	12/22/2022	12/22/2027
DOL	DOL		J.R. NELSON, LLC		531 THIRD STREET ALBANY NY 12206	11/07/2023	11/07/2028
DOL	DOL		J.R. NELSON, LLC		531 THIRD STREET ALBANY NY 12206	10/25/2022	10/25/2027
DOL	DOL		J.R.N COMPANIES, LLC		531 THIRD STREET ALBANY NY 12206	12/12/2022	12/12/2027

NYS DOL Bureau of Public Work Debarment List 12/20/2024

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DOL	DOL		J.R.N COMPANIES, LLC		531 THIRD STREET ALBANY NY 12206	11/07/2023	11/07/2028
DOL	DOL		J.R.N COMPANIES, LLC		531 THIRD STREET ALBANY NY 12206	10/25/2022	10/25/2027
DOL	DOL	*****1147	J.R.N. CONSTRUCTION, LLC		531 THIRD ST ALBANY NY 12206	11/07/2023	11/07/2028
DOL	DOL	*****1147	J.R.N. CONSTRUCTION, LLC		531 THIRD ST ALBANY NY 12206	12/22/2022	12/22/2027
DOL	DOL	*****1147	J.R.N. CONSTRUCTION, LLC		531 THIRD ST ALBANY NY 12206	10/25/2022	10/25/2027
DOL	DOL		JAMES J. BAKER		7901 GEE ROAD CANASTOTA NY 13032	08/17/2021	08/17/2026
DOL	DOL		JASON P. RACE		3469 STATE RT. 69 PERISH NY 13131	09/29/2021	09/29/2026
DOL	DOL		JASON P. RACE		3469 STATE RT. 69 PERISH NY 13131	02/09/2022	02/09/2027
DOL	DOL		JASON P. RACE		3469 STATE RT. 69 PERISH NY 13131	11/15/2022	11/15/2027
DOL	DOL		JASON P. RACE		3469 STATE RT. 69 PERISH NY 13131	03/01/2022	03/01/2027
DOL	DOL	*****7993	JBS DIRT, INC.		7901 GEE ROAD CANASTOTA NY 13032	08/17/2021	08/17/2026
DOL	DOL	*****2435	JEFFEL D. JOHNSON	JMJ7 AND SON	5553 CAIRNSTRAIL CLAY NY 13041	11/21/2022	11/21/2027
DOL	DOL		JEFFEL JOHNSON ELITE CARPENTER REMODEL AND CONSTRUCTION		C2 EVERGREEN CIRCLE LIVERPOOL NY 13090	11/21/2022	11/21/2027
DOL	DOL	*****2435	JEFFREY M. JOHNSON	JMJ7 AND SON	5553 CAIRNS TRAIL CLAY NY 13041	11/21/2022	11/21/2027
DOL	DOL		JIM PLAUGHER		17613 SANTE FE LINE ROAD WAYNEFIELD OH 45896	07/16/2021	07/16/2026
DOL	DOL		JMJ7 & SON CONSTRUCTION, LLC		5553 CAIRNS TRAIL LIVERPOOL NY 13041	11/21/2022	11/21/2027
DOL	DOL		JMJ7 AND SONS CONTRACTORS		5553 CAIRNS TRAIL CLAY NY 13041	11/21/2022	11/21/2027
DOL	DOL		JMJ7 CONTRACTORS		7014 13TH AVENUE BROOKLYN NY 11228	11/21/2022	11/21/2027
DOL	DOL		JMJ7 CONTRACTORS AND SONS		5553 CAIRNS TRAIL CLAY NY 13041	11/21/2022	11/21/2027
DOL	DOL		JMJ7 CONTRACTORS, LLC		5553 CAIRNS TRAIL CLAY NY 13041	11/21/2022	11/21/2027
DOL	DOL		JOHN MARKOVIC		47 MANDON TERRACE HAWTHORN NJ 07506	03/29/2021	03/29/2026
DOL	DOL		JOHN WASE		8545 RT 9W ATHENS NY 12015	03/09/2021	03/09/2026
DOL	DOL		JORGE RAMOS		8970 MIKE GARCIA DR MANASSAS VA 20109	07/16/2021	07/16/2026
DOL	DOL		JOSEPH K. SALERNO		1010 TILDEN AVE UTICA NY 13501	07/24/2023	07/24/2028
DOL	DOL		JOSEPH K. SALERNO II		1010 TILDEN AVE UTICA NY 13501	07/24/2023	07/24/2028
DOL	DOL	*****5116	JP RACE PAINTING, INC. T/A RACE PAINTING		3469 STATE RT. 69 PERISH NY 13131	02/09/2022	02/09/2027
DOL	DOL	*****5116	JP RACE PAINTING, INC. T/A RACE PAINTING		3469 STATE RT. 69 PERISH NY 13131	11/15/2022	11/15/2027
DOL	DOL	*****5116	JP RACE PAINTING, INC. T/A RACE PAINTING		3469 STATE RT. 69 PERISH NY 13131	09/29/2021	09/29/2026
DOL	DOL	*****5116	JP RACE PAINTING, INC. T/A RACE PAINTING		3469 STATE RT. 69 PERISH NY 13131	03/01/2022	03/01/2027
DOL	DOL	*****5116	JP RACE PAINTING, INC. T/A RACE PAINTING		3469 STATE RT. 69 PERISH NY 13131	03/01/2022	03/01/2027
DOL	DOL		JRN CONSTRUCTION CO, LLC		1024 BROADWAY ALBANY NY 12204	11/07/2023	11/07/2028
DOL	DOL	*****1147	JRN CONSTRUCTION, LLC		531 THIRD STREET ALBANY NY 12206	10/25/2022	10/25/2027
DOL	DOL	*****1147	JRN CONSTRUCTION, LLC		531 THIRD STREET ALBANY NY 12206	12/22/2022	12/22/2027
DOL	DOL	*****1147	JRN CONSTRUCTION, LLC		531 THIRD STREET ALBANY NY 12206	11/07/2023	11/07/2028
DOL	DOL		JRN PAVING, LLC		531 THIRD STREET ALBANY NY 12206	10/25/2022	10/25/2027
DOL	DOL		JRN PAVING, LLC		531 THIRD STREET ALBANY NY 12206	12/22/2022	12/22/2027
DOL	DOL		JRN PAVING, LLC		531 THIRD STREET ALBANY NY 12206	11/07/2023	11/07/2028

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DOL	DOL		JULIUS AND GITA BEHREND		5 EMES LANE MONSEY NY 10952	11/20/2002	11/20/3002
DOL	DOL		KARIN MANGIN		796 PHELPS ROAD FRANKLIN LAKES NJ 07417	12/01/2020	12/01/2025
DOL	DOL		KATE E. CONNOR		7088 INTERSTATE ISLAND RD SYRACUSE NY 13209	03/31/2021	03/31/2026
DOL	DOL		KEAN INDUSTRIES, LLC		2345 RT. 52 SUITE 2NHOPEWELL JUNCTION NY 12533	12/18/2023	12/18/2028
DOL	DOL	****2959	KELC DEVELOPMENT, INC		7088 INTERSTATE ISLAND RD SYRACUSE NY 13209	03/31/2021	03/31/2026
DOL	DOL		KIMBERLY F. BAKER		7901 GEE ROAD CANASTOTA NY 13032	08/17/2021	08/17/2026
DOL	DOL		KMA GROUP II, INC.		29-10 38TH AVENUE LONG ISLAND CITY NY 11101	10/11/2023	10/11/2028
DOL	DOL	****1833	KMA GROUP INC.		29-10 38TH AVENUE LONG ISLAND CITY NY 11101	10/11/2023	10/11/2028
DOL	DOL		KMA INSULATION, INC.		29-10 38TH AVENUE LONG ISLAND CITY NY 11101	10/11/2023	10/11/2028
DOL	DOL		KRIN HEINEMANN		2345 ROUTE 52, SUITE 2N HOPEWELL JUNCTION NY 12533	12/18/2023	12/18/2028
DOL	NYC		KULWANT S. DEOL		9-11 40TH AVENUE LONG ISLAND CITY NY 11101	09/26/2023	09/26/2028
DOL	DA	****8816	LAKE CONSTRUCTION AND DEVELOPMENT CORPORATION		150 KINGS STREET BROOKLYN NY 11231	08/19/1998	08/19/2998
DOL	DOL		LEROY E. NELSON JR		531 THIRD ST ALBANY NY 12206	10/25/2022	10/25/2027
DOL	DOL		LEROY E. NELSON JR		531 THIRD ST ALBANY NY 12206	12/22/2022	12/22/2027
DOL	DOL		LEROY E. NELSON JR		531 THIRD ST ALBANY NY 12206	11/07/2023	11/07/2028
DOL	AG	****3291	LINTECH ELECTRIC, INC.		3006 TILDEN AVE BROOKLYN NY 11226	02/16/2022	02/16/2027
DOL	DOL		LOUIS A. CALICCHIA		1223 PARK ST. PEEKSKILL NY 10566	05/17/2021	05/17/2026
DOL	NYC		LUBOMIR PETER SVOBODA		27 HOUSMAN AVE STATEN ISLAND NY 10303	12/26/2019	12/26/2024
DOL	NYC		M & L STEEL & ORNAMENTAL IRON CORP.		27 HOUSMAN AVE STATEN ISLAND NY 10303	12/26/2019	12/26/2024
DOL	DOL	****2196	MAINSTREAM SPECIALTIES, INC.		11 OLD TOWN RD SELKIRK NY 12158	02/02/2021	02/02/2026
DOL	DA		MANUEL P TOBIO		150 KINGS STREET BROOKLYN NY 14444	08/19/1998	08/19/2998
DOL	DA		MANUEL TOBIO		150 KINGS STREET BROOKLYN NY 11231	08/19/1998	08/19/2998
DOL	DOL		MAQSOOD AHMAD		618 OCEAN PKWY BROOKLYN NY 11230	09/17/2020	09/17/2025
DOL	NYC		MARIA NUBILE		84-22 GRAND AVENUE ELMHURST NY 11373	03/10/2020	03/10/2025
DOL	DOL	****1320	MJC MASON CONTRACTING, INC.		42 FOWLER AVENUE CORTLAND MANOR NY 10567	10/25/2022	10/25/2027
DOL	DOL	****1320	MJC MASON CONTRACTING, INC.		42 FOWLER AVENUE CORTLAND MANOR NY 10567	01/24/2023	01/24/2028
DOL	NYC		MUHAMMED A. HASHEM		524 MCDONALD AVENUE BROOKLYN NY 11218	09/17/2020	09/17/2025
DOL	NYC		NAMOW, INC.		84-22 GRAND AVENUE ELMHURST NY 11373	03/10/2020	03/10/2025
DOL	DOL	****7790	NATIONAL BUILDING & RESTORATION CORP		1010 TILDEN AVE UTICA NY 13501	07/24/2023	07/24/2028
DOL	DOL	****1797	NATIONAL CONSTRUCTION SERVICES, INC		1010 TILDEN AVE UTICA NY 13501	07/24/2023	07/24/2028
DOL	NYC		NAVIT SINGH		402 JERICO TURNPIKE NEW HYDE PARK NY 11040	08/10/2022	08/10/2027
DOL	DOL		NELCO CONTRACTING, LLC		1024 BROADWAY ALBANY NY 12204	11/07/2023	11/07/2028
DOL	DA		NICHOLAS T. ANALITIS		505 MANHATTAN AVE WEST BABYLON NY 11704	10/05/2023	10/05/2028
DOL	DOL		NICHOLE E. FRASER A/K/A NICHOLE RACE		3469 STATE RT. 69 PERISH NY 13131	03/01/2022	03/01/2027
DOL	DOL		NICHOLE E. FRASER A/K/A NICHOLE RACE		3469 STATE RT. 69 PERISH NY 13131	11/15/2022	11/15/2027
DOL	DOL		NICHOLE E. FRASER A/K/A NICHOLE RACE		3469 STATE RT. 69 PERISH NY 13131	09/29/2021	09/29/2026

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DOL	DOL		NICHOLE E. FRASER A/K/A NICHOLE RACE		3469 STATE RT. 69 PERISH NY 13131	02/09/2022	02/09/2027
DOL	DOL	****7429	NICOLAE I. BARBIR	BESTUCCO CONSTRUCTION, INC.	444 SCHANTZ ROAD ALLENTOWN PA 18104	09/17/2020	09/17/2025
DOL	NYC	****5643	NYC LINE CONTRACTORS, INC.		402 JERICHO TURNPIKE NEW HYDE PARK NY 11040	08/10/2022	08/10/2027
DOL	DOL		PATRICK PENNACCHIO		2345 RT. 52 SUITE 2NHOPEWELL JUNCTION NY 12533	12/18/2023	12/18/2028
DOL	DOL		PATRICK PENNACCHIO		2345 RT. 52 SUITE 2NHOPEWELL JUNCTION NY 12533	12/18/2023	12/18/2028
DOL	DOL		PAULINE CHAHALES		935 S LAKE BLVD MAHOPAC NY 10541	03/02/2021	03/02/2026
DOL	DOL		PETER STEVENS		11 OLD TOWN ROAD SELKIRK NY 12158	02/02/2021	02/02/2026
DOL	DOL		PETER STEVENS		8269 21ST ST BELLEROSE NY 11426	12/22/2022	12/22/2027
DOL	DOL	****4168	PHANTOM CONSTRUCTION CORP.		95-27 116TH STREET QUEENS NY 11419	07/12/2024	07/12/2029
DOL	DOL	****4168	PHANTOM CONSTRUCTION CORP.		95-27 116TH STREET QUEENS NY 11419	05/28/2024	05/28/2029
DOL	DOL	****0466	PRECISION BUILT FENCES, INC.		1617 MAIN ST PEEKSKILL NY 10566	03/03/2020	03/03/2025
DOL	NYC		RASHEL CONSTRUCTION CORP		524 MCDONALD AVENUE BROOKLYN NY 11218	09/17/2020	09/17/2025
DOL	DOL	****1068	RATH MECHANICAL CONTRACTORS, INC.		24 ELDOR AVENUE NEW CITY NY 10956	02/03/2020	02/03/2025
DOL	DOL	****2633	RAW POWER ELECTRIC CORP.		3 PARK CIRCLE MIDDLETOWN NY 10940	07/11/2022	07/11/2027
DOL	DA	****7559	REGAL CONTRACTING INC.		24 WOODBINE AVE NORTHPORT NY 11768	10/01/2020	10/01/2025
DOL	DOL		RICHARD REGGIO		1617 MAIN ST PEEKSKILL NY 10566	03/03/2020	03/03/2025
DOL	DOL		ROBBYE BISSEAR		89-51 SPRINGFIELD BLVD QUEENS VILLAGE NY 11427	01/11/2003	01/11/3003
DOL	DOL		ROMEO WARREN		161 ROBYN RD MONROE NY 10950	07/11/2022	07/11/2027
DOL	DOL	****7172	RZ & AL INC.		198 RIDGE AVENUE VALLEY STREAM NY 11581	06/06/2022	06/06/2027
DOL	DOL		SAL FRESINA MASONRY CONTRACTORS, INC.		1935 TEALL AVENUE SYRACUSE NY 13206	07/16/2021	07/16/2026
DOL	DOL		SAL MASONRY CONTRACTORS, INC.		(SEE COMMENTS) SYRACUSE NY 13202	07/16/2021	07/16/2026
DOL	DOL	****9874	SALFREE ENTERPRISES INC		P.O BOX 14 2821 GARDNER RDPOMPEI NY 13138	07/16/2021	07/16/2026
DOL	DOL		SALVATORE A FRESINA A/K/A SAM FRESINA		107 FACTORY AVE P.O BOX 11070SYRACUSE NY 13218	07/16/2021	07/16/2026
DOL	DOL		SAM FRESINA		107 FACTORY AVE P.O BOX 11070SYRACUSE NY 13218	07/16/2021	07/16/2026
DOL	DA	****0476	SAMCO ELECTRIC CORP.		3735 9TH ST LONG ISLAND CITY NY 11101	01/05/2023	01/05/2028
DOL	NYC	****1130	SCANA CONSTRUCTION CORP.		863 WASHINGTON STREET FRANKLIN SQUARE NY 11010	03/10/2020	03/10/2025
DOL	DOL	****2045	SCOTT DUFFIE	DUFFIE'S ELECTRIC, INC.	P.O BOX 111 CORNWALL NY 12518	03/03/2020	03/03/2025
DOL	DOL		SCOTT DUFFIE		P.O BOX 111 CORNWALL NY 12518	03/03/2020	03/03/2025
DOL	DA		SILVANO TRAVALJA		3735 9TH ST LONG ISLAND CITY NY 11101	01/05/2023	01/05/2028
DOL	DOL	****0440	SOLAR GUYS INC.		8970 MIKE GARCIA DR MANASSAS VA 20109	07/16/2021	07/16/2026
DOL	NYC		SOMATIE RAMSUNAHAI		115-46 132ND ST SOUTH OZONE PARK NY 11420	09/17/2020	09/17/2025
DOL	DOL	****2221	SOUTH BUFFALO ELECTRIC, INC.		1250 BROADWAY ST BUFFALO NY 14212	02/03/2020	02/03/2025
DOL	NYC	****3661	SPANIER BUILDING MAINTENANCE CORP		200 OAK DRIVE SYOSSET NY 11791	03/14/2022	03/14/2027
DOL	DOL		STANADOS KALOGELAS		485 RAFT AVENUE HOLBROOK NY 11741	10/19/2021	10/19/2026

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DOL	DOL	****3496	STAR INTERNATIONAL INC		89-51 SPRINGFIELD BLVD QUEENS VILLAGE NY 11427	08/11/2003	08/11/3003
DOL	DOL	****9528	STEEL-IT, LLC.		17613 SANTE FE LINE ROAD WAYNESFIELD OH 45896	07/16/2021	07/16/2026
DOL	DOL	****3800	SUBURBAN RESTORATION CO. INC.		5-10 BANTA PLACE FAIR LAWN PLACE NJ 07410	03/29/2021	03/29/2026
DOL	DOL	****9150	SURGE INC.		8269 21ST STREET BELLEROSE NY 11426	12/22/2022	12/22/2027
DOL	DOL		SYED MUHAMMAD S. JAFRI A/K/A SHARRUKH JAFRI		4307 28TH AVE ASTORIA NY 11103	10/11/2024	10/11/2029
DOL	DOL		SYED RAZA		198 RIDGE AVENUE NY 11581	06/06/2022	06/06/2027
DOL	DOL		TARLOK SINGH		95-27 116TH STREET QUEENS NY 11419	05/28/2024	05/28/2029
DOL	DOL		TARLOK SINGH		95-27 116TH STREET QUEENS NY 11419	07/12/2024	07/12/2029
DOL	DOL		TERRY THOMPSON		11371 RIDGE RD WOLCOTT NY 14590	02/03/2020	02/03/2025
DOL	DOL	****9733	TERSAL CONSTRUCTION SERVICES INC		107 FACTORY AVE P.O BOX 11070SYRACUSE NY 13208	07/16/2021	07/16/2026
DOL	DOL		TERSAL CONTRACTORS, INC.		221 GARDNER RD P.O BOX 14POMPEI NY 13138	07/16/2021	07/16/2026
DOL	DOL		TERSAL DEVELOPMENT CORP.		1935 TEALL AVENUE SYRACUSE NY 13206	07/16/2021	07/16/2026
DOL	DOL	****5766	THE COKER CORPORATION	COKER CORPORATIO N	2610 SOUTH SALINA ST SUITE 14SYRACUSE NY 13205	09/17/2020	09/17/2025
DOL	DOL	****2426	THE MATRUKH GROUP, INC.		4307 28TH AVE PO BOX 9082ASTORIA NY 11103	10/11/2024	10/11/2029
DOL	DOL		TIMOTHY PERCY		29807 ANDREWS ROAD BLACK RIVER NY 13612	10/17/2023	10/17/2028
DOL	DA	****1050	TRI STATE CONSTRUCTION OF NY CORP.		50-39 175TH PLACE FRESH MEADOWS NY 11365	03/28/2022	03/28/2027
DOL	DA	****4106	TRIPLE H CONCRETE CORP		2375 RAYNOR STREET RONKONKOMA NY 11779	08/04/2021	08/04/2026
DOL	DOL	****8210	UPSTATE CONCRETE & MASONRY CONTRACTING CO INC		449 WEST MOMBASHA ROAD MONROE NY 10950	06/06/2022	06/06/2027
DOL	DOL	****6418	VALHALLA CONSTRUCTION, LLC.		796 PHLEPS ROAD FRANKLIN LAKES NJ 07417	12/01/2020	12/01/2025
DOL	NYC	****2426	VICKRAM MANGRU	VICK CONSTRUCTI ON	21 DAREWOOD LANE VALLEY STREAM NY 11581	09/17/2020	09/17/2025
DOL	NYC		VICKRAM MANGRU		21 DAREWOOD LANE VALLEY STREAM NY 11581	09/17/2020	09/17/2025
DOL	DOL		VIKTORIA RATH		24 ELDOR AVENUE NEW CITY NY 10956	02/03/2020	02/03/2025
DOL	DOL		VINCENT CORRAO		PO BOX 393 NANUET NY 10954	09/17/2024	09/17/2029
DOL	DOL	****8266	WILLIAM CHRIS MCCLENDON	MCCLENDON ASPHALT PAVING	1646 FALLS STREET NIAGARA FALLS NY 14303	05/01/2023	05/01/2028
DOL	DOL		WILLIAM CHRIS MCCLENDON		1646 FALLS STREET NIAGARA FALLS NY 14303	05/01/2023	05/01/2028
DOL	DOL		WILLIAM G. PROERFRIEDT		85 SPRUCEWOOD ROAD WEST BABYLON NY 11704	01/19/2021	01/19/2026
DOL	DOL	****5924	WILLIAM G. PROPHY, LLC	WGP CONTRACTIN G, INC.	54 PENTAQUIT AVE BAYSHORE NY 11706	01/19/2021	01/19/2026
DOL	DOL		WILLIAM SCRIVENS		4192 SIR ANDREW CIRCLE DOYELSTOWN PA 18902	07/18/2024	07/18/2029
DOL	DOL		XENOFON EFTHIMIADIS		29-10 38TH AVENUE LONG ISLAND CITY NY 11101	10/11/2023	10/11/2028

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PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. This Section is to be coordinated with and complementary to the General Conditions, wherever applicable to Mechanical and Electrical Work.
- B. Where items of the General Conditions are repeated in this Section of the Specifications, it is intended to qualify or to call particular attention to them; it is not intended that any other parts of the General Conditions shall be assumed to be omitted if not repeated herein.
- C. This Section applies equally and specifically to all Contractors and Subcontractors supplying labor and/or equipment and/or materials as required under the Heating, Ventilating and Air Conditioning, Plumbing, Sprinkler and Electrical Sections of the Specifications.

1.2 DEFINITIONS

- A. "The Contractor" or "Each Contractor" means specifically, the Contractor or Subcontractor working under his respective Section (Heating, Ventilating and Air Conditioning, Plumbing, Sprinkler or Electrical) of this Specification.
- B. "Provide" means to supply, erect, install, and connect up in complete readiness for regular operation, the particular work referred to.
- C. "Furnish" means to supply and deliver to the job.
- D. "Piping" includes, in addition to pipe, all fittings, valves, hangers, and other accessories related to such piping.
- E. "Concealed" means hidden from sight as in chases, furred spaces, shafts, hung ceilings, or embedded in construction.
- F. "Exposed" means "not concealed" as defined above. Work in trenches, crawl spaces, and tunnels shall be considered "exposed" unless otherwise specifically noted. Work located in mechanical rooms, accessible attics, open storage rooms, janitor's closets, on the roof or anywhere outdoors shall be considered "exposed".
- G. "Approved equal" means any equipment or material which, in the opinion of the Architect, is equal in quality, durability, appearance, strength, design, performance, physical dimensions, and arrangement to the equipment or material specified, and will function adequately in accordance with the general design.
- H. "Governmental" means all municipal, state and federal governmental agencies.
- I. Where any device or part of equipment is herein referred to in the singular number (such as "the pump"), such reference shall be deemed to apply to as many such devices as are required to complete the installation as shown on the Drawings.
- J. "HVAC" means Heating, Ventilating and Air Conditioning.

- K. "Plumbing Contractor" means the Contractor doing Plumbing and Fire Protection Work including Sprinkler Work.

1.3 CODES AND STANDARDS

- A. NY State Building Code, Fire Code, Mechanical Code, Plumbing Code, Fuel Gas Code, Energy Conservation Construction Code
- B. New Jersey Uniform Construction Code (UCC)
- C. NFPA National Fire Protection Association
- D. ASME American Society of Mechanical Engineers
- E. ANSI American National Standards Institute
- F. ASTM American Society for Testing Materials
- G. AWWA American Water Works Association
- H. IBR Institute of Boiler and Radiator Manufacturers
- I. NEMA National Electrical Manufacturers Association
- J. ASHRAE American Society of Heating, Refrigeration and Air Conditioning Engineers
- K. SMACNA Sheet Metal and Air Conditioning Contractors National Association, Inc.
- L. ARI Air Conditioning and Refrigeration Institute
- M. UL Underwriters' Laboratories
- N. AMCA Air Movement Control Association
- O. AABC Associated Air Balance Council
- P. Local Water Company Rules and Regulations
- Q. National Electric Code

1.4 INTENT

- A. It is the intention of the Specifications and Drawings to call for finished work, tested, and ready for operation. All materials, equipment, and apparatus shall be new and of first-class quality.
- B. Any apparatus, appliance, material, or work not shown on Drawings, but mentioned in the Specifications, or vice versa, or any incidental accessories, or minor details not shown but necessary to make the work complete and perfect in all respects and ready for operation, even if not particularly specified, shall be provided without additional expense to the Owner.

1.5 DRAWINGS

- A. The Drawings are generally diagrammatic and are intended to convey the scope of work and indicate general arrangement of equipment, ducts, conduits, piping, and fixtures.

- B. The locations of all items shown on the Drawings or called for in the Specifications that are not definitely fixed by dimensions are approximate only. The exact locations necessary to secure the best conditions and results must be determined at the project and shall have the approval of the Architect before being installed. Do not scale Drawings.
- C. Follow Drawings in laying out work and check Drawings of other trades to verify spaces in which work will be installed. Maintain maximum headroom and space conditions at all points. Where headroom and space conditions appear inadequate, the Architect shall be notified before proceeding with installation.
- D. If directed by the Architect, without extra charge, make reasonable modifications in the layout as needed to prevent conflict with the work of other trades or for proper execution of the work.
- E. Piping or ductwork connected to equipment may require different size connection than indicated on the Drawings. The Contractor shall provide transition pieces as required at the equipment.

1.6 INTERPRETATION OF DRAWINGS AND SPECIFICATIONS

- A. Any questions or disagreements arising as to the true intent of this Specification or the Drawings or the kind and quality of work required thereby shall be decided by the Architect, whose interpretations thereof shall be final, conclusive, and binding on all parties.
- B. In case of disagreement between Drawings and Specifications, or within either document itself, the better quality, greater quantity, or more costly work shall be included in the Bid Price, and the matter referred to the Architect's attention for decision and/or adjustment prior to the Contractor's submission of their Bid. If such ambiguity is identified by the Contractor during construction (after bid period), then the Architect shall be consulted merely to decide on the proper technical approach; the more costly work's value shall be included.
- C. Maintain an awareness to avoid space conflict with other trades.
- D. Purchase the equipment and material required in accordance with field measurements taken at the proper time during the construction progress.

1.7 VISITING THE SITE

- A. Before submitting the final proposal, examine the site of the proposed work to determine the existing conditions that may affect the work, as this Section will be held responsible for any assumptions in regard.

1.8 EQUIPMENT AND MATERIALS

- A. The proposal and bid must cover all items on the Drawings and in the Specifications exactly as drawn and specified.
- B. All pipes, fittings, and valves shall be manufactured in the United States of America.
- C. All proposed substitutions of equipment of other manufacturers than those specified shall be attached to the base bid in an itemized list. Directly opposite each item indicate the amount to be added to or deducted from the base bid if the proposal is accepted. Failure to furnish such an itemized list will be interpreted to mean that it is agreed to provide all items exactly as drawn and specified. The information given in the above-itemized list will in no way affect the determination of the low bidder.

- D. Substitutions of material and equipment of makes other than specifically named on the Drawings and in the Specifications and as provided for in the above paragraph will be approved for the following reasons only:
- E. The material or equipment proposed for substitution is equal to or superior to that specified; and that the material or equipment called for on the Drawings or in the Specifications cannot be delivered to the job in time to complete the work in proper sequence to the work of other trades, due to conditions beyond control.
- F. To receive consideration, requests for substitutions must be accompanied by documentary proof of equality and difference in price and delivery, if any, in the form of certified quotations from suppliers of both specified and proposed equipment. In case of a difference in price, the Owner shall receive compensation in the form of a credit and all benefits of the difference in cost involved in any substitutions.
- G. The words "or approved equal" shall be understood to apply only to those items of equipment and material listed under the paragraph "List of Approved Manufacturers" or as otherwise indicated on the Drawings or in the Specifications.
- H. Within twenty (20) working days after the acceptance of the proposal, and prior to the submission of any shop drawings for review, a complete list of manufacturers shall be submitted to the Architect of all equipment and materials proposed for the work. No reviews will be rendered on shop drawings submitted before the complete list of manufacturers is reviewed.
- I. If material or equipment is installed before the Contractor obtains a "No Objections" comment from the Architect, and/or in the opinion of the Architect the material or equipment does not meet the intent of the Drawings and Specifications, the removal and replacement shall be made at no extra cost to the Owner.
- J. The materials, workmanship, design, and arrangement of all work installed under the Contract shall be subject to the approval of the Architect.
- K. If material or equipment is installed before the Contractor obtains a "No Objections" comment from the Architect, the trade installing same shall be liable for the removal and replacement at no extra charge to the Owner if, in the opinion of the Architect, the material or equipment does not meet the intent of the Drawings and Specifications.
- L. The words "or approved equal" are understood to follow:
 - 1. The name of any manufacturer, vendor, equipment or materials.
 - 2. Any trade name, plate number, or catalog number.
 - 3. Any detailed description is used to define equipment or material; except where otherwise indicated on the Drawings or in the Specifications.
 - 4. It is the intent of these Specifications that wherever a manufacturer of a product is specified, and the terms "other approved" or "or approved equal" are used, the substituted item must conform in all respects to the specified item. Consideration will not be given to claim that the substituted item meets the performance requirements with lesser construction (such as lesser heat exchange surface, etc.) Performance as delineated in schedules and in the Specifications shall be interpreted as minimum performance.
- M. All equipment and materials required for installation under these Specifications shall be new and without blemish or defect. All electrical equipment shall bear labels attesting to Underwriters'

Laboratories approval. Where no specific indication as to the type or quality of the material or equipment is indicated, a first-class standard article shall be furnished.

- N. Where it is proposed to use an item of equipment other than that specified or detailed on the Drawings which requires any redesign of the structure, partitions, foundations, piping, wiring, or of any other part of the mechanical, electrical, or architectural layout, all such redesign, and all new drawings and detailing required therefore shall, with the review of the Architect and subsequent comments by the Architect "No Exception" or "Exception as Noted" on the shop drawings, be prepared at no additional cost to the Owner.
- O. Where such deviation from contract documents requires a different quantity and arrangement of ductwork, piping, wiring, conduit, and equipment from that specified or indicated on the Drawings, furnish and install any such ductwork, piping, structural supports, insulation, controllers, motors, starters, electrical wiring, and conduit, and any other additional equipment required by the system, at no additional cost to the Owner.
- P. All equipment of one type (such as fans, coils, etc.) shall be the product of the same manufacturer.
- Q. Note that the comments "No Exception" or "Exception as Noted" marked on the shop drawings or other information submitted in accordance with the requirements herein before specified does not assure that the Engineer, Architect, or any other Owner's representative attests to the dimensional accuracy or dimensional suitability of the material or equipment involved or the mechanical performance of equipment. Comments on the shop drawings do not invalidate the Plans and Specifications if the shop drawings are in conflict with the Plans and Specifications.

1.9 SHOP DRAWINGS AND SUBMITTALS

- A. Prior to delivery to the job site, but sufficiently in advance of requirements necessary to allow Architect ample time for review, submit copies (as stated in "General Conditions") of shop drawings of all equipment, materials, piping, sleeves, conduit, ductwork, and wiring diagrams, and further obtain written comments "No Exception" or "Exception as Noted" for same from the Architect, before installing any of these items.
- B. All shop drawings shall be prepared using AutoCAD. Manually drafted shop drawings are prohibited. If a Contractor is incapable of developing CAD drawings in-house, then they shall engage the services of an external drafting service in order to do so. The cost for such service shall be borne by the Contractor and included as part of their bid. Shop drawing submittals shall be on paper as described herein. While shop drawings are being developed and revised throughout the construction process, the Contractor shall continually update the CAD files. As construction approaches completion, these shop drawing CAD files shall be developed by the Contractor(s) into "As-Built" drawings. As part of standard project close-out documents, in addition to providing conventional paper copies of As-Built Shop Drawings, the Contractor must also provide CD's containing electronic AutoCAD versions of same.
- C. Shop drawings shall consist of manufacturer's certified scale drawings, cuts, or catalogs, including descriptive literature and complete certified characteristics of equipment, showing dimensions, capacity, code requirements, motor and drive testing, as indicated on the Drawings or Specifications.
- D. Certified performance curves for all pumping and fan equipment shall be submitted for review.
- E. Shop drawings submitted with insufficient information shall be rejected without review.

- F. All shop drawings and submittals shall be sent electronically in PDF format. Other electronic file formats will be rejected without review.
- G. Samples of materials or equipment, when requested by the Architect, shall be submitted for review.
- H. Provide a detailed Transmittal with all shop drawings, via email. Any Transmittal, Shop drawing, sample, specification, etc. which is not labeled with all of the following information shall be rejected without review:
 - 1. Project name
 - 2. Project location
 - 3. Contractor's name and address, Subcontractor's name and address
 - 4. Applicable section and article number of specifications
 - 5. Contractor's approval stamp and signature
 - 6. Submission number
 - 7. Specific service for which material is to be used.
- I. Catalogs, pamphlets, or other documents submitted to describe items on which review is being requested, shall be specific and shall include clear identification in such catalog, pamphlet, etc., of the item submitted, with identification clearly made in ink and highlighted. Data of a general nature such as tabulated charts will not be accepted and will be rejected without review.
- J. Shop drawings indicating an unsuitable manufacturer shall be rejected without review.
- K. The HVAC Subcontractor shall prepare ductwork shop drawings at $\frac{3}{8}$ "=1'-0" scale and submit to the Architect for their approval to prepare the coordination drawings as called for in paragraph 1.14. Ductwork shop drawings shall be drawn with double-line ductwork and shall indicate the elevation above the finished floor of all ducts, the location and height of the building structure (beams, etc.), and lengths of fabrication pieces and fittings. Show new and existing work. Shop drawings submitted shall be ready for sheet metal fabrication.
- L. The comments "No Exception" or "Exceptions as Noted" rendered on shop drawings shall not be considered as a guarantee of measurements or building conditions. Where drawings are reviewed, said review does not in any way relieve responsibility, or necessity, of furnishing material or performing work as required by the Contract Drawings and Specifications.
- M. "EXCEPTIONS, AS NOTED" means, unless otherwise noted on the drawings to be approved for construction, fabrication, and/or manufacture subject to the provision that the work shall be carried out in compliance with all annotations and/or corrections indicated on the shop drawings and in accordance with the requirements of the Contract Documents. If also marked "RESUBMIT", "EXCEPTIONS AS NOTED" is invalid, and a corrected submittal of the drawing is required.
- N. If a shop drawing is resubmitted and does not comply with all of the comments indicated on the previous submission(s), and does not reflect specific reasons for such non-compliance, it shall be rejected without review.
- O. Label resubmitted shop drawings with a stamp indicating the submittal number, for example SECOND SUBMISSION; THIRD SUBMISSION, etc. and send separate transmittals for each item being submitted so that one transmittal does not cover more than one specific item or group of items from one manufacturer.

- P. Failure to submit shop drawings in ample time for checking shall not entitle an extension of Contract time, and no claim for an extension by reason of such default will be allowed.
- Q. Prior to submission of shop drawings, thoroughly check each shop drawing, reject those not conforming to the Specifications, and indicate (by signature) that the shop drawings submitted meet Contract requirements. Deviations and/or exceptions to the contract documents should be clearly noted as being deviations and/or exceptions. The Contractor will later be required to correct such deviations and/or exceptions at his own expense if they have not been noted and approved on the shop drawing.
- R. All shop drawings showing routing of ductwork, piping, and conduit, shall be not less than $\frac{3}{8}$ " = 1'-0" scale.
- S. Incorporate a numbering system to help keep track of shop drawing submittals as follows:
 - 1. H or M.....HVAC shop drawings
 - 2. PPlumbing shop drawings
 - 3. FP.....Sprinkler / Standpipe shop drawings
 - 4. E.....Electrical and Fire Alarm shop drawings
- T. Concurrent numbers shall follow the prefix letter. Example: H-1, H-2, etc. In addition, shop drawings requiring resubmission should bear the number of the original submission and bear a suffix as follows: H-1A (second submission), H-1B (third submission), etc.
- U. Before the request for acceptance and final payment for the work, write a letter to the Architect stating that all shop drawings are brought to a condition "No Exception" or "Exception as Noted". Any outstanding shop drawings must be cleared with the Engineer.

1.10 RECORD DRAWINGS

- A. The Contractor shall furnish, coordinate, produce, and distribute record drawings as stated within the General Conditions of the Contract.
- B. During construction keep an accurate record of all deviations between the work as shown on the Drawings and that which is actually installed.
- C. On certain projects where Record Drawings must be on Mylar, secure from the Architect, a complete set of Drawings and note thereon all changes. Make a complete record of all changes and revisions in the original design that exist in the complete work. Furnishing these transparencies and preparing these Record Drawings shall be at no additional cost to the Owner. When all revisions showing the work as finally installed are made, the corrected Mylar transparencies shall be submitted for review by the Architect. After reviewing the Record Drawings by the Architect, provide the Owner with one set of black line prints and Mylar transparencies, at no additional cost to the Owner.
- D. Where record drawings are CAD type, provide CD's containing AutoCAD files of these drawings to the Architect, the Engineer, and the Owner.

1.11 LAWS, ORDINANCES, PERMITS AND FEES

- A. Give all necessary notices, obtain all permits and pay all governmental taxes, fees, and other costs in connection with the work; file all necessary plans, prepare all documents, and obtain all necessary approvals of all governmental departments having jurisdiction; obtain all required

Certificates of Inspection for the work and deliver to the Architect before request for acceptance and final payment for the work. File for and obtain all required equipment use permits, Special Inspections, submission of fire alarm as-built drawings, backflow prevention device (BFP) signoffs, boiler and domestic hot water heater filings with DEP and all other required filings.

- B. Include in the work, without extra cost to the Owner, any labor, materials, services, apparatus, drawings, (in addition to Contract Drawings and Documents) in order to comply with all applicable laws, ordinances, rules and regulations, whether or not shown on Drawings and/or specified.
- C. All materials furnished and all work installed shall comply with the rules and recommendations of the National Fire Protection Association, with all requirements of local utility companies, with the recommendations of the fire insurance rating organization having jurisdiction, and with the requirements of all governmental departments having jurisdiction.
- D. Include in the bid, without extra cost to the Owner, retaining the service of a licensed professional engineer to obtain equipment use permits, filing of sprinkler drawings with hydraulic calculations, DEP BFP sign-off, all DEP chimney and boiler submissions, preparation of fire alarm as-built drawings, testing of all fire and fire smoke dampers, and approvals and all other required filings.

1.12 INDEMNIFICATION

- A. Pay all royalties and defend all suits or claims for infringement of any patent rights and save the Owner harmless from loss on account thereof.
- B. If the process or article specified is an infringement of a patent, promptly notify the Architect in writing, and any necessary changes shall be as provided in the Contract for changes in the work. If the Contractor performs any work specified knowing it to be an infringement of the patent, he shall bear all costs arising therefrom.
- C. Take out all necessary insurance, free of extra charge, and agree to indemnify and save harmless the party contracting for services against loss or expense, by reason of the liability imposed by law upon such party for damages because of bodily injuries, including death at any time resulting therefrom, accidentally sustained by any person or persons or on account of damage to property arising out of or in consequence of the performance of this Contract, whether such injuries to persons or damage to property are due or claimed to be due to any negligence in the performance of the Contract, the party contracting for services, employees or agents, or any other person.

1.13 ORGANIZATION OF WORK

- A. The work throughout shall be executed in the best and most thorough manner under the direction of and to the satisfaction of the Engineers, Owners, and Architects, who will jointly interpret the meaning of the Drawings and Specifications and shall have the power to reject any work and materials which, in their judgment, are not in full accordance therewith.
- B. The work called for under this Contract shall be carried on simultaneously with the work of other trades in a manner such as not to delay the overall progress of the work. Furnish promptly to other trades involved at the project, all information and measurements relating to the work which they may require. Cooperate with them in order to secure the harmony necessary in the interest of the project as a whole.

- C. Furnish and install all the work as expeditiously as possible in order to meet all construction schedules.
- D. Keep a competent superintendent in charge of the work at all times. Such superintendent shall be replaced if deemed unsatisfactory to the Owner.
- E. Upon award of contract, consult with the Architect and negotiate with subcontractors and manufacturers, and within thirty (30) days submit a preliminary list of major equipment for approval, complete with name of manufacturer, dates of purchase orders, and delivery dates to the site. Also, submit within thirty (30) days a preliminary schedule of installation of the various systems. This list shall be revised monthly and resubmitted. The second submittal shall contain the names of manufacturers of scheduled equipment (with names, addresses, and telephone numbers of local representatives).
- F. Maintain a complete file of shop drawings at all times available to the Owner's representative.
- G. Every facility shall be provided to permit inspection of the work by the Owner's representative during the course of construction.
- H. Where items of equipment and/or materials are indicated in the Specifications as being furnished by other trades for installation, assume responsibility for the unloading of such equipment and/or materials from the delivery trucks, and for providing safe storage for same as required pending installation.
- I. Where the work is to be installed in close proximity to work of other trades, or where there is evidence that the work is to interfere with work of other trades, assist in working out space conditions to make a satisfactory adjustment.
- J. If so directed by the Architect, prepare composite working drawings and sections at a suitable scale not less than $\frac{3}{8}$ " = 1'-0" clearly showing how the work is to be installed in relation to the work of other trades. If the installation is made before coordinating with other trades, make all necessary changes in the work without extra charge to the Owner.
- K. Before submitting shop drawings for sleeves, piping, and ductwork, the Heating, Ventilating and Air Conditioning Subcontractor shall prepare a combined $\frac{3}{8}$ " = 1'-0" scale shop drawing for piping and ductwork indicating the location of piping and ductwork with dimensions for each floor and Mechanical Rooms. A digital version of these shop drawings shall be given to the Electrical Contractor. The Electrical Contractor shall indicate the location of all lighting fixtures and conduit runs on these shop drawings. The Electrical Contractor shall provide a digital version of the updated shop drawings, with lighting fixtures and conduit runs indicated to the Plumbing Contractor. The Plumbing and Sprinkler Contractor shall indicate his piping on these digital shop drawings.
- L. The Heating, Ventilating and Air Conditioning Contractor shall arrange a Coordination Meeting for each floor and Mechanical Equipment Room with Plumbing and Electrical Contractors under the supervision of the General Contractor. After coordination, each Contractor shall digitally sign the a copy. The Heating, Ventilating and Air Conditioning Contractor shall submit these drawings to the Architect for review and he shall call any conflicts that could not be resolved in the coordination meetings, and/or deviation from the original design, to the Architect's attention. After receiving a written review from the Architect, each Contractor shall prepare the shop drawings as required under the paragraph "Shop Drawings" in the Specifications.

1.14 PROTECTION OF WORK AND PROPERTY

- A. Maintain and protect all equipment, materials, and tools from loss or damage from all causes until final acceptance by the Owner.
- B. Assume responsibility for the protection of any finished work or other trades from damage or defacement by the operations and remedy any such injury or damages.

1.15 TEMPORARY OPENINGS

- A. Ascertain from examination of the Architectural Drawings whether any special temporary openings in the building will be required for the admission of apparatus provided under the Contract and notify the Architect accordingly. In the event of failure to give sufficient notice to the Architect in time to arrange for these openings during construction, assume all costs of providing such openings thereafter.

1.16 SHUTDOWNS

- A. When installation of a new system requires the temporary shutdown of an existing operating system, the connection of the new system shall be performed at such regular time or at overtime when designated by the Owner at no additional cost to the Owner.
- B. The Owner shall be notified of the estimated duration of the shutdown period at least ten (10) days in advance of the date the work is to be performed.
- C. Work shall be arranged for continuous performance, including overtime, when approved by the Owner, if required, to assure that existing operating services will be shut down only during the time actually required to make necessary connections.

1.17 ACCESS DOORS IN FINISHED CONSTRUCTION

- A. Install all work so that all parts required are readily accessible for inspection, operation, maintenance, and repair. Minor deviations from the Drawings may be made to accomplish this, but changes of magnitude shall not be made without prior written review from the Architect.
- B. Wherever mechanisms requiring access for maintenance, reading of instruments, or for operation are concealed in the structure and wherever else indicated on the Drawings, supply access doors of sizes necessary to provide ready access to the concealed items. Group together valves, controls, dampers, traps, expansion joints, cleanouts, gauges, switches, and other equipment requiring access in walls and furred spaces to reduce the number of access doors.
- C. Access doors shall be Milcor Style A, B or K, L or M, as manufactured by Inland Steel Products Co. or approved equal. Minimum access door shall be 12" x 12". For installation in plastered wall or ceiling, provide Style "K" or "L" as required. For installation in masonry walls, provide Style "M". For installation in acoustical tile surfaces, provide Style "AT". For installation in acoustical plaster surfaces provide Style "AP". Fire resistive access doors for suspended drywall ceiling shall be Style ATC's. Provide fire-rated access doors at fire-rated shafts, stairwells, corridors and at all other walls with Fire Rating.

- D. Provide 24" x 24" access door for each duct or pipe shaft. Provide at least one (1) per floor, or as indicated on the drawings. Provide an 18" x 24" access door in each outside air and exhaust air plenum.
- E. All plumbing, electric and heating and ventilating access doors, etc., shall be provided with Corbin #2722-1/2 master keyed cylinder locks. These locks shall be supplied and installed by the respective Contractor. These cylinder locks shall be purchased through the General Contractor's subcontractor for hardware after submission and review of the panel schedule as hereinafter specified.
- F. Prepare a schedule showing the location of all panels, cabinets, etc. to receive the Corbin lock. This schedule shall be designed, by building and room number, the panel or cabinet location and shall be submitted to the Architect. This schedule is required for use in preparation for keying information. Locks shall not be purchased prior to review of this schedule.
- G. Access doors for fire and smoke dampers shall be permanently identified on the exterior by a label having letters not less than 0.5 inch in height and reading: SMOKE DAMPER or FIRE DAMPER or FIRE/SMOKE DAMPER. This shall include ceiling tiles that provide access to these dampers.

1.18 PIPE EXPANSION

- A. All pipe connections shall be installed to allow for freedom of movement of the pipe during the expansion and contraction without undergoing damage due to excessive stress. Proper anchors and guides shall be provided where necessary and/or when shown on the Drawings. Anchors and guides shall be subject to the review of the Architect. Refer to Section 23 20 00 and provide pipe support and expansion calculations by an independent Professional Engineer, using the project's piping shop drawings.

1.19 SCAFFOLDING, RIGGING, HOISTING

- A. Provide all scaffolding, rigging, hoisting, and services necessary for erection and delivery into the premises of all equipment and materials furnished under this Section of the Specifications, and remove same from premises when no longer required.
- B. In the event that supplementary bracing of the basic building structure is required to ensure a secure rigging procedure and a secure route for the equipment being handled, assume full responsibility for such supplementary bracing.

1.20 BASES AND SUPPORTS

- A. Provide all bases and supports not part of the building structure of required size, type, and strength, as approved by the Architect, for all equipment and materials furnished by him. All equipment, bases, and support shall be adequately anchored to the building structure to prevent shifting of position under operating conditions.
- B. The Section furnishing the equipment shall provide not less than six-inch high concrete bases for all pumps, refrigeration machines, compressors, fans, humidifier units, air handlers, boilers, etc., and rotating machinery. Bases shall extend six inches beyond the machinery base in all directions, with the top edge chamfered. Provide 1/2" x 6" steel dowels into floors to anchor bases. Provide anchor bolts set in pipe sleeves; two sizes larger than anchor bolts for securing machinery. After anchor bolts are aligned with equipment bases, fill sleeves with concrete and allow to set.

- C. Concrete pads shall also be provided below any floor-mounted duct support, pipe support and electrical panel support (including switchboards, power panels, starters, VFDs, pull boxes, etc.). Provide six-inch high concrete pads below the mounting feet of any of the above duct, pipe or equipment support legs. Provide connection hardware (anchor bolts) as described above for rotating equipment.
- D. Concrete bases are specified under other Sections of the Specification. Each Contractor shall furnish dimensioned drawings to the General Contractor. Steel dowels, sleeves, and anchor bolts shall be furnished and set by the Contractor.
- E. New concrete pads shall be dowelled into the existing concrete with ½" rods at corners, drilled 6" deep and grouted. An epoxy bonding agent shall be applied between the old and new concrete. Concrete shall be 3000 psi reinforced with one middle layer 4 x 4 - w2.9 x w2.9.

1.21 SLEEVES, PIPE AND CONDUIT INSERTS AND ANCHOR BOLTS

- A. Provide and assume responsibility for the location and maintenance of proper position of all sleeves, inserts, and anchor bolts required for the work. In the event that failure to do so requires cutting and patching of finished work, it shall be done without additional cost to the Owner.
- B. All pipes and conduits passing through all walls or partitions shall be provided with sleeves having an internal diameter larger than the outside diameter of the pipe or insulation enclosing the pipe or conduit. Sleeves through masonry walls and partitions shall be Schedule 40 black steel pipe. Sleeves through non-masonry partitions may be 22-gauge galvanized steel sheet metal, set flush with the finished surfaces of partitions.
- C. Sleeves through foundation walls shall be James B. Clow & Sons № F-1430 or F-1435 cast iron wall sleeve with intermediate integral flange. Sleeves shall be set with ends flush with each face of wall. The space between sleeve and pipe shall be packed with a mechanical rubber seal, such as "Link Seal" manufactured by Thunder line Corp., (VICO) and then with oakum to within 2" of each face of the wall. The remaining space shall be packed and made watertight with a waterproof compound.
- D. Sleeves through concrete floors shall be Schedule 40 black steel pipe and extending 1" above finished floors. The open sleeve space shall be packed with non-combustible materials.
- E. Inserts shall be preset concrete inserts with steel reinforced rods through the insert and both ends hooked over the reinforced mesh. Inserts shall be of individual type of malleable iron construction with accommodation for removable nuts and threaded rods up to ¾" diameter, permitting lateral adjustment, except as otherwise noted. Individual inserts shall be Grinnell Fig. 279 up to 5" pipe and conduit, Fig. 282, 6" and up to 8" pipe and conduit, Fig. 152 above 8" and up to 12" pipe and conduit. For figures 282 and 152, they shall come with an opening at the tip to allow reinforcing rods up to ½" in diameter to be passed through the insert body. Rods shall extend a minimum of 4" on either side of the insert. Pipes larger than 12" shall be suspended from steel members only.
- F. In general, all piping and conduit shall be supported by structural steel building members only or approved malleable steel inserts embedded in concrete pours. Concentrated loads up to 200 lbs. may use inserts in concrete in buildings having poured concrete floors whose thickness is 6" or more. All other loads shall be supported by steel building members. Inserts shall not be located in any corrugated deck flute as ceiling tabs nor within 2 feet in any direction from ceiling tabs. Inserts shall not be spaced closer than 4 feet on center in all directions.

- G. Where layout revisions are required, and are approved after concrete deck is poured, piping conduit 3" and smaller may be supported at Intermediate Points by Phillips' ¾" expansion bolts with lead shields, provided main supports are welded to structural steel and are not more than twenty feet on centers.
- H. Piping and conduit 3" and smaller shall be supported from the existing slab by "Phillips" ¾ expansion bolts with lead shields. Piping 4" and larger shall be supported by means of 4" x 4" x ¾" clip knee angle with ¾" expansion bolt in shear and supporting rod at 90° from another bolt or using two expansion bolts per hanging post - pipes 8" and larger shall be supported from steel building members. In concrete buildings, add supplementary steel tied into the concrete structural members. Support such piping, conduits, and ductwork from the supplementary steel.
- I. Provide sleeves for pipes passing through roofs. Sleeves passing through roofs shall be as detailed on drawings extending min. 12" above the finished roof. All pipes passing through the roof shall be a minimum of 10" from walls or other construction to permit proper flashing. Provide counter flashing.
- J. Where sleeves pass through waterproofed floors, they shall be IPS brass pipe sleeves of the required diameter, brazed at the bottom to 18" x 18", 16-ounce copper flashing for bond with waterproofing. The tops of the sleeves shall extend 1" above the finished floor.
- K. No ductwork, piping, conduit, or equipment shall be supported from corrugated decking construction. For this area provide supplementary steel to support ductwork, piping, conduit or equipment. Supplemental steel members shall be welded to building structural steel.
- L. All hangers, rods and supports shall be installed prior to construction fireproofing.
- M. The required fire resistance rating of floor or floor/ceiling assemblies and walls shall be maintained where a penetration is made for electrical, mechanical, plumbing pipes, conduits, ducts and systems. Fire stopping shall be provided at openings around vents, pipes, ducts, conduits at floor levels and walls with non-combustible materials. For openings around pipes and conduits and/or sleeves, 3M product Caulk CP 25 and Putty 303 or approved equal shall be provided.
- N. Owner shall retain the services of a NYS Licensed Professional Engineer and under his direction shall inspect the existing spray or fireproofing of existing structural members exposed during the renovation. Provide a report of deficiencies.

1.22 ESCUTCHEONS

- A. Provide escutcheons on pipes wherever they pass through ceilings, walls, or partitions.
- B. Escutcheons on pipes passing through outside walls shall be Ritter Pattern and Casting Co., № 1, solid, cast brass, flat type secured to pipe with set screw.
- C. Escutcheons for pipes passing through floors shall be Ritter Pattern and Casting Co., № 36A, split-hinged, cast brass type, designed to fit pipe on one end and cover sleeve projecting through floor on the other end.
- D. Escutcheons for pipes passing through interior walls, partitions, and ceilings shall be Ritter Pattern and Casting Co., № 3A, split-hinged, cast brass chromium plated type.

1.23 MANUFACTURERS' IDENTIFICATION

- A. Manufacturer's nameplate, name or trademark, shall be permanently affixed to all equipment and material furnished under this Specification. Where such equipment is in a finished occupied space, the nameplate shall be in a concealed but accessible location. The nameplate of a Subcontractor or Distributor will not be acceptable.

1.24 EQUIPMENT NAMEPLATES

- A. Provide for each item of equipment, including panelboards, disconnects, breakers, starters, switches, and all control devices, pumps, fans, compressors, boilers, etc., a permanently attached nameplate made of black surface, white core laminated plastic with incised letters. Subcontractor furnishing equipment shall provide nameplate. Pneumatic, electric and mechanically actuated gauges shall have a brief, but complete description of their function. Stating the air pressure or voltage range alone is not acceptable. Nameplates shall be a minimum of 3" long by 1½" wide and shall bear the equipment name and item number (tag number) in ½" high white letters as designated in the equipment schedule. Nameplates shall be attached to their respective equipment by screws or rivets.

1.25 TAGS AND CHARTS

- A. Furnish and attach to each valve as hereinafter specified, a 1½" diameter brass tag with ½" indented numerals filled with durable black compound. Tags shall be securely attached to stems of valves with chain and "S" hooks.
- B. Valve charts shall consist of schematic drawings of piping layouts, showing and identifying each valve and describing the function. Upon completion of the work, one (1) copy of each chart, sealed to rigid backboard with clear lacquer placed under glass and framed, shall be hung in a conspicuous location in the main equipment room, unless otherwise directed by the Architect. Two (2) additional unmounted copies in 8½" x 11" leather ring binders shall be delivered to the Architect. Also furnish three (3) copies of schematic flow chart with corresponding valve numbers noted on chart.
- C. Provide tags for the following valves:
 - 1. Zone control, bypass, shut-off, check and balancing valves.
 - 2. Building and area shut-off and balancing valves.
 - 3. Control, by-pass, shut-off, balancing and drain valves for major pieces of equipment such as boilers, domestic hot water heaters, heat exchangers, refrigeration machines, pumps, heating, ventilating and air conditioning units, cooling towers, etc.
 - 4. System drain valves, safety and relief valves. Vacuum breakers.
- D. Tags on control valves shall bear the valve tag numbers shown on the ATC shop drawings. These shall be brass 1¼" diameter tags, with ½" indented numerals filled with durable black compound. Tags shall be securely attached to stems of valves with chain and "S" hooks.

1.26 IDENTIFICATION

- A. Identification shall be in accordance with "Scheme for Identification of Piping System ANSI A13.1" and OSHA safety color regulation.
- B. Markers shall be snap-on type as manufactured by Craftmark, Fort Worth, TX or Seton Nameplate Corp., New Haven, CT (Setmark System), or Bunting Stamp Co. Inc., Pittsburgh, PA or approved

equal. Markers shall completely encircle the pipe with a substantial overlap. No adhesive shall be used. They shall be manufactured of U.L. approved, self-extinguishing plastic. When the pipe, including insulation (if any), is 4 inches diameter and larger, markers shall be strap-on type. For piping located outdoors, all markers shall be strap-on type for all pipe diameters, and straps shall be of stainless steel. Markers for medical gas piping shall be by means of metal tags, stenciling, stamping or with adhesive markers, in a manner that is not readily removable. *

- C. Provide identification for piping, ductwork and electrical conduits.
- D. All piping and ductwork shall be labeled, whether concealed above ceilings or exposed. Labels shall be installed at intervals no greater than 15 feet (unless noted otherwise) and shall be installed after every turn or elbow, and in every room. Where concealed above ceilings, a minimum of one (1) label shall occur above each room. Due to various above ceiling visual obstructions, the Engineer reserves the right to request additional labels in order to ensure visibility, at no additional cost to the Owner.
- E. Pipe shall be lettered and valves tagged in accordance with the schedule below. Lettering shall be located near each valve and branch connection and at intervals of not over 20 feet (10 feet on fire lines, and at least once in each room and in each story traversed for medical gas piping*) on straight runs of pipe. Provide flow arrows on all piping and ductwork labels. Adjacent to the legend, stencil the size of the pipe, conduit or ductwork. Letter Colors are as follows: Yellow with black letters, green with white letters, blue with white letters and red with white letters.

LABEL AND VALVE TAG SCHEDULE			
Service	Label Designation	Color	Tag Designation
Cold Water	Cold Water	Green	C.W.
Hot Water (Plumbing)	Hot Water-Deg. F	Yellow	H.W.-Deg. F
Condenser Water Supply	Condenser Water	Green	C.W.S.
Condenser Water Return	Condenser Water Ret.	Green	C.W.R.
Refrigerant Suction	Refrigerant Suction	Green	RS
Refrigerant Liquid	Refrigerant Liquid	Green	RL
Refrigerant Hot Gas	Refrigerant Hot Gas	Green	RHG
Air Conditioning Drain	Air Conditioning Drain	Green	----
Safety Valve Discharge	Safety V. Disch.	Yellow	S.V.D.
Air Conditioned Supply Air	A.C. Supply Air	Green	----
Return Air	R.A.	Green	----
Outside Air	O.A.	Green	----
Mixed Air	M.A.	Green	----

- F. Tanks, pumps, fans and other equipment shall be labeled to show the number, if any, and service.

- G. Exposed conduits for alarm and communication systems shall be banded at intervals of not over 10 feet. Bands shall be of the following colors:
 - 1. Fire Alarm SystemRed
 - 2. Mechanical & Electrical Supervisory SystemGreen & Blue
- H. HIGH VOLTAGE" in black letters two inches high, stenciled at 10-foot intervals over a continuous painted orange background.
- I. Except where other means of identification are specified, electric cabinets, switchboards, motor control centers, transformers, system control boards, disconnecting switches, remote control switches, individual motor starters and motor control pushbutton stations shall be stenciled to show the service and number, if any, of the equipment controlled, as appropriate. Panelboards and other electrical equipment located in finished areas, such as offices, shall have the identification placed on the inside of the cabinet doors.
- J. Cabinets housing 460Y/265 Volt panelboards shall have "460/265 volt" stenciled in 2-inch-high yellow letters on the inside of the cabinet doors.
- K. Cabinet housing emergency lighting panelboards shall have the word "EMERGENCY" stenciled in 2-inch high red letters on the outside of the cabinet, in addition to other lettering required above.
- L. The bolted covers of housings for disconnecting switches or links in bus ducts between network transformers and switchboards shall be lettered to identify the equipment within.
- M. Serial numbers shall be stenciled on the tanks and covers of transformers having their nameplates attached to the high voltage switch chamber covers.
- N. Signs for Equipment Controlled through the BAS: For all fans, pumps and other motor-driven equipment with start/stop control through the BAS provides a red surface, white core laminated plastic sign with incised letters, permanently mounted on the equipment indicating, "Warning. This Equipment Is Started and Stopped Automatically from the Building Automation System."

1.27 COORDINATION OF MECHANICAL AND ELECTRICAL EQUIPMENT LOCATIONS

- A. The space equal to the width and depth plus 6" on either side of the electrical equipment and extending to a height of 6 feet above the equipment or the structural ceiling, whichever is lower, shall be dedicated to the electrical installation and shall not contain piping ducts or other equipment foreign to the electrical installation. Electrical equipment shall include switchboards, panelboards and motor control centers.
- B. Examine the drawings, and in cooperation with the Electrical Work confirm the final location of all electrical equipment to be installed in the vicinity of piping and ductwork. Plan and arrange all overhead piping no closer than three feet, and ductwork no closer than one foot from a vertical line to electric switchboards, panelboards, motor control centers or similar equipment.
- C. Where the installation of piping or ductwork does not comply with the requirements of foregoing paragraphs, where feasible, the piping and ductwork shall be relocated. Installation of a barrier between piping and ductwork and electrical equipment below will be considered if located more than six feet above the electrical equipment. Refer to NEC Article 110. If piping ductwork and foreign equipment cannot be located outside of the space dedicated to electrical installation, a

drip pan as described below can be considered to protect the electrical equipment from condensation, leaks or breaks, but shall be approved by the Engineer after the Contractor has demonstrated that piping, ductwork and/or equipment cannot be installed to avoid this space.

- D. Provide galvanized steel gutters as follows:
1. Provide a gutter of 18-gauge galvanized steel under every pipe and roof drain which is within 2'-0" (two feet) of being vertically over any motor, transformer, electrical controllers, switchboards, panelboards, generator or the like.
 2. Also provide drip pans below any drain piping located above the ceiling in food preparation or storage areas. In such areas, if piping also runs vertical through the floor slab above, then fully enclose the vertical portion with an extension of said drip pan and fully seal this enclosure to the underside of the floor slab above.
 3. Each gutter shall be made watertight, properly suspended; and carefully pitched to a convenient point for draining. Provide a $\frac{3}{4}$ inch drain, to nearest floor drain or slop sink.
 4. In lieu of such separate gutters, a continuous protecting sheet of similar construction, adequately supported and braced, properly rimmed, pitched and drained, may be provided over any such motor, and extending 3'-0" in all directions beyond the motor, over which such piping has to run.

1.28 CONDENSATE DISPOSAL

- A. Fuel-Burning Appliances: Liquid combustion by-products of condensing appliances shall be collected and discharged to a plumbing fixture or disposal area in accordance with the manufacturer's installation instructions. Condensate piping shall be of corrosion-resistant material and shall not be smaller than the drain connection on the appliance. Such piping shall maintain a minimum horizontal slope in the direction of discharge of not less than $\frac{1}{4}$ unit vertical in 12 units horizontal (1% slope).
1. Condensate Disposal: Condensate from all fuel burning appliances and associated flues shall be neutralized to a pH of at least 6 and no more than 8 prior to disposal to a sanitary system.
- B. Evaporators and Cooling Coils: Condensate drain systems shall be provided for equipment and appliances containing evaporators or cooling coils. Condensate drain systems shall be designed, constructed and installed with the following:
1. Condensate Disposal: Condensate from all cooling coils and evaporators shall be conveyed from the drain pan outlet to an approved place of disposal. Such piping shall maintain a minimum horizontal slope in the direction of discharge of to less than $\frac{1}{8}$ unit vertical in 12 units horizontal (1% slope). Condensate shall not discharge into a street, alley or other areas so as to cause a nuisance.
 2. Drain Pipe Materials and Sizes: Components of the condensate disposal system shall be copper pipe or tubing as specified in the piping section of this specification. All components shall be selected for the pressure and temperature rating of the installation. Condensate waste and drain line size shall be not less than $\frac{3}{4}$ " (19 mm) internal diameter and shall not decrease in size from the drain pan connection to the place of condensate disposal. Where the drain pipes from more than one unit are manifolded together for condensate drainage, the pipe or tubing shall be sized in accordance with the following:

CONDENSATE DRAIN SIZING	
Equipment Capacity	Minimum Condensate Per Diameter
Up to 90 tons of refrigeration	1¼”
Over 90 tons to 125 tons of refrigeration	1½”
Over 125 tons to 250 tons of refrigeration	2”

3. **Auxiliary and Secondary Drain Systems:** Where damage to any building components could occur as a result of overflow from the equipment primary condensate removal system, the following auxiliary protection methods shall be provided for each cooling coil or fuel-fired appliances that produces condensate:
 A water-level detection device shall be provided that will shut off the equipment served in the event that the primary drain is blocked. The device shall be installed in the primary drain line, the overflow drain line, or in the equipment-supplied drain pan, located at a point higher than the primary drain line connection and below the overflow rim of such pan.
 Exception: Fuel-fired appliances that automatically shut down operation in the event of a stoppage in the condensate drainage system.
 - a. **Water-Level Monitoring Devices:** On down-flow units and all other coils that do not have a secondary drain or provisions to install a secondary or auxiliary drain pan, a water-level monitoring device shall be installed inside the primary drain pan. This device shall shut off the equipment served in the event that the primary drain becomes restricted. Devices installed in the drain line shall not be permitted.
4. **Traps:** Condensate drains shall be trapped as required by the equipment or appliance manufacturer.

1.29 TOOLS

- A. All special tools for proper operation and maintenance of the equipment shall be delivered to the Owner's representative and a receipt requested for same at no additional cost to the Owner.

1.30 QUIET OPERATION

- A. All equipment and material shall operate under all conditions of load without any sound or vibration, which in the opinion of the Architect is objectionable. Where sound or vibration conditions arise that are considered objectionable by the Architect, eliminate same in a manner reviewed by the Architect.

1.31 RUBBISH REMOVAL

- A. See to it that the project is at all times maintained free of all rubbish, rubble, waste material, packaging materials, etc. accumulating as a result of his work. Assume responsibility for the cleaning up of packaging removed from materials and equipment furnished by other trades for the installation. Note that final acceptance of the work is contingent upon the project being free of all excess and waste materials resulting from the work.
- B. Clean all parts of the building exterior spaces and adjacent roads, sidewalks, and pavement, free from material and debris resulting from the execution of the work. Debris resulting from interior construction shall be neatly stacked on each floor near elevators, material hoists and rubbish

chutes, as directed by the Architect or his representative. Debris resulting from exterior construction shall be similarly stacked. All debris stacked will be removed under other Sections. Excess material will not be permitted to accumulate either on the interior, exterior or on sidewalk.

1.32 CLEANING, PIPING, DUCTS AND EQUIPMENT

- A. Clean all piping, ducts, and equipment of all foreign substances inside and out before being placed in operation.
- B. If any part of a system should be stopped by foreign matter after being placed in operation, the system shall be disconnected, cleaned, and reconnected wherever necessary to locate and remove obstructions. Any work damaged in the course of removing obstructions shall be repaired when the system is reconnected at no additional cost to the Owner.
- C. During construction, properly cap all pipes and equipment nozzles so as to prevent the entrance of sand, dirt, etc.

1.33 DELIVERY OF MATERIAL

- A. Deliver the material and store the same in spaces indicated by the Architect and assume full responsibility for damage to structure caused by any overloading of the material.

1.34 CUTTING AND PATCHING (IN EXISTING CONSTRUCTION)

- A. All cutting and patching shall be done under another Section. Furnish the sizes and locations of all chases and openings required for the installation of his work before the walls, floors and partitions are built.
- B. As a general rule, chases, shafts and wall openings as shown on the Drawings will be provided for most of the ducts and piping, but promptly arrange with the Construction Supervisor for additional openings should any be required for the work.
- C. Provide the labor and materials for all work included under the Contract or Subcontract in ample time and sufficient quantities so that all of the work of the Contract or Subcontract may be installed in proper sequence to avoid unnecessary cutting of the floors and walls.
- D. Any cutting and patching required due to the failure to comply with the above provisions shall be done at no extra cost to Owner. Such cutting and patching shall be done under Division One, as approved by the Architect.
- E. Where existing piping or ductwork insulation are damaged by the requirements of the work, replace all damaged insulation to match existing.
- F. Refer to Paragraph: "Sleeves, Inserts and Anchor Bolts" for additional requirements.
- G. Prior to performing any core drilling or cutting of existing floor or roof slabs, Contractor shall perform a scan of the slab using ground penetrating radar (GPR) to confirm that there are no existing conduits or pipes in area of core drill or cutting of slab.

1.35 ALTERATIONS

- A. When new work and alterations render equipment, piping and ductwork useless, such equipment, piping and ductwork when exposed to view, shall be removed and connections thereof to lines or

ducts remaining shall be properly capped or plugged and left in construction. If construction, such as hung ceiling, furred beam, chase, etc., is opened up and removed during the course of the construction, the useless pipe and ducts therein shall be treated as though exposed to view. When required to accommodate new work, useless piping and ductwork concealed in construction shall be treated as though exposed to view.

- B. When existing piping and duct systems, at points of connection to new work or in rerouting are found defective, such defective portions shall be removed and replaced with new materials without cost to the Owner.
- C. Provide temporary support where required.
- D. Where alterations reveal piping, ductwork, conduit circuits, wiring, and accessories that must necessarily remain in service, same shall be rerouted, replaced, or altered as required to make same completely concealed in the new work at no additional cost to the Owner.
- E. Where existing piping or ductwork insulation is damaged by the requirements of the work, replace all damaged insulation to match existing.
- F. Cutting in the existing building shall be done by each Contractor as reviewed by the Architect. Rough patching shall be done by each Contractor. Finish patching, ceiling construction removal, new ceiling in the existing building will be done under another Section.

1.36 PAINTING

- A. All finished painting of MEP/FP work shall be provided as specified below.
- B. Painting Schedule
 - 1. No on-site painting is required on the following items unless specifically indicated otherwise:
 - a. Stainless steel or aluminum sheet metal.
 - b. Stainless steel piping.
 - c. Piping or ductwork to be insulated.
 - d. Insulation on piping or ductwork in unfinished spaces or concealed.
 - e. Insulated piping covered with stainless steel, aluminum, or all service jacketing, unless otherwise specified.
 - f. Insulated piping in walk-in and non-walk-in tunnels.
 - g. Mechanical equipment with a factory-applied baked-on enamel finish, not specified to be insulated or provided with an enameled steel insulated jacket.
 - h. Insulated equipment or smokestacks specified or noted on the Drawings to be covered with stainless steel or aluminum sheet metal jacketing.
 - i. Factory-fabricated multi-wall metal smoke flue piping.
 - j. Concealed piping.
 - 2. Paint the following:
 - a. Uninsulated Black Steel Piping:
 - 1) Exposed in Finished Rooms or Finished Spaces: 1 coat of primer and 2 coats of latex semi-gloss enamel.
 - 2) Exposed in Unfinished Rooms, or Unfinished Spaces, or in Pipe Shafts: 1 coat of primer and 2 coats of finish.
 - 3) Exposed Exterior to a Building: 1 coat of primer and 2 coats of exterior acrylic latex gloss enamel.
 - b. Uninsulated Galvanized, Cast Iron, Brass or Copper Piping:

- 1) Exposed in Finished Rooms or Finished Spaces: 1 coat of primer and 2 coats of latex semi-gloss enamel.
 - 2) Exposed Exterior to a Building: 1 coat of primer and 2 coats of exterior acrylic latex gloss enamel.
 - 3) Exposed in Unfinished Rooms or Unfinished Spaces: 1 coat of primer and 2 coats of finish.
- c. Piping in floor trenches after fabrication: primer and finish.
- d. Uninsulated Mechanical Equipment:
- 1) Furnished with a Factory Applied Prime Coat Finish: 2 coats of acrylic latex semi-gloss enamel. No primer is required.
- e. Vessels, Tanks, and Like Equipment Specified to be Insulated: 1 coat of corrosion resistant paint, prior to the application of insulation.
- f. Uninsulated Exposed Iron and Steel Surfaces of Boilers, Including the Steel Casing, Buck Stays, Boiler Fronts, Castings, Smoke Pipes, Breeching and the Exposed Surfaces of all Other Iron or Steel Installed in Conjunction with Boiler Work: 1 coat of primer and 2 coats of heat-resistant enamel.
- g. Insulated exposed piping in Mechanical Rooms, Boiler Plants, Chiller Plants and Generator Rooms (except on segments of pipe which are clad in aluminum).
- h. Hangers, Supports and Accessories:
- 1) Exposed: Paint to match adjacent piping, pipe insulation or ductwork insulation.
 - 2) All black steel or iron pipe hangers, rods, inserts, brackets and accessories for supporting piping systems and duct systems: 1 coat of primer and 2 coats of latex semi-gloss enamel. Paint black steel hanger rods, threaded on the job site, with a primer immediately after installation.
 - 3) Metal Fabrications in Finished Spaces: Paint over shop coat with 2 coats of alkyd gloss enamel.
- i. Sheet Metal Work:
- 1) Exposed Black Iron, Galvanized Iron, and Aluminum, including Hangers for Insulated and Uninsulated Ductwork, in Finished Rooms, Finished Spaces or Exterior to a Building: 1 coat of primer and 2 coats of latex semi-gloss enamel.
 - 2) Jacketing on Exposed Insulated Ductwork in Finished Rooms and Finished Spaces: 2 coats of latex semi-gloss enamel. No primer required.
- j. Uninsulated Exposed Valves, Flanges, Unions and Irregular Surfaces in Piping Systems Installed in Finished Rooms or Finished Spaces: 1 coat of primer and 1 coat of black heat-resistant enamel.
- k. Convectector enclosures shall be painted at the factory as specified in Section 15835: Convectors.
- l. Underground pipe, ducts and conduits - two coats of black asphaltum paint (except when constructed using a pre-engineered underground insulation system with poly jacketing).
- C. Color Coding:
1. Apply finish paints of colors indicated opposite the various items listed below where such items are installed in Mechanical Equipment Rooms, Machine Rooms, Boiler Rooms, Penthouse Mechanical Equipment Rooms:
 2. Ductwork: Grey.
 3. Equipment - Bare and Insulated (Except Factory Painted): Grey.
- D. The inside of all ductwork where visible through openings shall be painted with two prime coats of flat black paint.

- E. Nameplates on all equipment shall be cleaned and left free of paint. Where equipment is to be painted, the Contractor shall carefully mask all equipment nameplates and data tags prior to application of paint. Such masking shall be removed after the paint has dried.
- F. All flashing shall be painted with two coats of waterproof black asphaltum varnish.

1.37 LUBRICATION

- A. Assume responsibility that all rotating equipment is properly lubricated as soon as it is connected by the Electrical Subcontractor before operation of this equipment is started. Assume responsibility for any damage to any equipment that is turned on without previously having been oiled or greased when connected up.

1.38 TESTS

- A. All piping, wiring, and equipment shall be tested as specified under the various sections of the work. Labor, materials, instruments and power required for testing shall be furnished under the particular Section of the Specifications.
- B. Tests shall be performed satisfaction of the Architect. The Architect will be present at such test, when he deems necessary and such other parties as may have legal jurisdiction.
- C. Pressure tests shall be applied to piping only before connection of equipment and installation of insulation. In no case shall piping, equipment, or accessories be subjected to pressure exceeding their rating.
- D. All defective work shall be promptly repaired or replaced, and the tests shall be repeated until the particular system and component parts thereof receive the review of the Architect.
- E. Any damages resulting from tests shall be repaired or replaced and the tests shall be repeated until the particular system and component parts thereof receive the approval of the Architect.
- F. The duration of tests shall be as determined by all authorities having jurisdiction, but in no case less than the time prescribed in each Section of the Specifications.
- G. Equipment and systems that normally operate during certain seasons of the year shall be tested during the appropriate season. Tests shall be performed on individual equipment, systems, and their controls. Whenever the equipment or system under test is interrelated with and depends upon the operation of other equipment, systems, and controls for proper operation, functioning, and performance, the latter shall be operated simultaneously with the equipment or system being tested.
- H. The electrical work shall include providing any assistance (such as removal of switchboard and panelboard trims and covers, pull and junction box covers, etc.) deemed necessary by the Architect to check compliance with the Drawings and Specifications.

1.39 OPERATING INSTRUCTIONS

- A. Two months prior to the completion of all work and the final inspection of the installation by the Owner, five (5) copies of a complete Instruction Manual, bound in booklet form and suitably indexed, shall be submitted to the Architect for review. All written material contained in the manual shall be typewritten or printed.

B. The Manual shall contain the following items:

Table of Contents (Plumbing, HVAC and Electrical)

- I. Introduction - Explanation of Manual and its use.
- II. Description of Systems
 1. Complete schematic drawings of all systems.
 2. Functional and sequential description of all systems.
 3. Relationship of system where applicable to the supervisory data system.
- III. Systems Operation
 1. Start-up procedures.
 2. Shut-down procedures.
 3. Reset and adjustment and balancing procedures.
 4. Seasonal operation.
 5. All posted instruction charts.
- IV. Maintenance
 1. Cleaning and replacement - lines, components, filters, strainers, ducts, fans, etc.
 2. Lubrication.
 3. Charging and filling.
 4. Purging and draining.
 5. Systems trouble shooting charts.
 6. Instruments checking and calibration.
 7. Procedures for checking out functions with remote (Supervisory Data Console) indication and control.
 8. Recommended list of spare parts.
- V. Listing of Manufacturers
- VI. Manufacturer's Data (Where multiple model, type and size listings are included, clearly and conspicuously indicate those that are pertinent to this installation).
 1. Description - Literature, drawings, illustrations, certified performance charts, technical data, etc.
 2. Operation.
 3. Maintenance - including complete trouble-shooting charts.
 4. Parts List.
 5. Names, addresses and telephone numbers of local recommended repair and service companies.
 6. Guarantee data.
 7. Model No. and Serial No. of all equipment.

1.40 INSTRUCTION OF OWNER'S PERSONNEL

- A. Provide training on the operation and maintenance for equipment, as indicated within the equipment specification. If not indicated within the equipment specification section, provide the following training:
 1. Automatic Temperature Controls: One (1) day within one (1) year of the Owner's acceptance.

2. Packaged AHU Units: One (1) day.
 - a. Where more than one (1) day is required, the Contractor shall schedule the first day and the Owner shall schedule all other days.
 - b. All training shall be by factory authorized representatives, fully trained in the systems and the equipment operation and maintenance.

1.41 GUARANTEE

- A. The Contractor guarantees by his acceptance of the Contract that all work installed will be free from any and all defects and that all apparatus will develop capacities and characteristics specified, and that if during a period of one year from date of completion and acceptance of work, one (1) entire heating and cooling season or eighteen (18) months from date of shipment, whichever is later, any such defects in workmanship, material or performance. He shall immediately replace, repair, or otherwise correct the defect or deficiency, including parts, labor and travel time, without cost to the Owner within a reasonable time. Notify the Architect in writing of the time required to do work. For heating systems, the guarantee period must include one continuous heating season from November 1st to April 1st. For cooling systems, the guarantee period must include one continuous cooling season from May 1st to October 1st.
- B. Replace or repair to the satisfaction of the Owner any and all damage done to the building or its contents or to the work of other trades in consequence of work performed in fulfilling guarantee.
- C. This Article is general in nature and will not waive stipulations of other claims which specify guarantee periods in excess of one (1) year.
- D. In the event default on this Guarantee, the Owner may have such work done as required and charge the cost to the Contractor.
- E. The date of acceptance shall be the date of final payment by the Owner or notice of acceptance by the Owner, whichever is later.

1.42 OPERATION PRIOR TO COMPLETION

- A. The Owner may require operation of parts or all of the installation for the beneficial occupancy prior to final completion and acceptance of the building.
- B. The operation shall not be construed to mean acceptance of the work by the Engineer for the Owner. The Owner will furnish supervisory personnel to direct operation of the entire system and the Contractor shall continue to assume this responsibility until final acceptance.

1.43 INSTALLATION OF MOTORS AND CONTROL EQUIPMENT

- A. The Electrical Contractor shall furnish and install power wiring for all electrical devices, individual motor starters furnished to him at the job site by other trades.
- B. The HVAC Contractor shall provide all wiring for the Automatic Temperature Controls, Combustion Control, Burner and Boiler Control, and condenser water treatment controls, except as otherwise specified herein. This shall include low voltage wiring and 120 VAC power wiring unless electrical drawings show 120 VAC feed for the ATC panels.

- C. The Electrical Contractor shall, except where otherwise noted, provide wiring for all Plumbing and Sprinkler Control and Alarm Systems. The Plumbing Contractor shall provide all devices in connection with same.
- D. The Electrical Contractor shall provide all low voltage wiring and 120 VAC power to all auto smoke and combination fire/smoke dampers, which shall be controlled by the Fire Alarm Panel.
- E. For single phase motors which are not interlocked with other motors, and which have temperature control or motor control devices in the power circuit, furnishing of control devices, installation and wiring shall be by the Electrical Contractor.
- F. For all HVAC 3-phase motors or HVAC equipment, temperature control wiring, motor control wiring and associated interlocks shall be provided by the HVAC Contractor, including the installation of all control devices. For all plumbing and sprinkler 3-phase motors, equipment control wiring, motor control wiring and associated interlocks shall be provided by the electrical Contractor, including the installation of all control devices.
- G. All wiring between fire/smoke dampers and fire alarm panel shall be by the Electrical Contractor. All wiring between the fire alarm panel and air handling equipment for automatic fire alarm shutdown shall be by the Electrical Contractor. All wiring for operation of the smoke purge fan and associated floor dampers shall be by the Electrical Contractor.
- H. Electrically operated equipment supplied by other trades, which are to be installed and wired by the Electrical Contractor, shall be delivered with detailed instructions for their installation and wiring in sufficient time and proper sequence to meet the work schedule.
- I. Each contractor shall furnish all electrical motors, starters and other motor control devices for motor driven equipment required for the work. In his work, the Electrical Contractor shall provide the code required disconnect switches for all motors, except where otherwise noted. The setting up of all motors, required for mechanical equipment, including unmounted motors, shall be done as part of the mechanical work.
- J. If a motor is replaced (even with the same horsepower) a new starter shall be provided for that motor.
- K. Equipment which includes a group of electrical control devices mounted in a single enclosure or on a common base with equipment, shall be supplied completely wired as a unit with terminal boxes or leads ready for external wiring.
- L. All electrical items furnished and/or installed as part of the mechanical work shall conform to NEMA Standards, to the requirements of the National Fire Protection Association, and to the requirements of any local authority having jurisdiction. Any field modifications required to insure such conformance shall be included as part of the mechanical work.
- M. The furnishing of floor mounted motor starting equipment shall include the purchase and delivery of channel sills for mounting.
- N. Whether or not shown on the drawings, the Electrical Contractor shall furnish and install a local disconnect switch at each motor that is not in sight from the controller location.

- O. The supplying of any and all "field instruction" diagrams deemed necessary by the Architect for the complete delineation of electrical wiring for mechanical equipment shall be included as part of the mechanical work.
- P. The drawings describing the electrical or the mechanical work may include explanatory wiring diagrams indicating the function intended for the motor control circuits of certain motors. The "field instructions" wiring diagrams required as part of the mechanical work shall conform to these intended functions.
- Q. Electric power required for control circuits shall be taken by the HVAC Contractor (Subcontractor) from the electric circuits in the junction boxes left by the Electrical Contractor (Subcontractor) for ATC use as indicated on the electrical drawings. Where junction boxes are not indicated on the electrical drawings, the HVAC Contractor (Subcontractor) shall run power wiring to the nearest electrical panel with spare circuits and provide required circuit breaker. The ATC Contractor (Subcontractor) shall provide and wire all required transformers for the ATC system.
- R. The HVAC Contractor (Subcontractor) shall coordinate the control systems with unit ventilator and VAV terminal box manufacturers. The HVAC Contractor (Subcontractor) shall provide all necessary control equipment which is not provided by the unit manufacturer to complete the sequence of operation as specified herein. The HVAC Contractor (Subcontractor) shall provide all field wiring.

1.44 ELECTRIC MOTORS

- A. Each Contractor shall provide all electric motors required for driving all motor driven equipment required to be furnished under his Section of the Specification.
- B. All motors shall be designed for 3-phase, 60 cycle alternating current operation with 200 volts across the motor terminals, except that, unless otherwise specified herein, all motors $\frac{1}{3}$ HP and smaller shall be designed for single phase, 60 cycle alternating current at 120 volts across the terminals. Before ordering motors, ascertain the actual voltages and other current characteristics that will be available and permissible for each motor. Report the same in writing to the Architect and obtain approval before ordering motors. The designation of current characteristics in these Specifications does not relieve the responsibility for ascertaining the actual conditions of electric service available for each motor or for the proper operation of all motors under the actual conditions.
- C. The speed, horsepower, type and other essential data for each motor, if not given under paragraphs describing the various motor driven apparatus, or in schedules on the drawings shall be obtained from the manufacturer of the respective apparatus and shall be submitted to the Architect for his review. All two speed motors shall be single winding type.
- D. Provide oversized motor junction box for 2 speed motors.
- E. All motors shall be built in accordance with the latest rules of NEMA, of the Institute of Electrical and Electronic Engineers and also as hereinafter specified.
- F. Motors $\frac{1}{2}$ HP and larger shall have Class F insulation. All motors shall be rated for continuous duty and shall be designed for temperature rises not to exceed 55°C for fully enclosed type, 55°C for splashproof types and 40°C for all other motors excepting as otherwise specified herein.

Motors shall be capable of withstanding momentary overloads of fifty (50%) without injurious heating. They shall operate without excessive heating, flashing or sparking under any conditions within the specified capacity of load and speed. All motors shall operate quietly and shall be replaced if, in the Architect's opinion, they do not do so. All motors which are in the airstream of air conditioning units shall be totally enclosed type.

- G. Motors ½ HP and larger shall have ball or roller bearings with pressure grease lubrication, except where otherwise noted.
- H. Direct connected motors shall be furnished without an adjustable base. All motors connected to driven equipment by belt shall be furnished with adjustable sliding bases, except fractional motors with slotted mounting holes.
- I. All motor leads shall be permanently identified and supplied with connectors.
- J. Motors shall have nameplates giving the manufacturer's name, serial number, horsepower, speed, voltage, phase, and current characteristics.
- K. The insulation resistance between stator conductors and frames of motors at the time of final inspection shall be not less than one-half megohm.
- L. All motors shall be of the proper type for the duty and shall have sufficient torque to start and run the equipment to which they are connected and starting currents and running currents shall not exceed the limits imposed by the laws or rules and regulations of the public authorities having jurisdiction or of the electrical utility company. All motors shall have sufficient horsepower capacity and rated duty to operate the apparatus to which they are connected so as to give the speeds and performances specified, but the horsepower shall be in no case less than that stated herein or shown on the drawings. A schedule giving the characteristics of the motors proposed for each type of service shall be submitted to the Architect for approval.
- M. The maximum full load speed of each directly connected motor shall be suitable for the equipment it drives.
- N. Except where V-belt drive is specified, the fan wheels for ventilating fans shall be mounted on the motor shafts, which shall be designed for this duty.
- O. All motors except motors furnished as an integral part of equipment and factory installed on the equipment shall be of the same manufacture.
- P. Polyphase motors shall be squirrel cage induction high-efficiency energy saver type, suitable for the starting torque and current requirements.
- Q. Single-phase motors shall be of the capacitor start induction run or split phase type as required for proper operation of the driven equipment.
- R. Where used with VFD equipment, the motor shall be rated for inverter service without excessive noise, vibration, hum, or damage.
- S. All motors operated on variable frequency drives (VFD) shall be equipped with a maintenance-free, conductive microfiber, shaft grounding ring with a minimum of two rows of circumferential microfibers to discharge electric shaft currents within the motor and/or its bearings. Motors up to 100 HP shall be provided with a minimum of one shaft grounding ring installed either on the

drive end or non-drive end. Motors over 100 HP shall be provided with an insulated bearing on the non-drive end and a shaft grounding ring on the drive end of the motor. Grounding rings shall be provided by the motor manufacturer or Contractor and shall be installed in accordance with the manufacturer’s recommendations.

- T. The efficiency of energy-efficient motors shall be verified in accordance with NEMA standard MG1-12.53a. Submittals and shop drawings for all equipment shall state motor efficiency and shall meet or exceed that listed in the table below. Minimum acceptable efficiency shall be as follows:

Minimum Electric Motor Efficiencies							
Open Drip-Proof (ODP)				Totally Enclosed Fan Cooled (TEFC)			
Motor Size (hp)	Speed (rpm)			Motor Size (hp)	Speed (rpm)		
	1200	1800	3600		1200	1800	3600
1	82.5%	85.5%	77.0%	1	82.5%	85.5%	77.0%
1.5	86.5%	86.5%	84.0%	1.5	87.5%	86.5%	84.0%
2	87.5%	86.5%	85.5%	2	88.5%	86.5%	85.5%
3	88.5%	89.5%	85.5%	3	89.5%	89.5%	86.5%
5	89.5%	89.5%	86.5%	5	89.5%	89.5%	88.5%
7.5	90.2%	91.0%	88.5%	7.5	91.0%	91.7%	89.5%
10	91.7%	91.7%	89.5%	10	91.0%	91.7%	90.2%
15	91.7%	93.0%	90.2%	15	91.7%	92.4%	91.0%
20	92.4%	93.0%	91.0%	20	91.7%	93.0%	91.0%
25	93.0%	93.6%	91.7%	25	93.0%	93.6%	91.7%
30	93.6%	94.1%	91.7%	30	93.0%	93.6%	91.7%
40	94.1%	94.1%	92.4%	40	94.1%	94.1%	92.4%
50	94.1%	94.5%	93.0%	50	94.1%	94.5%	93.0%
60	94.5%	95.0%	93.6%	60	94.5%	95.0%	93.6%
75	94.5%	95.0%	93.6%	75	94.5%	95.4%	93.6%
100	95.0%	95.4%	93.6%	100	95.0%	95.4%	94.1%
125	95.0%	95.4%	94.1%	125	95.0%	95.4%	95.0%
150	95.4%	95.8%	94.1%	150	95.8%	95.8%	95.0%
200	95.4%	95.8%	95.0%	200	95.8%	96.2%	95.4%

1.45 INDIVIDUAL MOTOR STARTERS

- A. For single-phase motors 1/3 HP or smaller, starters shall be manual, 120 volts, single-pole or 240 volts, 2-pole with thermal overload protection and pilot light. Where interlocking or automatic control (other than for unit and cabinet heaters) is required, starters shall be a combination circuit breaker and magnetic starter with pilot light.
- B. For 3-phase motors 1/2 HP and over, starters shall be full-voltage combination circuit breaker and magnetic across-the-line contactor, rated 208 or 480 volts, 3-pole. All magnetic starters shall have three thermal overloads.

- C. Unless otherwise specified, motors 25 HP and over, rated 200 volts and motors 50 HP and over, rated 460 volts shall be furnished with reduced voltage starters of the autotransformer closed transition type.
- D. For motors requiring electric interlocks, or automatic control features, starters shall be equipped with the necessary auxiliary relays and contacts to provide the control features desired. All starters shall be provided with "hand-off-auto" twist-type switches mounted in the cover. For two-speed motors, provide "high-low-off-auto" four position selector switch. Furnish adjustable 20-second time delay between high and low speeds for motors 10 HP and above.
- E. Electrical Control Devices
 - 1. Allen-Bradley® Electrical Control Devices are the basis of design,
 - 2. The electrical control devices shall include:
 - a. Pilot Devices
 - b. Relays and Timers
 - c. Miniature Circuit Breakers
 - d. Terminal Blocks and Fuse Blocks
 - e. Alarms and Signals
 - f. Power Supplies
 - g. Panel-mounted disconnect switches.
 - 3. The electrical control devices shall be interoperable with standard electrical equipment.
- F. Pilot Devices
 - 1. 30.5 MM Push Buttons, Selector Switches and Pilot Lights
 - a. 30.5 mm push buttons, selector switches and pilot lights shall be Allen-Bradley heavy industrial Type 4/13 watertight/oiltight metal [Bulletin 800T].
 - b. 30.5 mm push buttons, selector switches and pilot lights shall provide EN/IEC 60529 IP66/65 degree of protection.
 - c. 30.5 mm push buttons, selector switches and pilot lights shall have electrical ratings of:
 - 1) Dielectric strength – 2200V for 1 minute [or 300V for 1 minute (Logic Reed)]
 - 2) Electrical design life cycles – 10,000,000 at max. rated load [200,000 at max rated load (Logic Reed)]
 - d. 30.5 mm push buttons, selector switches and pilot lights shall have an operating range of -40 to 131°F (-40 to 55°C).
 - e. Illuminated devices shall offer universal LED that accepts 12 to 130 VAC/VDC voltage input.
 - f. 30.5 mm push buttons shall have a diaphragm seal for protection from liquids, particles, and corrosive agents.
 - g. 30.5 mm selector switches shall incorporate a positive detent to prevent the switch from hanging up between positions.
 - 2. Potentiometer Devices
 - a. 30.5 mm potentiometer devices shall be Allen-Bradley heavy industrial Type 4/13 watertight/oiltight metal [Bulletin 800T].
 - b. Potentiometer devices shall be rated for 300 VAC/VDC, 2 W maximum (6 VDC minimum):
 - 1) Mechanical design life – Min. 25,000 cycles
 - 2) Rotational torque – 3 to 12 in-oz
 - 3) Stopping torque – Min. 12 in-lb
 - c. Potentiometer devices shall have single-turn operation, 312-degree rotation.
 - d. Potentiometer devices shall be finger safe.

3. Control Stations
 - a. Control stations shall provide Allen-Bradley heavy industrial 30.5 mm push button(s) or selector switch with appropriate contact action, button/lever type and color/legend marking. Devices shall be Type 4/13 watertight/oiltight metal [Bulletin 800T].
 - b. Control stations shall be constructed of diecast aluminum.

- G. Relays And Timers
 1. Relays – Time Delay
 - a. Allen-Bradley time delay relays [Bulletin 700-HT] shall mount on tube-type bases with pin-style socket mounting.
 - b. Time delay relays shall have 10A, B300, DPDT contact ratings, and coil voltages as shown on drawings.
 - c. Time delay relays should have adjustable timing ranges [or fixed timing ranges to avoid tampering]. Timing ranges shall be as shown on drawings.
 2. Relays – General Purpose
 - a. Allen-Bradley general purpose relays [Bulletin 700-HA] shall have tube-base/Octal 8-pin [or 11-pin] terminals and ON/OFF flag indicators.
 - b. General purpose relay contacts shall be silver nickel [or silver nickel bifurcated or gold-plated bifurcated] and have 10A, B300, DPDT [or 3PDT] ratings. Coil voltages shall be as shown on drawings.
 - c. General purpose relays shall have an electrical schematic on the faceplate, a clear cover for visual inspection and snap-in marker ability.
 - d. General purpose relays shall have LED status indicators, push-to-test and manual override.
 3. Relays – Miniature
 - a. Allen-Bradley miniature relays [Bulletin 700-HC] shall be square-base, 4-pole, plug-in type with blade-style terminals and ON/OFF flag indicators.
 - b. Miniature relay contacts shall be silver nickel [or gold-plated silver nickel] and have 7A [or 10A], DPDT [or 4PDT] ratings. Coil voltages shall be as shown on drawings.
 - c. Miniature relays shall have an electrical schematic on the faceplate and a clear cover for visual inspection.
 - d. Miniature relays shall have LED status indicators and push-to-test button with incorporated manual override lever.
 4. Relays – Industrial-Type
 - a. Allen-Bradley industrial-type relays [Bulletin 700-P] shall be ruggedly constructed (10 million operation mechanical life), 2-pole [or 4-pole, 8-pole, 12-pole], configured N.O./N.C. as shown on drawings, and panel- [or strip-, DIN rail-] mounted.
 - b. Industrial-type relays shall be finger-safe.
 - c. Industrial-type relay contacts shall be silver nickel with a double-break and bifurcated design and 10A, A600 rating for AC [5A, P600 rating for DC].
 - d. Accessories shall include adder decks, time delay, latching, surge suppressors and/or mounting strip.
 5. Timers – Solid-State
 - a. Allen-Bradley solid-state timers [Bulletin 700-FS] shall be DIN rail-mounted.
 - b. The solid-state timer contacts shall be available as SPDT or DPDT, 8A.
 - c. Solid-state timers shall be available with On-Delay, Off-Delay, On- and Off-Delay, One-Shot and Flasher operating modes as required on the drawings.
 - d. Solid-state timers shall have coil surge protection and adjustable timing ranges of 0.05 seconds to 60 hours as shown on drawings.

6. Timers – Programmable
 - a. Allen-Bradley programmable timers [Bulletin 700-HX] shall be digital timing relays with LCD display and shall be socket- [or panel-] mounted.
 - b. Programmable timer contacts shall be SPDT, rated 5A, B300.
 - c. Programmable timer panel surface shall offer Type 4X/IP66 protection.
 - d. Programmable timers shall be configurable for Signal On-Delay, Power On-Delay, Off-Delay, Repeat Cycle, One-Shot and Cumulative operating modes as required on the drawings.
 - e. Programmable timers shall have timing ranges of 0.000 seconds to 9999 hours, depending on selected mode and as shown on drawings.

- H. Miniature Circuit Breakers
 1. Miniature circuit breakers shall be Allen-Bradley Circuit Breakers [Bulletin 1489-M].
 2. Miniature circuit breakers shall be thermal-magnetic, current-limiting type, sized as specified on the drawings:
 - a. 0.5A to 63A current rating
 - b. 1-, 2- or 3-pole
 - c. Type C or Type D tripping characteristic
 3. Miniature circuit breakers shall be UL Listed (E197878), CSA Certified (259391), CE Marked, VDE and CCC Certified and RoHS Compliant. Standards compliances shall include:
 - a. UL 489
 - b. CSA C22.2, No. 5.1
 - c. EN 60947-2
 - d. GB 14048.2
 4. Miniature circuit breakers shall be rated for:
 - a. Voltage – Max. 480Y/277 VAC (UL/CSA); U_e 230/400 VAC (IEC)
 - b. Interrupting capacity – 10 kA (UL/CSA); 15 kA (IEC)
 5. Housing shall satisfy Insulation Group II/RAL 7035, shall have IP20 finger-safe design, shall be suitable for DIN rail mounting and shall include status indicator window and scratch- and solvent-resistant printing.
 6. Miniature circuit breakers shall support reversible line and load connections and shall have dual terminals that:
 - a. Connect up to 4 wires, or 2 wires and a bus bar.
 - b. Clamp from both sides.
 - c. Have a unique design that directs wires into openings to prevent wiring misses.
 7. Miniature circuit breakers shall be compatible with UL 508 Listed bus bars, auxiliary contacts, signal contacts, shunt trips and toggle-mount lockout attachments.

- I. Terminal Blocks And Fuse Blocks
 1. Terminal Blocks – Control, #22 to #8 AWG
 - a. Control terminal blocks shall be Allen-Bradley screw-type, feed-through [Bulletin 1492-J].
 - b. Control terminal blocks shall be certified:
 - 1) UR/CSA – #22 to #8 AWG wire range, 50A maximum current, 600 VAC/VDC voltage rating
 - 2) IEC – 6 mm² wire range, 41A maximum current, 800 VAC/VDC voltage rating
 - 3) ATEX – 6 mm² (#20 to #10 AWG) wire range, 36A maximum current, 550 VAC/VDC voltage rating
 - c. Control terminal blocks shall have a snap-in card marking system.

2. Terminal Blocks – Power
 - a. Power terminal blocks shall be Allen-Bradley [Bulletin 1492-PD]:
 - 1) Open-style power distribution block with aluminum or copper connectors – 3-pole [or 1-pole], rated at 600 VAC/VDC, 175 to 760A
 - b. Power terminal blocks shall be certified by UR, CSA and CE.
 - c. Wire ranges and tightening torques shall be labeled on the block.
 - d. Power terminal blocks shall have a write-on marking surface or marker retention feature.
 3. Fuse Blocks
 - a. Allen-Bradley fuse block kits [Bulletin 1491] shall be used for protection of transformers and control circuits capable of delivering no more than 200,000 RMS symmetrical amps, 600V maximum.
 - b. Fuse block kits shall be 1-pole, 2-pole or 3-pole.
 - c. Each pole shall have a fuse cover.
- J. Alarms and Signals
1. Alarm Horn
 - a. The alarm horn shall be an Allen-Bradley High Performance Electronic Horn [Bulletin 855H] and shall have up to 4 stages and low current consumption.
 - b. The alarm horn shall have a UV-stable plastic housing and non-moving parts.
 - c. The alarm horn shall have an on-board microphone, 45 alarm tones selectable by DIP switch and fine volume control via potentiometer.
 - d. The alarm horn shall allow synchronized output in multi-horn installations and shall have the ability to replicate content to other devices (master/slave).
 2. Alarm Beacon
 - a. The alarm beacon shall be an Allen-Bradley [Bulletin 855B] with high-intensity, minimum 5-Joule Xenon, minimum 20-Watt Halogen or LED illumination as required on the drawings.
 - b. The alarm beacon shall have polycarbonate housing and lens, available in square or round configuration, and Type 4/4X/13, IP65/IP66 ingress rating as required on the drawings.
 - c. Flashing frequency shall be 1 Hz.
 - d. Alarm beacon lens colors shall be red, green, amber, blue, yellow or clear as required on the drawings.
 3. Alarm Light Tower
 - a. The alarm light tower shall consist of Allen-Bradley Control Tower™ Stack Lights [Bulletin 854J or K], stacked 1 [or 2, 3, 4, 5] module(s) high and shall be surface- [or vertical-, quick-release-, pole-] mounted.
 - b. The alarm light tower shall be 40 mm [or 60 mm] size and the terminal block shall be top-mounted on the base.
 - c. The light modules shall be Type 4/4X/13, IP65 and are:
 - 1) LED (steady, flashing or strobe)
 - d. The alarm light tower shall include a continuous (or pulsing) piezo [or transducer] sound module.
 - e. The alarm light tower shall have a DeviceNet base.
 4. Signal Alarm (Panel Mount)
 - a. The signal alarm shall be an Allen-Bradley Panel Mount Signaling Alarm [Bulletin 855P] in a 30 mm [or 45 mm, 65 mm] size, that mounts in a standard 22.5 mm hole.
 - b. The signal alarm shall have a polycarbonate base and lens.
 - c. The signal alarm shall be a combination sounder and LED
 - d. The signal alarm should be rear-securing and finger-safe.

- K. Power Supplies
 - 1. Control Power Transformer
 - a. The control power transformer shall be an Allen-Bradley Global Control Transformer [Bulletin 1497], single-phase and sized as shown on drawings.
 - b. The control power transformer shall be epoxy encapsulated and shall offer EN 60-529 finger-safe protection.
 - c. The control transformer shall have a dual primary and secondary fuse block, pre-wired and top-mounted.
 - 2. 24 VDC Power Supplies
 - a. 24 VDC power supplies shall be Allen-Bradley [Bulletin 1606-XL] with active or passive PFC choke and input as shown in drawings [or auto-select input].
 - b. 24 VDC power supplies shall have low inrush current, and power supplies with greater than 100-Watt output shall incorporate a minimum 120% Power Burst design.
 - c. 24 VDC power supplies shall have NEC Class 2 "Limited Power" output.
 - 3. UPS
 - a. The UPS shall be an Allen-Bradley Industrial Uninterruptible Power Supply [Bulletin 1609-B/D] with 120 VAC input voltage and output power as shown in the drawings.
 - b. The UPS shall be back-of-panel- [or DIN rail-] mounted.
 - c. The UPS shall provide:
 - 1) Surge protection to 380 Joules
 - 2) Overload protection, resulting in delayed shutdown at 110 to 130% and immediate shutdown at 130%
 - 3) Protection against output short online – over-current protection from premises branch circuit
 - 4) Protection against output short on battery, resulting in shutdown
 - 5) Thermal protection
 - d. The UPS shall have USB communications and software, integrated remote on/off and dry I/O contacts.
 - e. The UPS shall have EtherNet/IP communications, expandable battery capacity and/or pure sine wave output.
 - f. The UPS shall perform to 40°C [50°C, with hi-temp battery].
- L. Disconnect/breakers shall be external flange mounted type, all metal construction with painted handle, lockable, similar to Allen Bradley Model 1494F-M1-412. Plastic switches and twist-type disconnects and breakers shall not be used.
- M. In addition to any auxiliary contacts required for interlocking purposes, each magnetic starter shall be equipped with one normally open auxiliary control circuit contact either for "sealing in" or as a spare for future use.
- N. Indicating lights shall be a transformer or series resistor type. There shall be one red light for each single-speed motor to indicate when the motor is running. For multiple-speed motors one indicating light for each speed shall be provided.
- O. The starter disconnecting means shall be circuit breakers. The external operating handle shall clearly indicate "ON" or "OFF" position of the switch and shall be interlocked with the door to require throwing the handle to the "OFF" position to open the door. The handle shall be arranged for locking both the door closed and the disconnect in the "OFF" position with up to 3 padlocks. Provide defeat device in cover to permit opening door in "ON" position.

- P. Circuit breakers in combination starter units shall be of the magnetic trip type with an adjustable trip setting for selecting instantaneous trip points of fault protection (motor circuit protector). Field adjustment of the instantaneous trip shall be performed by the Electrical Contractor. Select the trip setting at approximately 10 times the motor nameplate full-load current. If the circuit breaker trips on starting, incrementally increase the settings. In no case shall the trip setting exceed 13 times the motor full-load current.
 - Q. Overload heaters shall be furnished for all starters and shall be sized in the range of 115 to 125 percent of full load current. The motor starters shall be shipped with the overload heaters inside the compartment but not installed. The Electrical Contractor shall verify the ratings of the heater coils based on the motor nameplate data before installing the overloads. The Contractor supplying the starter shall replace any improperly selected heaters.
 - R. A transformer shall be supplied in each starter unit for 120 volt control voltage. Transformer capacity shall be adequate to supply the holding coil requirements plus the solenoids, e-p switches, relays and other devices required to be controlled from the starter. A fuse shall be supplied in one secondary terminal of the control transformer. The other terminal shall be grounded to the housing of the starter. Fuses shall be also provided in the transformer primary leads per the National Electrical Code.
 - S. All enclosures shall be NEMA Type 1 steel with hinged cover for general purpose indoor application, unless otherwise indicated. Enclosures shall be arranged for equipment or wall mounting. Weather resistant NEMA 3R steel enclosures shall be provided for all outdoor starters. All devices mounted on the outside of all enclosures shall be NEMA 4.
 - T. Each starter shall be clearly identified by engraved nameplates after installation. The nameplates shall be plastic black plates with ½" high white letters and shall be securely fastened to starter with mounting screws made of non-corrosive metals.
 - U. Stainless steel flush mounted starter and enclosures shall be provided for all starters located in the kitchen and dishwasher areas.
 - V. All starters, except those furnished as an integral part of equipment and factory installed on the equipment, shall be of the same manufacturer.
 - W. Starters shall be manufactured by Westinghouse, General Electric, Square D, Eaton/Cutler-Hammer, or Allen-Bradley.
 - X. Shop drawings shall be provided with dimensions, ratings, wiring diagrams, and a schedule of nameplates for approval prior to fabrication.
 - Y. If a motor is replaced (even with the same horsepower), a new starter shall be provided for that motor.
- 1.46 MOTOR CONTROLLERS
- A. Motor controllers shall be defined as control devices such as pushbuttons, switches, etc. which are not mounted in starter cover, required for remote control of motors.
 - B. Unless otherwise noted, motor controllers shall be housed in NEMA Type 12 general-purpose steel enclosures. Outdoor controllers shall be provided with weather-resistant NEMA Type 3R steel enclosures. Provide a nameplate to indicate the motor with which they are associated.

- C. Provide reduced voltage starters for all motors 10 HP and larger and provide time delay for restart.
- D. The controllers to be installed in the finished area shall be flush-mounted.
- E. The Electrical Contractor shall install and provide wiring for motor controllers. The contractor providing the motor shall furnish the controllers.
- F. Unless otherwise noted, pushbuttons shall be of the normal duty, spring return momentary type.
- G. Selector switches and pushbuttons shall be equipped with nameplates indicating the function of each of their positions as noted in the list of electric motors and motor controls or shown on the drawings.
- H. Pilot light shall be a transformer or series resistor type for operation at 120 V.
- I. Pilot lights shall be equipped with nameplates indicating the operating conditions they annunciate as noted in the list of electric motors and motor controls or shown on the drawings.
- J. Electrical Control Devices
 1. Allen-Bradley® Electrical Control Devices are the basis of design,
 2. The electrical control devices shall include:
 - a. Pilot Devices
 - b. Relays and Timers
 - c. Miniature Circuit Breakers
 - d. Terminal Blocks and Fuse Blocks
 - e. Alarms and Signals
 - f. Power Supplies
 - g. Panel-mounted disconnect switches
 3. The electrical control devices shall be interoperable with standard electrical equipment.
- K. Pilot Devices
 1. 30.5 MM Push Buttons, Selector Switches and Pilot Lights
 - a. 30.5 mm push buttons, selector switches and pilot lights shall be Allen-Bradley heavy industrial Type 4/13 watertight/oiltight metal [Bulletin 800T].
 - b. 30.5 mm push buttons, selector switches and pilot lights shall provide EN/IEC 60529 IP66/65 degree of protection.
 - c. 30.5 mm push buttons, selector switches and pilot lights shall have electrical ratings of:
 - 1) Dielectric strength – 2200V for 1 minute [or 300V for 1 minute (Logic Reed)]
 - 2) Electrical design life cycles – 10,000,000 at max. rated load [200,000 at max rated load (Logic Reed)]
 - d. 30.5 mm push buttons, selector switches and pilot lights shall have an operating range of -40 to 131°F (-40 to 55°C).
 - e. Illuminated devices shall offer universal LED that accepts 12 to 130 VAC/VDC voltage input.
 - f. 30.5 mm push buttons shall have a diaphragm seal for protection from liquids, particles and corrosive agents.
 - g. 30.5 mm selector switches shall incorporate a positive detent to prevent the switch from hanging up between positions.
 2. Potentiometer Devices
 - a. 30.5 mm potentiometer devices shall be Allen-Bradley heavy industrial Type 4/13 watertight/oiltight metal [Bulletin 800T].

- b. Potentiometer devices shall be rated for 300 VAC/VDC, 2 W maximum (6 VDC minimum):
 - 1) Mechanical design life – Min. 25,000 cycles
 - 2) Rotational torque – 3 to 12 in-oz
 - 3) Stopping torque – Min. 12 in-lb
 - c. Potentiometer devices shall have single-turn operation, 312-degree rotation.
 - d. Potentiometer devices shall be finger-safe.
3. Control Stations
- a. Control stations shall provide Allen-Bradley heavy industrial 30.5 mm push button(s) or selector switch with appropriate contact action, button/lever type and color/legend marking. Devices shall be Type 4/13 watertight/oil-tight metal [Bulletin 800T].
 - b. Control stations shall be constructed of die-cast aluminum
- L. Relays And Timers
1. Relays – Time Delay
- a. Allen-Bradley time delay relays [Bulletin 700-HT] shall mount on tube-type bases with pin-style socket mounting.
 - b. Time delay relays shall have 10A, B300, DPDT contact ratings and coil voltages as shown on drawings.
 - c. Time delay relays should have adjustable timing ranges [or fixed timing ranges to avoid tampering]. Timing ranges shall be as shown on drawings.
2. Relays – General Purpose
- a. Allen-Bradley general purpose relays [Bulletin 700-HA] shall have tube-base/Octal 8-pin [or 11-pin] terminals and ON/OFF flag indicators.
 - b. General purpose relay contacts shall be silver nickel [or silver nickel bifurcated or gold-plated bifurcated] and have 10A, B300, DPDT [or 3PDT] ratings. Coil voltages shall be as shown on drawings.
 - c. General purpose relays shall have an electrical schematic on the faceplate, a clear cover for visual inspection and snap-in marker ability.
 - d. General purpose relays shall have LED status indicators, push-to-test and manual override.
3. Relays – Miniature
- a. Allen-Bradley miniature relays [Bulletin 700-HC] shall be square-base, 4-pole, plug-in type with blade-style terminals and ON/OFF flag indicators.
 - b. Miniature relay contacts shall be silver nickel [or gold-plated silver nickel] and have 7A [or 10A], DPDT [or 4PDT] ratings. Coil voltages shall be as shown on drawings.
 - c. Miniature relays shall have an electrical schematic on the faceplate and a clear cover for visual inspection.
 - d. Miniature relays shall have LED status indicators and push-to-test button with incorporated manual override lever.
4. Relays – Industrial-Type
- a. Allen-Bradley industrial-type relays [Bulletin 700-P] shall be ruggedly constructed (10 million operation mechanical life), 2-pole [or 4-pole, 8-pole, 12-pole], configured N.O./N.C. as shown on drawings, and panel- [or strip-, DIN rail-] mounted.
 - b. Industrial-type relays shall be finger-safe.
 - c. Industrial-type relay contacts shall be silver nickel with a double-break and bifurcated design and 10A, A600 rating for AC [5A, P600 rating for DC].
 - d. Accessories shall include adder decks, time delay, latching, surge suppressors and/or mounting strip.

5. Timers – Solid-State
 - a. Allen-Bradley solid-state timers [Bulletin 700-FS] shall be DIN rail-mounted.
 - b. The solid-state timer contacts shall be available as SPDT or DPDT, 8A.
 - c. Solid-state timers shall be available with On-Delay, Off-Delay, On- and Off-Delay, One-Shot and Flasher operating modes as required on the drawings.
 - d. Solid-state timers shall have coil surge protection and adjustable timing ranges of 0.05 seconds to 60 hours as shown on drawings.
 6. Timers – Programmable
 - a. Allen-Bradley programmable timers [Bulletin 700-HX] shall be digital timing relays with LCD display and shall be socket- [or panel-] mounted.
 - b. Programmable timer contacts shall be SPDT, rated 5A, B300.
 - c. Programmable timer panel surface shall offer Type 4X/IP66 protection.
 - d. Programmable timers shall be configurable for Signal On-Delay, Power On-Delay, Off-Delay, Repeat Cycle, One-Shot and Cumulative operating modes as required on the drawings.
 - e. Programmable timers shall have timing ranges of 0.000 seconds to 9999 hours, depending on selected mode and as shown on drawings.
- M. Miniature Circuit Breakers
1. Miniature circuit breakers shall be Allen-Bradley Circuit Breakers [Bulletin 1489-M].
 2. Miniature circuit breakers shall be thermal-magnetic, current-limiting type, sized as specified on the drawings:
 - a. 0.5A to 63A current rating
 - b. 1-, 2- or 3-pole
 - c. Type C or Type D tripping characteristic
 3. Miniature circuit breakers shall be UL Listed (E197878), CSA Certified (259391), CE Marked, VDE and CCC Certified and RoHS Compliant. Standards compliances shall include:
 - a. UL 489
 - b. CSA C22.2, No. 5.1
 - c. EN 60947-2
 - d. GB 14048.2
 4. Miniature circuit breakers shall be rated for:
 - a. Voltage – Max. 480Y/277 VAC (UL/CSA); U_c 230/400 VAC (IEC)
 - b. Interrupting capacity – 10 kA (UL/CSA); 15 kA (IEC)
 5. Housing shall satisfy Insulation Group II/RAL 7035, shall have IP20 finger-safe design, shall be suitable for DIN rail mounting and shall include status indicator window and scratch- and solvent-resistant printing.
 6. Miniature circuit breakers shall support reversible line and load connections and shall have dual terminals that:
 - a. Connect up to 4 wires, or 2 wires and a bus bar.
 - b. Clamp from both sides.
 - c. Have a unique design that directs wires into openings to prevent wiring misses.
 7. Miniature circuit breakers shall be compatible with UL 508 Listed bus bars, auxiliary contacts, signal contacts, shunt trips and toggle-mount lockout attachments.
- N. Terminal Blocks and Fuse Blocks
1. Terminal Blocks – Control, #22 to #8 AWG
 - a. Control terminal blocks shall be Allen-Bradley screw-type, feed-through [Bulletin 1492-J].
 - b. Control terminal blocks shall be certified:

- 1) UR/CSA – #22 to #8 AWG wire range, 50A maximum current, 600 VAC/VDC voltage rating
 - 2) IEC – 6 mm² wire range, 41A maximum current, 800 VAC/VDC voltage rating
 - 3) ATEX – 6 mm² (#20 to #10 AWG) wire range, 36A maximum current, 550 VAC/VDC voltage rating
 - c. Control terminal blocks shall have a snap-in card marking system.
 2. Terminal Blocks – Power
 - a. Power terminal blocks shall be Allen-Bradley [Bulletin 1492-PD]:
 - 1) Open-style power distribution block with aluminum or copper connectors – 3-pole [or 1-pole], rated at 600 VAC/VDC, 175 to 760A
 - b. Power terminal blocks shall be certified by UR, CSA and CE.
 - c. Wire ranges and tightening torques shall be labeled on the block.
 - d. Power terminal blocks shall have a write-on marking surface or marker retention feature.
 3. Fuse Blocks
 - a. Allen-Bradley fuse block kits [Bulletin 1491] shall be used for protection of transformers and control circuits capable of delivering no more than 200,000 RMS symmetrical amps, 600V maximum.
 - b. Fuse block kits shall be 1-pole, 2-pole or 3-pole.
 - c. Each pole shall have a fuse cover.
- O. Alarms and Signals
1. Alarm Horn
 - a. The alarm horn shall be an Allen-Bradley High Performance Electronic Horn [Bulletin 855H] and shall have up to 4 stages and low current consumption.
 - b. The alarm horn shall have a UV-stable plastic housing and non-moving parts.
 - c. The alarm horn shall have an on-board microphone, 45 alarm tones selectable by DIP switch and fine volume control via potentiometer.
 - d. The alarm horn shall allow synchronized output in multi-horn installations and shall have the ability to replicate content to other devices (master/slave).
 2. Alarm Beacon
 - a. The alarm beacon shall be an Allen-Bradley [Bulletin 855B] with high-intensity, minimum 5-Joule Xenon, minimum 20-Watt Halogen or LED illumination as required on the drawings.
 - b. The alarm beacon shall have polycarbonate housing and lens, available in square or round configuration, and Type 4/4X/13, IP65/IP66 ingress rating as required on the drawings.
 - c. Flashing frequency shall be 1 Hz.
 - d. Alarm beacon lens colors shall be red, green, amber, blue, yellow or clear as required on the drawings.
 3. Alarm Light Tower
 - a. The alarm light tower shall consist of Allen-Bradley Control Tower™ Stack Lights [Bulletin 854J or K], stacked 1 [or 2, 3, 4, 5] module(s) high and shall be surface-[or vertical-, quick-release-, pole-] mounted.
 - b. The alarm light tower shall be 40 mm [or 60 mm] size and the terminal block shall be top-mounted on the base.
 - c. The light modules shall be Type 4/4X/13, IP65 and are:
 - 1) LED (steady, flashing or strobe)
 - d. The alarm light tower shall include a continuous (or pulsing) piezo [or transducer] sound module.

- e. The alarm light tower shall have a DeviceNet base.
- 4. Signal Alarm (Panel Mount)
 - a. The signal alarm shall be an Allen-Bradley Panel Mount Signaling Alarm [Bulletin 855P] in a 30 mm [or 45 mm, 65 mm] size, that mounts in a standard 22.5 mm hole.
 - b. The signal alarm shall have polycarbonate base and lens.
 - c. The signal alarm shall be combination sounder and LED
 - d. The signal alarm shall be rear-securing and finger-safe.
- P. Power Supplies
 - 1. Control Power Transformer
 - a. The control power transformer shall be an Allen-Bradley Global Control Transformer [Bulletin 1497], single-phase and sized as shown in the drawings.
 - b. The control power transformer shall be epoxy encapsulated and shall offer EN 60-529 finger-safe protection.
 - c. The control transformer shall have a dual primary and secondary fuse block, pre-wired and top-mounted.
 - 2. 24 VDC Power Supplies
 - a. 24 VDC power supplies shall be Allen-Bradley [Bulletin 1606-XL] with active or passive PFC choke and input as shown in drawings [or auto-select input].
 - b. 24 VDC power supplies shall have low inrush current, and power supplies with greater than 100-Watt output shall incorporate a minimum 120% Power Burst design.
 - c. 24 VDC power supplies shall have NEC Class 2 “Limited Power” output.
 - 3. UPS
 - a. The UPS shall be an Allen-Bradley Industrial Uninterruptible Power Supply [Bulletin 1609-B/D] with 120 VAC input voltage and output power as shown on drawings.
 - b. The UPS shall be back-of-panel- [or DIN rail-] mounted.
 - c. The UPS shall provide:
 - 1) Surge protection to 380 Joules
 - 2) Overload protection, resulting in delayed shutdown at 110 to 130% and immediate shutdown at 130%
 - 3) Protection against output short on line – over-current protection from premises branch circuit
 - 4) Protection against output short on battery, resulting in shutdown
 - 5) Thermal protection
 - d. The UPS shall have USB communications and software, integrated remote on/off and dry I/O contacts.
 - e. The UPS shall have EtherNet/IP communications, expandable battery capacity and/or pure sine wave output.
 - f. The UPS shall perform to 40°C [50°C, with hi-temp battery].
- Q. Disconnect/breakers shall be external flange mounted type, all metal construction with painted handle, lockable, similar to Allen Bradley Model 1494F-M1-412. Plastic switches and twist type disconnects and breakers shall not be used.

1.47 SEMI-FINAL AND FINAL SITE VISITS FOR OBSERVATION

- A. As the project approaches completion, the Engineer and Architect, at their discretion shall determine a period of time in which they shall perform a Semi-Final Site Visit to observe the Mechanical and Electrical installation. At the conclusion of this Semi-Final Site Visit, a Semi-

Final Punchlist shall be issued to the appropriate Contractor for the deficiencies in the work of his trade. Complete all work and perform all corrective measures as required by the Semi-Final Punchlist. After this corrective and completion work has been accomplished, in writing, advise the Architect and the Engineer that every item on the Semi-Final Punchlist has been completed. After the Architect and Engineer make a Final Site Visit to observe the Mechanical and Electrical installation and make a Punchlist, a similar letter of Compliance shall be forwarded through the appropriate channels.

PART 2 - PRODUCTS - (NOT USED)

PART 3 - EXECUTION

3.1 INSTALLATION OF EQUIPMENT

- A. The Contractor shall be responsible for the installation of all equipment in accordance with the Manufacturer's Installation/Operation & Maintenance Manuals and instructions. If other requirements of this Specification contradict what is stated in the Manufacturer's instructions, the matter shall be brought to the attention of the Architect and Engineer for clarification. Any and all of the Manufacturer's requirements for utilities (electrical power and control wiring, piped water, drain, gas, fuel oil, steam, condensate, etc.), ducted supply or exhaust air, mounting and support shall be provided by the Contractor, regardless of how, or whether or not stated elsewhere in the Contract/Bid Documents.

END OF SECTION 01 31 46

SECTION 01 81 00

GENERAL COMMISSIONING REQUIREMENTS
(HVAC, PLUMBING, ELECTRICAL, ETC.)

PART 1 - GENERAL

1.1 COMMISSIONING

- A. This project will have the HVAC, Plumbing and Electrical systems commissioned. The equipment and systems to be commissioned are specified in the Mechanical and Electrical Commissioning Requirements section. The commissioning process which the Contractor is responsible for executing is defined in Divisions 23. The commissioning process will be directed by the Commissioning Authority.

1.2 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.
- B. OPR and BOD documentation prepared by Owner and MEP Engineer contains requirements that apply to this Section.

1.3 SUMMARY

- A. This Section includes general requirements that apply to implementation of commissioning without regard to systems, subsystems, and equipment being commissioned.
- B. Related Sections include the following:
 - 1. Supplementary General Requirements.
 - 2. Division 23 Section "Commissioning of HVAC".

1.4 ABBREVIATIONS

- A. The following are common abbreviations used in the Specifications and in the Commissioning Plan.
 - 1. A/EArchitect and Design Engineers
 - 2. CACommissioning Authority
 - 3. CCControls Contractor
 - 4. CM.....Construction Manager
 - 5. Cx.....Commissioning
 - 6. Cx Plan.....Commissioning Plan Document
 - 7. ECElectrical Contractor
 - 8. FT.....Functional Performance Test
 - 9. GCGeneral Contractor (Prime)
 - 10. MC.....Mechanical Contractor
 - 11. PC.....Pre-Functional Checklist
 - 12. PMProject Manager
 - 13. Subs.....Sub-Contractors to General
 - 14. TAB.....Testing and Balance Contractor

1.5 DEFINITIONS

- A. BoD: Basis of Design.
- B. CxA: Commissioning Authority.
- C. OPR: Owner's Project Requirements.
- D. Systems, Subsystems, and Equipment: Where these terms are used together or separately, they shall mean "as-built" systems, subsystems, and equipment.
- E. Owner:
- F. Construction Manager: This term refers to the constructor of the project. The Construction Manager (CM) has overall responsibility for the job and directs the efforts of all contractors.
- G. Architect: Includes Architect (A) identified in the Contract for Construction between Owner and Contractor, plus their sub-consultant/design professionals responsible for architectural and other related work. The Architect is...
- H. Contractors: This term refers collectively to Plumbing, HVAC and Electrical Contractors.
- I. MEP Engineer: Includes MEP Engineer identified in the Contract for Construction between Owner and Contractor, plus consultant/design professionals responsible for design of HVAC, electrical, communications, controls for HVAC systems, and other related systems. The MEP Engineer is...
- J. Schedule of Submittals: Is a document that is provided by Construction Manager that lists all the specified submittals; at a minimum there shall be a line for each submittal with space to indicate the status of the specified submittal; the schedule may also have space to track the Operation and Maintenance (O & M) manuals, warranties, start-up reports and training that may also be required by the specifications.
- K. Construction Checklists: Construction Checklists are forms produced by the CxA that are used by the contractor to verify the correct installation of equipment or components by visual inspection. See paragraph 1.8.F for further discussion.
- L. Construction Reports: Construction Reports are the Construction Checklists after they have been filled out by the Contractor.
- M. Test Procedures: Test Procedures are forms prepared by the CxA that list the steps for executing sequences of operation testing functions.
- N. Test Data Reports: Test Data Reports are the Test Procedures forms after they have been filled out by the Contractor.
- O. Systems Manual: A system-focused composite document that typically has a binder for each system to be commissioned. The documentation in each binder is indicated in paragraph 1.9.K below. The Construction Manager coordinates the information for this documentation. A detailed outline of the Manual is prepared by the CxA. The Construction Manager assembles the documentation as set forth in the Systems Manual Outline prepared by the CxA.

- P. Training Plan: A Training Plan typically consists of two documents prepared by the Construction Manager. The Training Summary which is a table listing the equipment that personnel are to be trained on, the number of hours of training required for each piece of equipment, the company responsible for doing that training and dates for when it is scheduled and dates when the training was actually done. The second document is the Plan itself which addresses all the specified training requirements including the topics to be included in each training session.
- Q. Issues Reports: Issues Reports are corrective action documents managed by the CM. They track Issues in the project that are in question or of concern. The reports come from a database in which each issue is a record. While an issue is being resolved it is printed out with other Open Issues in an Open Issues Report. After an issue has been resolved it is printed out in a Resolved Issues Report. All of the Issues together are referred to as the Issues Log.

1.6 COMMISSIONING TEAM

- A. Members Appointed by Contractor(s): Individuals, each having authority to act on behalf of the entity he or she represents, explicitly organized to implement the commissioning process through coordinated actions. The commissioning team shall consist of, but not be limited to, representatives of each Contractor, including Project superintendent and subcontractors, installers, suppliers, and specialists deemed appropriate by the CM.
- B. Members Appointed by Owner:
 - 1. CM: The designated person, company, or entity that plans, schedules, and coordinates the commissioning team to implement the commissioning process. Owner will engage the CM under a separate contract.
 - 2. Representatives of the facility user and operation and maintenance personnel.
 - 3. Architect and engineering design professionals.
 - 4. CxA Construction Authority.

1.7 OWNERS RESPONSIBILITIES

- A. Provide the OPR documentation to the CxA and each Contractor for use in developing the Commissioning Plan; Systems Manual; operation and maintenance training plan; Testing Procedures; and Equipment Checklists.
- B. Participate as a member of the Commissioning Team, discuss roles and responsibilities, review commissioning documentation and schedule and attend design review meetings, construction kick-off meeting, and Commissioning Team meetings.
- C. Review and distribute project design documents, shop drawings, TAB verification documentation, and commissioning documentation.
- D. Review and distribute documentation for installation of systems and components, start-up and checkout, HVAC and Plumbing pipe testing and flushing procedures, duct testing and cleaning procedures and testing of the controls system.
- E. Review and distribute Construction Checklists and Commissioning Test Procedures and Reports.
- F. Coordinate off-season deferred testing and post occupancy review.

- G. Review and distribute Warranties and Certifications of Work.
- H. Assign operation and maintenance personnel and schedule them to participate in commissioning team activities including, but not limited to, the following:
 - 1. Coordination meetings.
 - 2. Training in operation and maintenance of systems, subsystems, and equipment.
 - 3. Testing meetings.
 - 4. Demonstration of operation of systems, subsystems, and equipment. Retain paragraph below if services will be provided by Owner.
- I. Provide the BoD documents, prepared by MEP Engineer and approved by Owner, to the CM and each Contractor for use in developing the commissioning plan, Systems Manual, and operation and maintenance training plan.

1.8 ARCHITECT AND ENGINEER RESPONSIBILITIES

- A. Review the Owner's Project Requirements and prepare the initial BoD documents for use in development of commissioning plan.
- B. Participate as members of the Commissioning Team, review commissioning documentation, and attend design review meetings, construction kick-off meeting, and Commissioning Team meetings.
- C. Develop the design drawings and specifications, including the Sequence of Operations.
- D. Review and approve submittals and shop drawings and warranties for equipment and systems requiring commissioning, review documentation for installation of systems, component start-up and checkout, and TAB Verification testing documentation.
- E. Review Construction Checklists and Commissioning Test Procedures and Reports.
- F. Participate in and perform commissioning team activities including, but not limited to, the following:
 - 1. Participate in commissioning coordination meetings.
 - 2. Participate in Construction Checklist inspections.
 - 3. Participate in final review at acceptance meeting.
 - 4. Evaluate performance deficiencies identified in test reports and, in collaboration with entity responsible for system and equipment installation, recommend corrective action.
- G. Prepare As-Built Record drawings and documents for inclusion in Systems Manual.
- H. Review documentation for off-season deferred testing and Post Occupancy Review.

1.9 CONSTRUCTION MANAGER (CM) AND CONTRACTORS' RESPONSIBILITIES

- A. CM shall participate as a member of the Commissioning Team, schedule and attend design review meetings, and develop commissioning schedule.
- B. CM shall review the Owner's Project Requirements, Design Intent and Basis of Design, Project Design Documents, including design drawings, specifications, and Sequence of Operations, and commissioning documentation.

- C. CM shall include costs for Commissioning Process activities in the contract price and include Commissioning Process requirements and activities in all contractors' contracts.
- D. CM shall coordinate, process, and transfer submittals from the Contractors to the Owner, design professionals, and the Commissioning Authority.
- E. CM shall maintain a log and coordinate all deficiencies and resolutions for any system deficiencies and coordinate with CxA so that resolutions are incorporated into the CM's Master Issues Log.
- F. CM shall provide and review the Testing, Adjusting, and Balancing (TAB) Plan.
- G. CM shall issue Schedule of Submittals to CxA and MEP Engineer in hard copy and digital format.
- H. CM shall provide adequate accessibility as required to properly operate and maintain the facility.
- I. CM shall provide acceptable representation with the means and authority to prepare and coordinate implementation of the Commissioning Process as detailed in the Contract Documents.
- J. CM shall verify installation of systems and components, HVAC and Plumbing pipe testing and flushing procedures have been completed and issue a statement (Certificate of Readiness) certifying that all work has been completed and that the facility is operational, in accordance with Contract Documents.
- K. CM shall review approve, administer, coordinate, and verify completion of Construction Checklists, start-up and check-out procedures, pre-functional testing and functional performance testing procedures and reports.
- L. CM shall verify testing of the control system before TAB and review, approve, coordinate and document completion of TAB Verification testing.
- M. CM shall issue the appropriate final reports to the design professionals for review and acceptance.
- N. CM shall remedy deficiencies identified by the Commissioning Authority during verification of the installation or testing.
- O. CM shall assemble and review Systems Manual based on outline from CxA and paragraph 1.9 below "COMMISSIONING DOCUMENTATION".
- P. CM shall assemble and review O&M Manuals based on outline from CM and paragraph 19 below "COMMISSIONING DOCUMENTATION".
- Q. CM shall review and comment on the final Commissioning Process Report.
- R. CM shall develop a Training Plan and coordinate and implement the training program as defined above and as detailed in the Construction and Contract Documents.

- S. CM shall review documentation for off-season deferred testing and testing schedule and review documentation of Post Occupancy Review.
- T. Each Contractor shall assign representatives with expertise and authority to act on behalf of the Contractor and schedule them to participate in and perform commissioning team activities including, but not limited to, the following:
1. Participate in design- and construction-phase coordination meetings and Commissioning Team progress meetings.
 2. Review Design Intent, Basis of Design, and Sequence of Operations.
 3. Submit for approval the qualifications of personnel involved in Commissioning.
 4. Participate in developing and review start-up and checkout procedures and checklists.
 5. Review Pre-Functional Testing and Functional performance testing procedures and checklists.
 6. Develop the Testing, Adjusting, and Balancing (TAB) Plan.
 7. Review TAB Verification Testing procedures and checklists.
 8. Provide hard copy and digital submittals, including equipment and system submittals and shop drawings to the Owner, design professionals, and the Commissioning Authority through the Construction Manager.
 9. Provide adequate accessibility as required to properly operate and maintain the facility.
 10. Provide acceptable representation with the means and authority to implement the commissioning process as detailed in the Contract Documents.
 11. Furnish and Install all equipment, systems, and components.
 12. Perform all required start-up and checkout procedures.
 13. Perform all required HVAC and Plumbing pipe testing and flushing procedures.
 14. Perform all required duct testing and cleaning procedures.
 15. Perform all electrical checkout and testing procedures.
 16. Verify and document installation through construction checklists.
 17. Perform all required Testing, Adjusting and Balancing (TAB).
 18. Perform all Pre-Functional and Functional performance testing.
 19. Maintain a log of deficiencies and resolutions for all test procedures. Coordinate with CM and CxA so that deficiencies and resolutions are incorporated into the CxA's Master Issues Log.
 20. Provide Certificates of Readiness.
 21. Provide documentation of Warranties.
 22. Participate in maintenance orientation and inspection.
 23. Provide training of the Owner's O&M personnel. content, and participate in operation and maintenance training sessions.
 24. Provide qualified trainers (e.g. from equipment manufacturers) for installed equipment, coordinate with CM regarding schedule and duration.
 25. Participate in final review at acceptance meeting.
 26. Issue a statement certifying that the Work Of this Contractor is complete and systems are operational according to the Contract Documents, including calibration of instrumentation and controls and filling out of Construction Checklists.
 27. Certify date of acceptance and startup for each item of equipment for start of warranty periods.
 28. Perform Test Procedures and prepare Test Data Reports. Evaluate performance deficiencies identified in Test Data Reports and, in collaboration with entity responsible for system and equipment installation, recommend corrective action, and implementation.
 29. Review and approve final commissioning documentation.
 30. Conduct and document off-season deferred testing.
 31. Address items generated from Post Occupancy Review.

32. Compile system manual.
 33. Gather and submit operation and maintenance data for systems, sub-systems and equipment for the Systems Manual as specified in Division 01 and in this specification section.
- U. Subcontractors shall assign representatives with expertise and authority to act on behalf of subcontractor~ and schedule them to participate in and perform commissioning team activities including, but not limited to, the following:
1. Participate in design- and construction-phase coordination meetings and Commissioning Team progress meetings.
 2. Submit for approval the qualifications of personnel involved in Commissioning.
 3. Participate in developing start-up and checkout procedures and checklists.
 4. Review Pre-Functional Testing and Functional performance testing procedures and checklists.
 5. Participate in developing the Testing, Adjusting, and Balancing (TAB) Plan.
 6. Participate in review of TAB Verification Testing procedures and checklists.
 7. Provide hard copy and digital submittals, including equipment and system submittals and shop drawings to the Owner, design professionals, and the Commissioning Authority through the Construction Manager.
 8. Provide adequate accessibility as required to properly operate and maintain the facility.
 9. Provide acceptable representation with the means and authority to implement the commissioning process as detailed in the Contract Documents.
 10. Furnish and install all equipment, systems, and components.
 11. Perform all start-up and checkout procedures.
 12. Perform all required HVAC and Plumbing pipe testing and flushing procedures.
 13. Perform all required duct testing and cleaning procedures.
 14. Perform all required electrical checkout and testing procedures.
 15. Verify and document installation through construction checklists.
 16. Perform all required Testing, Adjusting and Balancing (TAB).
 17. Perform all required Pre-Functional and Functional performance testing.
 18. Provide documentation of Warranties.
 19. Participate in maintenance orientation and inspection.
 20. Participate in training of the Owner's O&M personnel.
 21. Participate in maintenance orientation and inspection.
 22. Participate in procedures meeting for Test Procedures and Test Data Reports and participate in the actual procedures and reporting.
 23. Participate in final review at acceptance meeting.
 24. Issue a statement certifying that Work of this Subcontractor is complete and systems are operational according to the Contract Documents, including calibration of instrumentation and controls and filling out of Construction Checklists
 25. Provide schedule for operation and maintenance data submittals, equipment startup, and System Performance Testing to CxA for incorporation into the Commissioning Plan. Update schedule on a weekly basis throughout the construction period.
 26. Provide information to the CM for developing construction-phase Commissioning Plan.
 27. Provide updated Project Record Documents to the CM on a timely basis as required by project schedule.
 28. Provide hard copy and digital submittals to the Owner, design professionals, and the Commissioning Authority through the Construction Manager.
 29. Gather and submit operation and maintenance data for systems, subsystems, and equipment, for the Systems Manual, as specified in Division 01 and in this specification section.

30. Provide technicians who are familiar with the construction and operation of installed systems and who shall develop an implementation plan for the means and methods of executing the Test Procedures and Test Data Reports and participate in testing of compile material for system manual and deliver to contractor.
 - V. Contractor shall provide line items for the Contactor's responsibilities regarding Commissioning in the Schedule of Values. Provide a line item for each system to be commissioned.
 - W. Contractor shall provide Operation and Maintenance manual containing operation and maintenance documentation for all equipment installed under this contract.
 - X. Contractor shall provide operation documentation for all systems installed under this contract including the Systems Manual which shall include items indicated in paragraph 1.9 below "COMMISSIONING DOCUMENTATION".
 - Y. Contractor, with Subcontractors' assistance, to complete Construction Reports and Test Procedure Reports.
 1. Review and comment on Construction Checklists.
 2. Fill-out Construction Checklists.
 3. Review and comment on Test Procedure Forms.
 4. Fill-out Test Procedure Forms.
 - Z. Contractor, with assistance of Subcontractors, to participate in TAB verification testing.
 1. Review TAB Verification Testing procedures and checklists.
 2. Perform all TAB Verification Testing.
 3. Fill-out TAB Verification Test Procedure Forms.
 4. Provide remedial action and re-testing for systems and equipment identified by CxA as not meeting specified performance requirements.
- 1.10 CxA'S RESPONSIBILITIES
- A. Organize and lead the commissioning team.
 - B. Review Owner's Project Requirements (OPR) and Architect's/Engineer's Basis of Design (BoD).
 - C. Review the qualifications of Commissioning Team members.
 - D. Review Project Design Documents, including Sequence of Operations.
 - E. Assist with developing and acceptance of Commissioning Specifications.
 - F. Prepare a construction-phase Commissioning Plan. Collaborate with each Contractor and with subcontractors to develop Performance Test and Inspection procedures. Include design changes and scheduled commissioning activities coordinated with overall Project schedule. Identify commissioning team member responsibilities, by name, firm, and trade specialty, for performance of each commissioning task.
 - G. Develop outline for Systems Manual including scope and tab division descriptions.

- H. Review and comment on Testing, Adjusting, and Balancing (TAB) Plan.
- I. Develop TAB Verification Testing Procedures.
- J. Review and comment on Submittal Schedule.
 - 1. Comment on any deficiencies observed
 - 2. Indicate critical submittals CxA needs to review
- K. Review and comment on sampling of submittals from Contractor for compliance with the OPR, BoD, Contract Documents, and construction-phase Commissioning Plan. Review and comment on performance expectations of systems and equipment and interfaces between systems relating to the OPR and BoD.
- L. Convene commissioning team meetings for the purpose of coordination, communication, and conflict resolution; discuss progress of the commissioning processes. Responsibilities include asking Construction Manager for facilities, preparing agenda and attendance lists, and notifying participants. The CM shall prepare and distribute minutes to commissioning team members and attendees.
- M. At the beginning of the construction phase, conduct an initial construction-phase coordination meeting for the purpose of reviewing the commissioning activities and reviewing Construction Manager's tentative schedules for operation and maintenance submittals; construction inspections; Performance Testing; operation and maintenance training sessions; TAB Work; and Project completion.
- N. Prepare project-specific Construction Checklists.
- O. Prepare project-specific Functional Performance Test Procedures.
- P. Review Construction Reports (filled out Construction Checklists).
- Q. Prepare Issues Logs and Reports.
- R. Observe and inspect construction and report progress and deficiencies in regard to compliance with the OPR, BoD, and Contract Documents.
- S. Review schedule with Contractor and witness sampling of Tests, Cleaning and Flushing Procedures, witness sample testing of the control systems, and witness sample TAB procedures; perform sample inspections, verify sample Construction Checklists, witness major systems startup indicated in Commissioning Plan, and witness sample Functional Performance Tests.
- T. Review Contractor's Test Data Reports (filled out Test Procedure documents), include them in the commissioning report, and verify contractor has inserted them into systems manual.
- U. Administer and review results of TAB Verification Testing, utilizing Contractors' personnel and test equipment.
- V. Verify Project Record Documents have been provided to the owner. Project Record Documents requirements are specified in Division 01 Section "Project Record Documents" and in the technical specification's sections.

- W. Review and comment on operation and maintenance documentation and Systems Manual for compliance with the OPR, BoD, and Contract Documents. Operation and maintenance documentation requirements are specified in Division 01 Section ‘Operation and Maintenance Data.’ And in the technical specification’s sections.
- X. Prepare scope (outline consisting of specification section, name of equipment/section and hours of training required) of operation and maintenance training program, review contractor’s training content, coordinate schedule with the contractor, verify training was videotaped by specifications, and review contractor supplied qualified instructors to conduct operation and maintenance training. Operation and maintenance training is specified in Division 01 Section “Demonstration and Training”.
- Y. Prepare Final Commissioning Report.
- Z. Conduct and document off-season deferred testing.
- AA. Conduct and document Post Occupancy Review

1.11 COMMISSIONING DOCUMENTATION

- A. OPR: A written document, prepared by Owner that details the functional requirements of Project and expectations of how it will be used and operated. This document includes Project and design goals, measurable performance criteria, budgets, schedules, success criteria, and supporting information.
- B. BoD Document: A document, prepared by MEP Engineer, that records concepts, calculations, decisions, and product selections used to meet the OPR and to satisfy applicable regulatory requirements, standards, and guidelines. The document includes both narrative descriptions and lists of individual items that support the design process.
- C. Commissioning Plan: A document, prepared by CxA, that outlines the schedule, allocation of resources, and documentation requirements of the commissioning process, and shall include, but is not limited to the following:
 - 1. Plan for delivery and review of submittals, Systems Manual, and other documents and reports. Identification of the relationship of these documents to other functions and a detailed description of submittals that are required to support the commissioning processes. Submittal dates shall include the latest date approved submittals must be received without adversely affecting the commissioning plan.
 - 2. Description of the organization, layout, and content of commissioning documentation (including Systems Manual and a detailed description of documents to be provided along with identification of responsible parties.
 - 3. Identification of systems and equipment to be commissioned.
 - 4. Description of schedules (with coordination with contractor) for Testing Procedures along with identification of parties involved in performing and verifying tests.
 - 5. Identification of items that must be completed before the next operation can proceed.
 - 6. Description of responsibilities of commissioning team members.
 - 7. Description of observations to be made.
 - 8. Description of scope of requirements for operation and maintenance training, including required training materials.
 - 9. Description of expected performance for systems, subsystems, equipment, and controls.

10. Schedule for commissioning activities with specific dates coordinated with overall construction schedule and contractor.
 11. Summary identification of installed systems, subsystems, and equipment, including design changes that occurred during the construction phase.
 12. Process and schedule for documenting changes on a continuous basis to appear in Project Record Documents.
 13. Process and schedule for completing pre-start and startup checklists for systems, to be verified and tested.
 14. Step-by-step procedures for Performance Testing of systems with descriptions for methods of verifying relevant data, recording the results obtained, and listing parties involved in performing and verifying tests.
- D. Cx Meeting Agendas and Minutes.
- E. Shop Drawings, Equipment Submittals and Coordination Drawings: The CxA will verify that the processing of these documents is being done effectively. A copy of each shop drawing, equipment submittal and coordination drawing indicated on Submittal Schedule mark-up shall be reserved for the CxA. The CxA will receive copies of the reviewed documents like the Contractor does. If the CxA finds something of concern, it will be added to the Issues Log for consideration by the team.
- F. Construction Checklists: CxA will distribute detailed construction checklists for components and systems to be commissioned. The Contractor will either comment on the lists or give written acceptance of them. Each Checklist will typically include model number verification, pre-installation checks, and checks for general installation, piping, electrical and controls installation, and startup. Most line items are a “yes or no” question where “yes” is the correct answer, and “no” indicates a problem. Documentation of specified inspections such as boiler inspections, and specified testing such as hydrostatic, duct leakage testing shall be required to be attached to applicable Construction Checklists/Reports. The last section of the Checklist is for negative responses. Explanations for any “no” answers are required here. Note: Startup and Test Procedures used by a technician that is authorized by the manufacturer of the installed equipment may be used instead of the Construction Checklists, however, the manufacturer’s written startup and testing checklists must be approved by the CxA in advance of the testing. The Construction Manager shall administer the distribution and collection of the Construction Checklists. Contractors shall complete the Construction Checklists provided by the CxA, via the Construction Manager.
- G. Test Procedures: CxA will distribute detailed sequence of operation Test Procedures for the components and systems identified in Section “HVAC Commissioning Requirements”, Section “Plumbing Commissioning Requirements”, and Section “Electrical Commissioning Requirements” to the Construction Manager and the MEP Engineer (for comment). The Contractor will either comment on the lists, or give written acceptance of them. The Test Procedures will include HVAC systems, subsystems, including interfaces and interlocks with other systems. Provide space for testing personnel to sign off on each checklist. Specific checklist content requirements are specified in Division 23 Section “Commissioning of HVAC.” Each checklist, regardless of system, subsystem, or equipment being tested, shall include, but not be limited to, the following
1. Name and identification code of tested item.
 2. Test number.
 3. Time and date of test.

4. Indication of whether the record is for a first test or retest following correction of a problem or issue.
 5. Dated signatures of the person performing test and of the witness, if applicable.
 6. Individuals present for test.
 7. Deficiencies.
 8. Issue number, if any, generated as the result of test.
- H. Test Data Reports: The Contractor will perform and complete the Test Procedures which will then comprise the Test Data Reports. The Construction Manager shall compile and submit completed Test Data Reports and forward them for review to the CxA. After review by CxA, approved checklists shall be given to the Construction Manager. The Construction Manager shall include them in the Systems Manual. The CxA may also include them in the commissioning report.
- I. Issues Log: CxA shall prepare and maintain an issues log that describes design, installation, and performance issues that are at variance with the OPR, BoD, and Contract Documents. Identify and track issues as they are encountered, documenting the status of unresolved and resolved issues.
1. Creating an Issues Log Entry:
 - a. Identify the issue with unique numeric or alphanumeric identifier by which the issue may be tracked.
 - b. Assign a descriptive title of the issue.
 - c. Identify date and time of the issue.
 - d. Identify test number of test being performed at the time of the observation, if applicable, for cross-reference.
 - e. Identify system subsystem, and equipment to which the issue applies.
 - f. Identify location of system, subsystem, and equipment.
 - g. Include information that may be helpful in diagnosing or evaluating the issue.
 - h. Note recommended corrective action.
 - i. Identify commissioning team member responsible for corrective action.
 - j. Identify expected date of correction.
 - k. Identify person documenting the issue.
 2. Documenting Issue Resolution:
 - a. Log date correction is completed, or the issue is resolved.
 - b. Describe corrective action or resolution taken. Include description of diagnostic steps taken to determine root cause of the issue, if any.
 - c. Identify changes to the OPR, BoD, or Contract Documents that may require action.
 - d. State that correction was completed, and system and subsystem is ready for retest, if applicable.
 - e. Identify person(s) who corrected or resolved the issue.
 - f. Identify person(s) documenting the issue resolution.
 3. Issues Log Report: On a periodic basis, but not less than for each commissioning team meeting, CM shall prepare a written narrative for review of outstanding issues and a status update of the issues log. As a minimum, CxA shall include the following information in the issues log and expand it in the narrative:
 - a. Issue number and title.
 - b. Date of the identification of the issue.
 - c. Name of the commissioning team member assigned responsibility for resolution.
 - d. Expected date of correction.

- J. Commissioning Report: CxA shall document results of the commissioning process including unresolved issues and performance of systems, subsystems, and equipment. The commissioning report shall indicate whether systems and subsystems have been completed and are performing according to the OPR, BoD, and Contract Documents. The commissioning report shall include, but is not limited to, the following:
1. Narrative description of systems commissioned and the results.
 2. Lists and explanations of substitutions; compromises; variances in the OPR, BoD, and Contract Documents; record of conditions; and, if appropriate, recommendations for resolution. This report shall be used to evaluate systems and subsystems and shall serve as a future reference document during Owner occupancy and operation. It shall describe components and performance that exceed requirements of the OPR, BoD, and Contract Documents and those that do not meet requirements of the OPR, BoD, and Contract Documents. It may also include a recommendation for accepting or rejecting systems and subsystems.
 3. OPR and BoD documentation.
 4. Commissioning plan.
 5. System Performance Testing plans and reports.
 6. Corrective modification documentation.
 7. Issues log.
 8. Completed System Performance Test checklists.
 9. Listing of off-season System Performance Test(s) not performed and a schedule for their completion.
 10. List outstanding items.
- K. Systems Manual: Prime Contractor shall gather required information and compile systems manual based on the outline document provided by CM. Systems manual shall include, but is not limited to, the following for each commissioned system:
1. OPR, including changes made throughout the Project.
 2. BoD, including system narratives, schematics, and changes made throughout the Project.
 3. System single line diagrams.
 4. Approved shop drawings of systems commissioned.
 5. As-built drawings of systems commissioned.
 6. As-built sequences of operations including time-of-day schedules, schedule frequency, detailed point listings and ranges, control drawings and original set-points.
 7. Operating instructions for integrated building systems including seasonal operational guidelines.
 8. Recommended schedule of maintenance requirements and frequency, if not already included in the Project O&M manuals.
 9. Recommended Schedule for retesting of commissioned systems, functional performance test results (benchmarks), and blank test forms from the original Commissioning Plan.
 10. Recommended schedule of calibrating sensors and actuators by type and use.
 11. Troubleshooting table for issues not covered above if applicable.
- L. O&M Manuals: Contractor shall gather required information and compile O&M Manuals. O&M manuals shall include, but not be limited to, the following for each commissioned system:
1. Operating instructions for integrated building systems equipment including seasonal operational guidelines.
 2. Recommended schedule of maintenance requirements and frequency.
 3. Troubleshooting table for issues not covered above if applicable.

- M. Training Summary: See Contractor's and CxA's responsibilities regarding this document in the above sections.

1.12 SUBMITTAL REQUIREMENTS FOR COMMISSIONING

- A. Normal Submittals
 1. The CxA will receive a copy of the normal submittals for equipment to be commissioned.
 2. The CxA will review and approve normal Contractor submittals applicable to systems being commissioned for compliance with commissioning needs, concurrent with the A/E reviews.
- B. Data for Commissioning
 1. The Contractor will receive a written report from the CxA requesting specific information needed about each piece of commissioned equipment or system.
 2. Typically, this will include detailed manufacturer installation and startup, operating, troubleshooting and maintenance procedures, full details of any owner-contracted tests, fan and pump curves, full factory testing reports, if any, and full warranty information including all responsibilities of the Owner to keep the warranty in force clearly identified. In addition, the installation and checkout materials that are actually shipped inside the equipment and the actual field checkout sheet forms to be used by the factory or field technician shall be submitted to the CxA.
 3. The CxA may request further documentation necessary for the commissioning process.
 4. This data request may be made prior to normal submittals.
 5. Much of this information is contained in the regular O&M manual submittals normally submitted in the project. Typically, this information is required prior to the regular formal O&M manual submittal.
 6. Contractor's responsibility for deviations in submittals from requirements of the Contract Documents is not relieved by the CxA's review.
- C. Commissioning Plan Pre-final Submittal: CxA shall submit five hard copies of prefinal commissioning plan. Deliver two copies to Owner, one copy to the Construction Manager, one to the Architect, and one to MEP Engineer. Present submittal in sufficient detail to evaluate data collection and arrangement process. One copy, with review comments, will be returned to the CxA for preparation of the final construction-phase commissioning plan.
- D. Commissioning Plan Final Submittal: CxA shall submit five hard copies and two sets of electronically formatted (digital) information of final commissioning plan. Deliver two hard copies and two sets of digital files to Owner, one copy to the Construction Manager, one copy to the Architect, and one copy to MEP Engineer. The final submittal must address previous review comments. The final submittal shall include a copy of the pre-final submittal review comments along with a response to each item.
- E. Submittal Schedule: Construction Manager shall submit to CxA and MEP Engineer.
- F. Construction Checklists: CxA shall submit Construction Checklists for systems indicated in Commissioning Plan, to the Construction Manager for distribution to each Contractor quality-control manager and subcontractors for use. Deliver one set of electronically formatted copies of each Construction Checklist.
- G. Construction Reports: Prime Contractor shall submit completed Construction Checklists to CM for review.

- H. Test Procedures Forms: CxA shall submit Test Procedures to MEP Engineer for Review. CM shall submit Test Procedures to Construction Manager for Contractor to coordinate, do testing, and complete. Deliver one set of electronically formatted copies of each Test Procedure Form to the MEP Engineer and the Construction Manager.
- I. Corrective Action Documents: CxA shall submit Issues Logs and Reports. Deliver electronically formatted copies to Owner, Construction Manager, Architect, and MEP Engineer.
- J. Pre-final Commissioning Report Submittal: CxA shall submit four hard copies of the pre-final commissioning report. CM shall deliver two copies to Owner, one copy to Architect and one copy to MEP Engineer. One copy, with review comments, will be returned to the CxA for preparation of final submittal.
- K. Final Commissioning Report Submittal: CxA shall submit four hard copies and two sets of electronically formatted (digital) information of the final commissioning report. CxA shall deliver two hard copies and two sets of digital files to Owner, and one copy to Architect, and one copy to MEP Engineer. The final submittal must address previous review comments and shall include a copy of the pre-final submittal review comments along with a response to each item.

1.13 QUALITY ASSURANCE

- A. Instructor Qualifications: Instructors shall be factory-authorized service representatives, experienced in training, operation, and maintenance procedures for installed systems, subsystems, and equipment.
- B. Test Equipment Calibration: Comply with test equipment manufacturers calibration procedures and intervals. Recalibrate test instruments immediately whenever instruments have been repaired following damage or dropping. Affix calibration tags to test instruments, Instruments shall have been calibrated within six months prior to use.

1.14 COORDINATION

- A. Coordinating Meetings: CxA shall conduct monthly coordination meetings of the commissioning team to review progress on the commissioning plan, to discuss scheduling conflicts, and to discuss upcoming commissioning process activities.
- B. Test Procedure Pretesting Meetings: CxA shall conduct pretest meetings of the commissioning team to review startup reports, Construction Checklists, pretest inspection results, testing procedures, testing personnel and instrumentation requirements, and manufacturers authorized service representative services for each system, subsystem, equipment, and component to be tested as listed in Section “Plumbing Commissioning Requirements”, Section “HVAC Commissioning Requirements”, and Section “Electrical Commissioning Requirements” for specific requirements for commissioning 1-IVAC systems.
- C. Test Procedure Testing Coordination: CxA shall review sequence of testing activities for major systems with Contractor to accommodate required quality-assurance and -control services with a minimum of delay and to avoid, where possible, necessity of removing and replacing construction to accommodate testing and inspecting.
 - 1. Schedule with Construction Manager times for observation of tests, inspections, obtaining samples, and similar activities.

2. CM may observe sampling of tests by Contractor and his personnel.

D. Manufacturers’ Field Services: Contractor shall coordinate services of manufacturers’ field services.

1.15 COMMISSIONING/VERIFICATION PROCESS HOURS

	Trade	Hours Assigned to Each Trade (hrs)
1	Mechanical (HVAC)	TBD

1.16 OPERATION AND MAINTENANCE TRAINING REQUIREMENTS

A. Training Preparation Conference: Before operation and maintenance training, CxA shall request the Construction Manager to schedule a training preparation conference to include Owner’s operation and maintenance personnel, each Contractor, and subcontractors. In addition to requirements specified in Division 01 Section ‘Demonstration and Training,’ and in the technical specifications sections, perform the following:

1. Review installed systems, subsystems, and equipment.
2. Review instructor qualifications provided by contractor.
3. Review instructional methods and procedures provided by contractor.
4. Review training module outlines and contents provided by contractor.
5. Review course materials (including operation and maintenance manuals) provided by contractor.
6. Inspect and discuss locations and other facilities required for instruction provided by contractor.
7. Review training schedule and Contractor’s documentation of availability of educational materials, instructors, audiovisual equipment, and facilities needed to avoid delays.
8. For instruction that must occur outside, review Contractor’s documentation of the weather and forecasted weather conditions and procedures to follow if conditions are unfavorable.

Construction Manager shall provide verification to the CxA that the above was done.

B. Training Modules: CxA to review Contractor - Developed instruction program that includes individual training modules for each system, subsystem, and equipment as specified in Division 01 Section “Demonstration and Training.”

C. See Contractor’s and CM’s responsibilities regarding training in the above sections.

1.17 PREREQUISITES TO FUNCTIONAL COMPLETION

A. All TAB work and the commissioning of Division ?? must be complete prior to Functional Completion, unless approved in writing by the Owner’s Project Manager. Exceptions to this are the planned control system training performed after occupancy and any required seasonal or approved deferred testing. This includes for all systems, but is not limited to:

1. Completed and signed startup and pre-functional checklist documentation.
2. Requested trend log data.
3. Submission of final approved TAB report.
4. Completion of all functional testing.
5. Required training of Owner personnel completed and approved.

6. Submission of the approved O&M manuals.
 7. All identified deficiencies have been corrected or are approved by the Owner to be excepted from this milestone.
- B. The Owner's Project Manager will determine the date of Functional Completion after reviewing the Commissioning Agent's recommendation for Functional Completion.
- C. Commissioning activities are non-compensable and cannot be a cause for delay claims.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION 01 81 00

SECTION 01 81 19.11

CONSTRUCTION IAQ MANAGEMENT

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

- A. This Sections is coordinate with and complementary to the General Conditions and Supplementary General Conditions of the Work, wherever applicable to Mechanical Work.
- B. Section 01 31 46 - Special Requirements for Mechanical and Electrical Work shall apply.

1.2 DESCRIPTION OF WORK

- A. The work includes the providing of all labor, materials, equipment, accessories, services and tests necessary to adopt an IAQ management plan to protect the HVAC system and completed areas of construction during construction, control pollutant sources and interrupt contamination pathways. The IAQ management plans shall meet or exceed the recommended design approaches contained in Chapter 3 of the SMACNA IAQ Guideline for Occupied Buildings Under Construction, 1995. Each contractor shall sequence the installation of materials to avoid contamination of absorptive materials such as insulation, carpeting, ceiling tile and gypsum wall board during construction.

1.3 QUALITY ASSURANCE

- A. Construction related IAQ procedures and issues shall be presented by each contractor at every construction progress meeting. Each contractor shall report on the implementation of their IAQ plan. Issues related to coordination with other contractors should be addressed. Each contractor shall report to the Construction Manager who will function as the IAQ Manager for the project. As the IAQ Manager, the Construction Manager will identify IAQ problems and direct the responsible contractor as to required mitigation.
- B. Each contractor shall provide a minimum of 18 photographs, 6 photographs taken on 3 different occasions during construction: the beginning, the midpoint, and the end. The contractor shall identify each SMACNA approach, as described herein, featured by each photograph.

1.4 SUBMITTALS

- A. Refer to Section - Special Requirements for Mechanical and Electrical Work and submit shop drawings.
- B. Submit all declarations & photographs as required under "Quality Assurance" above.
- C. Before the start of construction, submit a narrative of the proposed IAQ plan to be implemented. This shall include the specific procedures that shall be used to implement each of the five design approaches of the SMACNA IAQ Guideline for Occupied Buildings Under Construction 1995, Chapter 3; HVAC Protection, Source Control, Pathway Interruption, Housekeeping and

Scheduling. The HVAC Contractor shall include catalog cuts of filters to be utilized and a description of the Building Flush-Out procedure to be implemented.

1.5 COORDINATION

- A. Refer to Section 01 31 46 - Special Requirements for Mechanical and Electrical Work.

PART 2 - NOT USED

PART 3 - EXECUTION

3.1 CONSTRUCTION IAQ MANAGEMENT PLAN: DURING CONSTRUCTION

- A. Requirements
 - 1. Each contractor shall develop and implement an Indoor Air Quality (IAQ) Management Plan for the construction and pre-occupancy phases of the building as follows:
 - a. During construction meet or exceed the recommended Design Approaches of the Sheet Metal and Air Conditioning National Contractors Association (SMACNA) IAQ Guideline for Occupied Buildings under Construction, 1995, Chapter 3.
 - b. Protect stored on-site or installed absorptive materials from moisture damage.
 - c. When air handlers are used during construction, the HVAC Contractor shall provide filtration media with a minimum efficiency reporting value (MERV) of 8 at each return air grill. MERV shall be as determined by ASHRAE 52.2-1999.
 - d. The HVAC Contractor shall replace all air handler filtration media immediately prior to occupancy. Filtration media shall have a Minimum Efficiency Report Value (MERV) of 13, as determined by ASHRAE 52.2-1999 for media installed at the end of construction.
- B. The Plan shall address the protection of the ventilation system components during construction and cleanup of contaminated components after construction is complete. Required temporary ventilation and operation of the air handlers during construction shall be provided as required in the General Conditions of the construction contract.
- C. Construction-related IAQ procedures should be included in the pre-construction and construction progress meeting agendas. The Construction Manager shall make efforts to ensure that all participants in the construction process are aware of the IAQ procedures and understand the importance of the goals of the IAQ Management Plan.
- D. The referenced SMACNA standard recommends control measures in five areas: HVAC protection, source control, pathway interruption, housekeeping and scheduling. Review the applicability of each control measure and include those that apply in the final IAQ Management Plan.
- E. HVAC Protection - Shut down the return side of the HVAC system (which is, by definition, ductwork under negative pressure) whenever possible during heavy construction or demolition. The return side should also be isolated from the surrounding environment whenever possible. For example, all ceiling tiles for the ceiling plenum should be in place and all leaks in ducts and air handlers should be repaired promptly. When the ventilation system is operated during

construction, it should be fitted with temporary filters that can be replaced with clean media just prior to substantial completion and occupancy.

- F. The HVAC Contractor should ensure that the return side of the HVAC system is dampened off in the heaviest work areas and return system openings shall be sealed with plastic. In addition to protection of the HVAC system, filter efficiency shall be upgraded where major loading is expected to occur on operating HVAC systems.
- G. Source Control - Use nontoxic materials such as paints, caulks, sealants, and cleaning products.
- H. Pathway Interruption - During construction, isolate areas of work to prevent contamination of clean or occupied spaces. Depending on the climate, ventilate using 100% outside air to exhaust contaminated air directly to the outside during the installation of VOC emitting materials. Pressure differentials shall be utilized to prevent contaminated air from entering clean areas. Erect barriers between work areas and non-work areas.
- I. Housekeeping - Institute cleaning activities concentrating on HVAC and building spaces to remove contaminants from the building prior to occupancy. Building materials shall be protected from the weather and stored in a clean area prior to unpacking for installation. All coils, air filters, and fans shall be cleaned before performing testing and balancing procedures and especially before conducting baseline air quality tests.
- J. Scheduling - Use construction sequencing that reduces the absorption of VOCs by materials that act as sinks or contaminant sources. Complete applications of wet and odorous materials such as paints, sealants, and coatings before installing "sink" materials such as ceiling tiles, carpets, insulation, gypsum products, and fabric-covered furnishings. Materials directly exposed to moisture through precipitation, plumbing leaks, or condensation from the HVAC system are susceptible to microbial contamination.

END OF SECTION 01 81 19.11

SECTION 01 91 13

COMMISSIONING-GENERAL REQUIREMENTS

PART 1 - GENERAL

1.1 DESCRIPTION

- A. The purpose of the commissioning process is to provide the Owner/Operator of the facility with a high level of assurance that the mechanical and electrical systems have been installed in the prescribed manner and operate within the performance guidelines set in the design intent. The Commissioning Authority shall provide the Owner with an unbiased objective view of the system installation, operation, and performance. This process is not to take away or reduce the responsibility of the design professionals or installing contractors to provide a finished product. Commissioning is intended to enhance the quality of system start-up and aid in the orderly transfer of systems to beneficial use by the owner. The Commissioning Authority will be a member of the construction team, cooperating and coordinating all commissioning activities with the design professionals, construction manager, contractors, subcontractors, manufacturers and equipment suppliers.

1.2 SCOPE

- A. The functions and responsibilities of the Commissioning Authority shall include:
1. Responsibility: The primary point of responsibility is to inform the Owner on the status, integration, and performance of systems to be commissioned within the facility.
 2. Information: The Commissioning Authority shall function as a catalyst and initiator to disseminate information and assist the design and construction teams in the completion of the construction process for the commissioned scope of work. This shall include system completeness, performance, and adequacy to meet the intended performance standards of each system. Services include construction observation, spot testing, supervision of verification and functional performance testing, and providing performance and operating information to the responsible parties, e.g., contractors, design professionals, and the Owner.
 3. Quality Assurance: Assist the responsible parties to maintain a high quality level of installation and system performance.
 4. Observation of tests: The Commissioning Authority shall observe, coordinate and supervise testing as required to ensure system performance meets the design intent parameters.
 5. Documentation of tests: Commissioning Authority shall document the results of the performance testing directly and/or ensure that all testing is documented by the appropriate technicians. The Commissioning Authority shall provide standard forms to be used by all parties for consistency of approach and type of information to be recorded.
 6. Resolution of disputes: The Commissioning Authority is to remain an independent party present on the project with specific knowledge of the project. Should disputes arise, the Commissioning Authority shall perform research to determine the scope and extent of the problem and educate the involved parties as to the nature and extent of the problem. This shall include technical and financial aspects of the dispute, including assistance to help identify who the responsible parties are to implement corrective action. The Owner/Architect shall preside over resolution of the problem.

7. Deficiencies: Provision of technical expertise to oversee and verify the correction of deficiencies found during the commissioning process.
8. Acceptance: The Commissioning Authority shall determine and advise the Owner of the date of acceptance for each component and system for the start of the warranty period.
9. Provision of technical expertise to review and edit operating and maintenance descriptions by system.

- B. The Commissioning Agency is referred to as an independent contractor in this Division and shall work under a separate contract directly for the Owner.
- C. The Commissioning Agency shall not be financially associated with any of the contractors on this project to avoid potential conflicts of interest.

1.3 SYSTEMS TO BE INCLUDED IN COMMISSIONING PROCESS

The following pieces of equipment and systems shall be subject to commissioning:

- A. HVAC
 1. Pumps
 2. Air Handling Units
 3. Cooling Towers
 4. VFD
 5. Humidifier
 6. Fans
 7. Piping System
 8. Ductwork System
 9. TAB
 10. Controls

1.4 COORDINATION

- A. The Commissioning Authority shall receive directly from the design professional(s) a copy of all the construction documents, addenda, change orders, and appropriate approved submittals and shop drawings of all the equipment or system to be commissioned.
- B. The Commissioning Authority shall disseminate written information and documents to all responsible parties relative to the nature and extent of the communication.
- C. The Commissioning Authority is primarily responsible to the Owner, and as such, shall regularly apprise the Owner of progress, pending problems and/or disputes, and shall provide regular status reports on progress with each system to be commissioned. Any potential change in the contractual and/or financial obligations of the Owner (credits, change orders, schedule change, etc.) shall be identified and quantified as soon as possible.
- D. The Commissioning Authority shall coordinate the schedule of commissioning activities with the construction schedule. It is possible that some procedures will be implemented before the entire system is completed.

1.5 SCHEDULE

- A. Commissioning of systems shall proceed per the criteria established in the specific sections that follow, with activities to be performed on a timely basis. The Commissioning Authority shall be available to respond promptly to avoid construction delays.
- B. Start-up and testing of systems may proceed prior to final completion of systems to expedite progress. However, the Commissioning Authority shall not supervise standard, regular testing and checkout services that are the primary responsibility of the contractor/vendor in advance of their commissioning testing and checkout.
- C. Problems observed shall be addressed immediately, responsible parties notified, and actions to correct deficiencies coordinated in a timely manner.
- D. Contractor schedules and scheduling is the responsibility of the CM. The Commissioning Authority shall provide commissioning scheduling information to the CM for review and planning activities.

1.6 RELATED WORK SPECIFIED ELSEWHERE

- A. Commissioning requires support from the Contractors. The commissioning process does not relieve any Contractors from their obligations to complete all portions of work in a satisfactory and timely manner.
- B. Refer to Section 23 08 00 of Division 23 regarding roles and responsibilities relative to the commissioning process.

PART 2 - PRODUCTS

2.1 TEST EQUIPMENT

- A. All industry standard test equipment required for performing the specified tests shall be available at the project site. Any proprietary vendor specific test equipment shall be provided by that vendor or manufacturer.
- B. Any portable or hand-held setup / calibration devices required to initialize the control system shall be made available by the control vendor (at no cost) to the Commissioning Authority.
- C. The instrumentation shall meet the following standards:
 - 1. Be of sufficient quality and accuracy to test and/or measure system performance within the tolerances required.
 - 2. Be calibrated at the manufacturer=s recommended intervals with calibration tags permanently affixed to the instrument.
 - 3. Be maintained in good repair and operating condition throughout the duration of use on this project.
 - 4. Be immediately re-calibrated or repaired if dropped and/or damaged in any way during use on this project.

PART 3 - EXECUTION

3.1 COMMISSIONING PLAN AND SCHEDULE

- A. The Commissioning Authority shall develop and submit a schedule for the commissioning process which shall be integrated with the construction schedule. Included shall be the required work by all team members (the Commissioning Authority, design team, contractors, and the Owner). Overlay with the construction schedule, and include time for test and balance, verification, and functional performance testing.

3.2 CONSTRUCTION OBSERVATION

- A. This is an additional and separate activity from that provided by the design team. Construction observation is required as part of the commissioning and coordination process to be provided by the Commissioning Authority.

3.3 TEST AND BALANCE

- A. Air balance shall be accomplished by an independent test and balance firm. The Commissioning Authority shall spot check this work to verify accuracy of results.

3.4 VERIFICATION AND FUNCTIONAL PERFORMANCE TEST PROCEDURES AND ACCEPTANCE PROCEDURES

- A. Personnel experienced in the technical aspects of each system to be commissioned shall implement and document the commissioning procedure to be used outlined in the Checklists. Verification checklist and functional performance checklist shall be provided for each system and shall be reviewed by the appropriate design engineers for technical depth, clarity of documentation and completeness. Special emphasis shall be placed on testing procedures that shall conclusively determine actual system performance and compliance with the design intent.
- B. The Commissioning Authority shall determine the acceptance procedures for each commissioned system within Division 23 discipline. The acceptance procedures shall incorporate the commissioning standards and successful testing results as referred to throughout Division 23 specifications.
- C. The appropriate contractor and vendor(s) shall be informed of what tests are to be performed and the expected results. Whereas some test results and interpretations may not become evident until the actual test are performed, all parties shall have a reasonable understanding of the requirements.
- D. Acceptance procedures shall confirm the performance of systems to the extent of the design intent. When a system is accepted, the Owner shall be assured that the system is complete, works as intended, is correctly documented, and operator training has been performed.

3.5 SOFTWARE DOCUMENTATION REVIEW

- A. Review detailed software documentation for all DDC control systems related to the commissioned equipment and systems. This includes a review of vendor documentation, their programming approach, and the specific software routines applied to this project. Discrepancies in programming approaches and/or sequences shall be reported and coordinated in order to

provide the Owner with the most appropriate, simple, and straightforward approach to software routines.

3.6 OPERATING AND MAINTENANCE (O&M) MANUALS

- A. The Commissioning Authority shall review the draft form of the O&M manuals related to the commissioned equipment and system and provided by the Division 23 Contractor. The review process shall verify that O&M instructions meet specifications and are included for all equipment furnished by the contractor and that the instructions and wiring diagrams are specific (edited where necessary) to the actual equipment provided for this project. Published literature shall be specifically tailored to the provided equipment, indicating required operation and maintenance procedures, parts lists, assembly/disassembly, diagrams emergency telephone numbers, and related information. The Contractor shall incorporate the standard technical literature into system-specific formats for this facility as designed and as actually installed. The resulting O&M Information shall be system-specific, concise, to the point, and tailored specifically to this facility. The Commissioning Authority shall review and edit these documents as necessary for final corrections by the contractor.
- B. The O&M manual review and coordination efforts shall be completed prior to Owner training sessions, as these documents are to be utilized in the training sessions.

3.7 TRAINING

Schedule and coordinate training sessions for the owner's staff for each system to be commissioned. Training shall be in a classroom setting with the appropriate schematics, handouts, and visual/audio training aids on-site with equipment.

- A. The Commissioning Authority organizes, schedules, and directs the training sessions.
- B. The appropriate installation contractors shall provide training on all the major systems per specifications, including aspects and peculiarities specific to this project.
- C. The equipment vendors shall provide training on the specifics of each major equipment item subject to commissioning including philosophy, troubleshooting, and repair techniques.
- D. The automatic control vendor shall provide training on the control system per their specification section.

3.8 RECORD DRAWINGS

- A. The Commissioning Authority shall review the as-built contract documents to verify incorporation of both design changes and as-built construction details. Discrepancies noted shall be corrected by the appropriate party.

3.9 EXCLUSIONS

- A. Responsibility for construction means and methods: The Commissioning Authority is not responsible for construction means, methods, job safety, or any construction management functions on the job site.
- B. Hands-on work by the Commissioning Authority: The contractors shall provide all services requiring tools or the use of tools to start-up, test, adjust, or otherwise bring equipment and

systems into a fully operational state. The Commissioning Authority shall coordinate and observe these procedures (and may make minor adjustments) but shall not perform construction or technician services other than verification of testing, adjusting, balancing, and control functions.

END OF SECTION 01 91 13

SECTION 03 61 00

GROUTING

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

- A. Furnish material, equipment, labor, services required to provide non-shrink grout. Work includes but is not limited to grouting under steel and mechanical equipment base plates, filling of fence and rail posts sleeves, grouting of piping, and wherever else shown on Drawings.

1.2 RELATED SECTIONS

- C. Structural Steel..... Section 051200

1.3 REFERENCES

References and industry standards listed in this Section are applicable to the Work. Unless more restrictive criteria or differing requirements are explicitly stated in the Specifications, or mandated by governing codes or regulations, the recommendations, suggestions, and requirements described in the referenced standards shall be deemed mandatory and applicable to the Work.

- A. American Society of Testing and Materials (ASTM) Standards, latest editions.
 - ASTM C109 Test Method for Compressive Strength of Hydraulic Cement Mortars.
 - ASTM C191 Standard Test Methods for Time of Setting of Hydraulic Cement by Vicat Needle
 - ASTM C1090 Standard Test Method for Measuring Changes in Height of Cylindrical Specimens of Hydraulic-Cement Grout
 - ASTM C1107 Specification for Packaged Dry, Hydraulic-Cement Grout (Non-shrink).
- B. Army Corp of Engineers
 - CRD C-621 Specification for Non-Shrink Grout.

1.4 SUBMITTALS

- A. Product Data
 - Submit manufacturer's information on the non-shrink grout, including mixing and installation instructions for each type of application.

B. Quality Control Submittals

1. Qualifications

Provide proof of Manufacturer and Installer qualifications specified under “Quality Assurance”.

1.5 QUALITY ASSURANCE

A. Qualifications

1. Manufacturer: Company specializing in the production of grout shall have a minimum of five years experience.
2. Installer: Company specializing in performing the work of this section shall have three years minimum experience.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Materials shall be delivered in manufacturer’s sealed and undamaged packaging. Each package shall contain clear and legible labels that meet requirements of local, state and federal regulations identifying manufacturer’s name, product name, quantity of material, and batch number.
- B. Protect material from the elements and from other damage at site.
- C. Replace and pay for material and work damaged to the satisfaction of the Authority.

1.7 ENVIRONMENTAL REQUIREMENTS

- A. Do not apply grout at temperatures below 40°F or higher than 90°F. Follow manufacturer’s recommendations for placement temperatures, which is typically at an optimum range of 50°F to 80°F. Provide hot and cold weather procedures at other temperatures as per ACI 305R and ACI 306R respectively.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Grout

1. Sika Corp., Lyndhurst, NJ 07071
2. Euclid Chemical Company, Cleveland, OH 44110
3. Five Star Products, Inc., Fairfield, CT 06824
4. HiltiInc., Tulsa, OK 74146

5. Mapei, Deerfield Beach, FL 33442

2.2 MATERIALS

A. Grout

1. Grout shall be non-shrink, non-metallic, cement-based material meeting ASTM 1107 and CRD C-621 with the following characteristics:
 - a. Minimum compressive strength of 6000 psi @ 28 days when testing in accordance with ASTM C109 or CRD C-621.
 - b. Slight positive expansion when tested in accordance with CRD C-621 or ASTM C1090.
2. Products:
 - a. SikaGrout 212 by Sika Corp.
 - b. Dry Pack Grout and NS Grout by Euclid Chemical Company
 - c. "Five Star Grout" by U.S. Grout Corp.
 - d. Multipurpose Grout by Hilti, Inc.
 - e. Precision Grout by Hilti, Inc.
 - f. Planigrout 712 by Mapei

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine all adjoining work on which this Work is in any way dependent for proper installation and workmanship. Report to the Authority any condition that prevents the performance of this Work.
- B. Repair surfaces to receive grout as approved by the Engineer of Record to ensure that the maximum allowed thickness of material is not exceeded.

3.2 SURFACE PREPARATION

- A. Concrete surface shall be free of all loose material.
- B. All metal components shall be clean and free of corrosion.
- C. Surfaces and metal components shall be free of oil, grease, loose paint, corrosive deposits, dust, laitance and other contaminants.

- D. Sleeves and holes shall be clean of water, dust and debris.

3.3 APPLICATION

- A. Perform all grouting in accordance with the recommendations of ACI, CSI, and the grout manufacturer's published specifications for site preparation, product mixing, and placing. For grouting in weather below 50°F, contact manufacturer for cold weather instructions.
- B. Arrange with the manufacturer of the grout for the services of a qualified field representative to instruct the work crews in the mixing of components, preparation of surfaces, technique of installation, and inspection procedures.
- C. Place grout at a no more than "flowable" consistency as required by the application, carefully using the manufacturer's recommended water content for Dry Pack, Plastic or Flowable consistencies.
- D. Locations
 - 1. Provide grout 1" thick minimum, 2" thick maximum, unless otherwise specified, under column base plates and beam bearing plates. Work grout under plates to provide full and even bearing. Grouting is to be done prior to the placement of any concrete on the structure.
 - 2. Provide grout for grouting fence posts into sleeves. Grout is to be placed at a "plastic" consistency and crowned at the post to shed water away from the post onto the adjoining concrete surface.
 - 3. Provide grout for grouting bars in concrete and for "Dry Packing". Follow manufacturer's procedure for mixing and installation.
 - 4. Provide grout under equipment bases.
 - 5. Provide for grouting in pipes entering precast units.
 - 6. Provide grout wherever else it is indicated on Drawings or Specifications.
- D. Follow manufacturer's instructions for curing.

3.4 PROTECTION AND CLEANING

- A. Clean all adjacent areas of excess material and clean all floors and walls of powder and droppings.

3.5 FIELD QUALITY CONTROL

- A. The Authority's Testing Laboratory will inspect the grouting procedure and take cube specimens to test compressive strength.

- B. The Authority will inspect and reject any that are of inadequate strength or contain cracks or other defects. These areas shall be fixed at the contractor's expense.
- C. Engage the services of the material manufacturer's representative to instruct in the proper mixing and usage of the material to ensure the grout is placed in the correct consistency and manner.

END OF SECTION 03 61 00

LIST OF SUBMITTALS

SUBMITTAL	DATE SUBMITTED	DATE APPROVED
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Product Data:

1. Grout

Qualifications

1. Manufacturer
2. Installer

* * *

SECTION 04 20 00

UNIT MASONRY

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

- A. This Section includes, but is not limited to, the following:

Provide brick masonry, concrete unit masonry, structural facing tile masonry, glazed concrete block masonry, acoustic block masonry, fireclay flue lining work, cavity wall insulation, and other masonry Work as specified herein, as shown on the Drawings, and as needed for a complete and proper installation. The terms Concrete Masonry Unit (CMU) and Concrete Block are inter-changeable.

- B. Related Work includes, but is not limited to, Division 7 Section "Fluid-Applied Membrane Air Barrier, Vapor Retarding", for air barrier system at masonry cavity walls.

1.2 DESIGN REQUIREMENTS

- A. No air-entraining admixtures or material containing such shall be permitted in the mortar. Also, no anti-freeze compounds, calcium chloride, or other compounds, unless expressly permitted otherwise, shall be permitted in the mortar.

- B. Mortar types to be used at the following locations, unless otherwise stated:

1. Face brick, concrete masonry units - Type N unless otherwise noted.
2. Load bearing masonry, - Type S
3. GCB, SFT - Type N "White"
4. Brick and other masonry below grade and exposed to earth - Type M

1.3 REFERENCES

References and industry standards listed in this Section are applicable to the Work. Unless more restrictive criteria or differing requirements are explicitly stated in the Specifications, or mandated by governing codes or regulations, the recommendations, suggestions, and requirements described in the referenced standards shall be deemed mandatory and applicable to the Work.

- A. American Society of Testing and Materials (ASTM) standards, latest editions.

A153 Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Products.

A240 Standard Specification for Heat-Resisting Chromium and Chromium Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels.

- A615 Standard Specification for Deformed and Plain Billet - Steel Bars for Concrete Reinforcement.
- A706 Standard Specifications for Low-Alloy Steel Deformed and Plain Bars for Concrete Reinforcement.
- A951 Standard Specification for Steel Wire for Joint Reinforcement.
- C27 Standard Classification of Fireclay and High-Alumina Refractory Brick.
- C32 Standard Specification for Sewer and Manhole Brick (Made from Clay or Shale).
- C33 Standard Specification for Concrete Aggregates.
- C55 Standard Specification for Concrete Building Brick.
- C62 Standard Specification for Building Brick (Solid Masonry Units Made from Clay or Shale).
- C67 Standard Methods of Sampling and Testing Brick and Structural Clay Tile.
- C90 Standard Specification for Hollow, Load-Bearing Concrete Masonry Units.
- C109 Standard Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2-inch or 50 MM Cube Specimens).
- C126 Standard Specification for Ceramic Glazed Structural Clay Facing Tile, Facing Brick, and Solid Masonry Units.
- C129 Standard Specification for Non-Load-Bearing Concrete Masonry Units.
- C140 Standard Methods of Sampling and Testing Concrete Masonry Units.
- C144 Standard Specifications for Aggregate for Masonry Mortar.
- C145 Standard Specification for Solid Load-Bearing Concrete Masonry Units.
- C150 Standard Specification for Portland Cement.
- C207 Standard Specification for Hydrated Lime for Masonry Purposes.
- C216 Standard Specification for Facing Brick (Solid Masonry Units made from Clay or Shale).
- C270 Standard Specification for Mortar for Unit Masonry.
- C315 Standard Specification for Clay Flue Linings.
- C331 Standard Specification for Lightweight Aggregates for Concrete Masonry Units.

- C404 Standard Specifications for Aggregates for Masonry Grout.
- C476 Standard Specification for Grout for Reinforced and Nonreinforced Masonry.
- C578 Standard Specification for Preformed, Cellular Polystyrene Thermal Insulation.
- C595 Standard Specifications for Blended Hydraulic Cements.
- C652 Standard Specification for Hollow Brick
- C780 Standard Test Method for Preconstruction and Construction Evaluation of Mortars for Plain and Reinforced Unit Masonry.
- C979 Standard Specification for Pigments for Integrally Colored Concrete.
- C1019 Method of Sampling and Testing Grout
- C1232 Standard Terminology of Masonry.
- C1405 Standard Specification for single-fired Glazed Brick

B. Industry Standards.

1. "Standard for Concrete Masonry Units" - UL 618- Underwriters Laboratory.
2. American Welding Society – AWS D1.4 – Structural Welding Code – Reinforcing Steel

1.4 SUBMITTALS

A. Submittals for Specified Items

1. For items that are specified herein by manufacturer's name and model number, submit a Product Schedule indicating the item description, manufacturer name, model number and any other identifying nomenclature. The Schedule will be accepted by the Authority for record purposes only. Product Data and Samples are not required for such specified items except for selection of color or similar purpose. When submitting items that are not specified herein by manufacturer's name and model number, provide complete Product Data and Samples for each item for review and approval.

B. Product Data

Submit Product Data to show compliance with specified requirements.

1. Submit complete data for masonry units. Laboratory test reports for brick shall be no more than two years old. Submit a list indicating the maximum dry weight of each type and size of CMU to be used in the project.

2. Submit complete data for reinforcement and ties, of each type.
3. Portland Cement: Brand and manufacturer's name.
4. Lime: Brand and manufacturer's name.
5. Mortar Pigments: Brand and manufacturer's name.
6. Packaged Products: Manufacturer's specifications and application instructions.
7. Sand: Location of pit, name of owner, and previous test data.
8. Masonry reinforcement, anchors

C. Samples

1. Submit 3 of each color of: Concrete Block. Submit Block of special sizes and shapes to match existing.
2. Submit as many face brick of each color to show the entire color range and in quantities sufficient to determine percentages. Submit samples of face brick of special sizes and shapes, including factory fabricated corners and lip brick.

E. Quality Control Submittals

1. Schedule of Uses: By mortar type.
2. Certificates
 - a. Submit the lightweight CMU producer's and GCB manufacturer's certificate stating that the minimum equivalent thickness and mix design are in conformance with UL 618 for the indicated fire rating.
 - b. Submit lightweight CMU producer's certificate stating aggregate used is 100% lightweight, expanded shale, clay, or slate (rotary kiln) aggregate, in accordance with ASTM C331. To provide the required recycled content, it is acceptable to provide up to 20% lightweight recycled aggregate that will maintain the same fire resistance equivalent thickness of 100% expanded shale, clay, or slate without a decrease in block strength.
 - c. Furnish notarized Building Department affidavit from masonry manufacturer (Form 10H) stating materials delivered to project comply with the Specification requirements.
 - d. Furnish notarized Building Department affidavit from masonry supplier (Form 10J) stating materials delivered to project comply with the Specification requirements.

- e. For GCB, submit evidence of conformance to the requirements of Section BC 803 of the 2014 NYC Building Code for toxicity.
- f. Provide certification that insulation used in Project was not produced with, nor contains, any of the U.S. EPA regulated CFC compounds that are listed in the Montreal Protocol.

F. Mockups

In accordance with Article titled Quality Assurance.

1.5 QUALITY ASSURANCE

A. Qualifications

- 1. Company specializing in the Work of this Section shall have a minimum of three years experience and at least two projects with similar quantity of materials.
- 2. Adhesive Anchor Installer: Installer for adhesive anchors installed in a horizontal or upwardly inclined position supporting sustained tension loads shall be certified per ACI Appendix D9.2.2 as per Section BC 1912 of the 2014 NYC Building Code.

B. Regulatory Requirements

- 1. Building Code: Work of this Section shall conform to all requirements of the NYC Building Code and all applicable regulations of governmental authorities having jurisdiction, including safety, health, noise, and anti-pollution regulations. Where more severe requirements than those contained in the Building Code are given in this Section, the requirements of this Section shall govern.
- 2. UL 618: Fire rating of CMU and assemblies shall conform to the requirements UL 618 and Section BC 602.
- 3. NYC Board of Standards and Appeals (BSA) approvals, NYC Materials and Equipment Acceptance (MEA) approvals or Office of Technical Certification and Research (OTCR)

C. Certifications

Masonry construction shall conform to the material acceptance, certification and inspection requirements of Section BC 1701.

D. Mockups

1. General

- a. Construct sample panels to conform with appearance and workmanship as indicated in the Drawings and Specifications.

- b. Use approved sample panels for a standard of comparison for the Project. All Work shall conform in workmanship and appearance to that of the approved samples.
- c. If not approved, remove panel and install new panel (or panels) repeating the process until panel is approved.
- d. Do not proceed with Work until panels are approved in writing by the Project Architect. Do not build Sample Panel "B" until Sample Panel "A" has been approved.
- e. Approved Panel "B" may remain in place as part of the Project.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials to project site in undamaged condition per ASTM guidelines. Store in an enclosed location or off the ground with waterproof covering as needed to protect all materials from moisture, contaminants, corrosion, deleterious temperature changes, and other harmful conditions.
- B. Packaged Products
 1. Deliver materials to the site in manufacturer's original, sealed containers. Do not deliver materials which have exceeded shelf life limitation set forth by the manufacturer. Material containers shall bear the manufacturer's label indicating manufacturer's name, trade name of product, lot number, shelf life of product, and mix ratio (if applicable). This includes individual bags of pre-bagged mortar mixes.
 2. Comply with manufacturer's printed instructions for storing and protecting materials.

1.7 ENVIRONMENTAL REQUIREMENTS

- A. Cold Weather Construction Requirements
 1. Per Section BC 2104.3, cold weather construction provisions of TMS 602/ACI 530.1/ASCE 6 Article 1.8C shall be implemented when either the ambient temperature falls below 40°F or the temperature of masonry units is below 40°F.
 2. Salt or other chemicals for lowering the freezing temperature of the mortar shall not be used.
- B. Hot Weather Construction Requirements

Per the requirements of Section BC 2104.4, hot weather construction provisions of TMS 602/ACI 530.1/ASCE 6 Article 1.8D shall be implemented when temperatures exceed 100°F, or 90°F with a wind velocity greater than 8 mph.

C. Wetting of Clay Masonry Units

Provide prewetting of masonry for units with initial rates of absorption that require their wetting before laying (21.42 grams per 30 square inches or 0.025 ounce psi).

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Aggregate for Concrete Masonry Units (CMU)

1. Northeast Solite Corporation, Mt. Marion, N.Y.
2. Norlite Corporation, Cohoes, N.Y.

B. Reinforcement and Ties

1. Hohmann & Barnard, Inc., Hauppauge, N.Y.
2. Wire-Bond, Charlotte, NC
3. Other manufacturers for specific products as specified herein.

C. Insulation

1. Dow Chemical Co., Midland, Michigan.
2. UC Industries Inc., Parsippany, NJ

D. Insulation Adhesive

Adhesives, mastics, compatible with air barrier systems and other contacted materials:

1. Henry Company
2. W. R. Grace & Co.

E. Mortar Coloring

1. "SGS" Mortar Colors, Solomon Grind-Chem Services, Inc.
2. "True Tone Mortar Colors", Davis Colors, Rockwood Industries, Inc.
3. "Flamingo Colors ", Lehigh Corporation.

I. Fire Clay Brick (Fire Brick)

1. A.P. Green Refractories Co., Kearny, N.Y.
2. J.H. France Refractories Co., Long Island City, N.Y.

3. General Refractories Co.
 4. Harbison-Walker Refractories Co.
 - J. Fire Clay Flue Lining
 1. Superior Clay Products, Nelsonville, Ohio
 2. General Refractories Co.
 3. Harbison-Walker Refractories Co.
 - K. Refractory Mortar
 1. A.P. Green Refractories Co., Kearny, N.J.
 2. J.H. France Refractories Co., L.I.C., N.Y.
 - L. Mortar Additives
 1. ACM Chemistries, Norcross, GA 30010
 2. Master Builders, Inc., Cleveland, OH 44122
 3. Sika Corp., Lyndhurst, NJ 07071
 - M. Mortar Dropping Collection Net
 1. Advanced Building Products Inc., Springvale, Maine.
 2. Mortar Net USA, Ltd., Gary, Indiana
 3. Hohmann and Barnard, Inc., Hauppauge, NY
 4. Wire-Bond, Charlotte, NC
 - N. Mortar Weeps
 1. Mortar Net USA, Ltd., Gary, Indiana
 2. Hohmann and Barnard, Inc., Hauppauge, NY
 3. Wire-Bond, Charlotte, NC
- 2.2 FACE BRICK MANUFACTURERS/DISTRIBUTORS
- 2.3 MATERIALS
- A. Base Materials

1. Portland Cement
 - a. Type I ASTM C150
 - b. Type II (for manholes) ASTM C150
2. Slag cement (only use for Manufacture of concrete block) ASTM C989, Grade 100 or 120.
3. Sand for Mortar Mix
Sand shall be washed natural sand with 100% passing the No. 8 sieve.
Mix shall not contain chlorides. ASTM C144
4. Aggregate for CMU - 100% light-weight aggregate, expanded clay shale or slate (rotary kiln process). To meet recycled content, lightweight recycled aggregate of up to 20% of total material that will maintain the same fire resistance equivalent thickness of 100% expanded shale, clay, or slate without a decrease in block strength may be used. ASTM C331
5. Aggregate for Masonry Grout ASTM C404
6. Hydrated Lime ASTM C207
Type "S"
7. Water: Shall be clean potable water free of injurious foreign matter conforming to the requirements of Section BC 1903.4.
8. Mortar Coloring: Provide pure mineral pigments, natural and synthetic iron oxides, and chromium oxides compounded for use in mortar mixes. Material shall conform to ASTM C979. Coloring shall not contain alkalyde salts or chlorides. No liquid colorants shall be permitted.
9. Mortar additive for use in setting of exterior brick coping caps, granite steps, and other such elements with horizontal surfaces exposed to weather. Use additive for such elements within 10 vertical feet of grade or walking areas.
 - a. Additive shall be non-toxic, non-flammable, and non-hazardous during storage, mixing, application, and when cured.
 - b. Finished mortar shall be resistant to urine, dilute acid, dilute alkali, sugar, brine, and calcium chlorides and other salts used in de-icing salts.
10. Premixed sand and lime for mortar mixes is not permitted. The use of batched material by Spec-Mix and factory-packaged cement-lime-pigment by major mortar

manufacturers is permitted. Each individual bag of material shall have the manufacturer's label identifying the mortar type.

B. Brick

1. Modular Face Brick: Clay or shale, ASTM C216 (solid), grade SW, type FBX, or ASTM C652 (hollow), grade SW, type HBX of size $3\frac{5}{8}$ " x $2\frac{1}{4}$ " x $7\frac{5}{8}$ " (nominal dimensions 4" x $2\frac{2}{3}$ " x 8"). Cores holes shall be a minimum of 1" from faces of brick. Colors and textures as selected by the Project Architect. Where indicated on the Drawings or in the Specifications, the manufacturer and brick are the Basis of Design. Special sizes and shapes as shown on the Drawings or specified herein. Brick shall be manufactured to special sizes and shapes for corners, brick arches/lintels, and other locations and are not to be cut in the field from the standard brick. Brick shall be tested for efflorescence in accordance with ASTM Test Methods C67 and the rating shall be "Not Effloresced".
 - a. Lipped brick, such as are used above relieving angles and lintels, shall be manufactured with the lip portion having dimensions not less than $\frac{5}{8}$ " high and $\frac{3}{4}$ " deep. Provide brick with larger lip dimensions when recommended by brick manufacturer. When recommended by the manufacturer, lipped brick may be cut to the required dimensions from solid brick in the factory, provided that cuts are carefully made to a 90 degree interior angle and do not extend past this angle.
2. Building Brick (Common Brick): Clay or shale, ASTM C62 (solid), grade SW, or ASTM C652 (hollow), grade SW, modular size unless indicated otherwise on Drawings. Special sizes and shapes as shown on the Drawings or specified herein.
3. Manhole Brick: ASTM C32, Grade MS, burned clay or shale, modular sizes, cored or solid.

H. Joint Reinforcement and Ties

1. Material
 - a. Reinforcement and Ties for Exterior Walls (includes back-up walls of cavity wall systems): Formed from stainless steel, 18-8, type 304.
 - 1) Sheet steel: (No. 2B Finish), cold-rolled, annealed, ASTM A240.
 - 2) Wire steel: ASTM A951.
 - b. Reinforcement and Ties for Interior Walls: ASTM A951, hot-dip galvanized (after fabrication), ASTM A153.
 - c. Provide factory-fabricated corners and tees at corners and intersecting walls for continuous type reinforcing, such as truss type, except as indicated otherwise.
 - d. Width of truss and mesh reinforcement to place edge of reinforcement 1" from each face of masonry.

2. Manufactured Units. Units are listed by Hohmann & Barnard model number in order to establish a standard for comparison. For some units model numbers are also listed for products by Wire-Bond, Charlotte, NC; and product descriptions shall be the same as for the Hohmann & Barnard products. Deliver all units with manufacturer's printed installation instructions.

- a. Exterior Walls - Brick with Concrete Backup -All items to be stainless steel except for seismic clips:

Provide Flexible Dovetail Brick Tie, dovetail end to be 16 gage minimum, 1" wide. Tie diameter 3/16" of length to provide 2" embedment in brick. Dovetail Anchor Slots, 18 gage minimum. Provide multi-grooved rigid PVC Seismicclips for seismic interlock system. Provide 3/16" diameter Type 304 stainless steel continuous joint reinforcement wire.

H&B: #315-BT Vee Byna Brick tie, #305 Series Anchor slot, #187-A seismicclips and continuous joint reinforcement wire.

Wire-Bond: #2102-O dovetail offset triangular tie, #1304 dovetail slot, #3690 plastic seismicclips and continuous joint reinforcement wire.

- b. Exterior Walls - Brick with Concrete Masonry Unit (CMU) Backup – All items to be stainless steel:

- 1) Dub'l Loop Lok Truss Seismicclip Interlock System consisting of the following components: All components must be from same manufacturer.

- a) Type 304 stainless steel Dub'l Loop Lok truss type horizontal joint reinforcement with welded loops. Truss 9 gauge. Deformations along each longitudinal rod for mortar bonding. Loops 3/16" diameter.

H&B: #180

Wire-Bond: #6000

- b) 3/16" diameter Type 304 stainless steel ties. Provide Box type or Bent-Box type as required for coursing. Provide sizes required for 2" embedment in brick.

H&B: Byna-Ties

Wire-Bond: #1500-O

- c) Impact resistant, multi-grooved rigid PVC Seismicclips.

H&B: #187-A

Wire-Bond: #3690

- d) Type 304 stainless steel continuous wire.

H&B: 3/16" diameter wire

Wire-Bond: #3500 wire

- e) At walls with cavity insulation, provide washers to mechanically lock rigid insulation in place.
H&B: Loop-Lok
Wire-Bond: #3692

- 2) Column Anchor, 1/4" thick by 1 1/4" wide, twisted, with a slotted opening for lock stud. Provide a straight positive lock stud, 3/8" diam., threaded, with nut and washers for anchoring masonry to steel column when masonry is parallel to column flange. Length as required for conditions.
H&B: #355L
Wire-Bond: #2755L

- 3) Column Anchor, 1/4" thick by 1 1/4" wide, twisted, with a slotted opening for lock bolt. Provide a bent positive lock stud, 3/8" diam., threaded, with nut and washers, for anchoring masonry to steel column when masonry is perpendicular to column flange. Length as required for conditions.
H&B: #353L
Wire-Bond: #2751H

- 4) Juncture of exterior back-up wall with interior block partition: 16 gage Wire Mesh, of proper width for wall thickness.
H&B: #MWT, 1/2" square by 16 gage
Wire-Bond: #1900

- 5) Concrete block to steel spandrel: Channel type to be welded to steel spandrel. Length as required for conditions.
H&B: #360 Gripstay Channel with # 365 Gripstay Anchor, 12 gage
Wire-Bond: #1302 channel slot and #1402 channel slot anchor

- c. Exterior Brick Walls/Parapet Walls (Multi-wythe) - All items to be stainless steel: LOX-ALL #120 truss, 9-gage, of proper width for wall thickness. Deformations along each longitudinal rod for mortar bonding. Wire-Bond Truss Type Series 300.

- d. Interior Concrete Masonry Unit Walls – All items to be hot-dip galvanized: LOX-ALL #120 Truss-Mesh, 9 gage, of proper width for wall thickness. Deformations along each longitudinal rod for mortar bonding. Wire-Bond Truss Type Series 300.

- e. Interior Concrete Masonry Unit Walls (Non-Loading Bearing) - All items to be hot-dip galvanized:
 - 1) At Partition Junctures: #MWT, 1/2" square by 16 gage, of proper width for wall thickness. Wire-Bond #1900 Mesh Wall Tie.

 - 2) For Wall Carried up Separately: #344 steel straps, 1/4" x 1 1/2" x 8" with 2 bent ends (90 degrees). Wire-Bond #3000Z Rigid Steel Tie.

I. Miscellaneous Accessories

1. Weeps: High Density polyester, polypropylene, or polyethylene woven mesh, 90% open, full height of adjacent brick x full width of joint. Recessed 1/4" from face of brick, and extending to back of brick. Color to be selected by Architect from manufacturer's standard colors.
 - a. "Weep Vent" by Mortar Net
 - b. "Mortar-Trap Weep Vent" by Hohmann & Barnard.
2. Mortar Collection/Deflection Device: High density polyethylene, polyester, or polypropylene open woven mesh of width to fill entire cavity after installation of the insulation. Provide double layer of material to ensure cavity is filled. Mesh shall be installed to create an up and down effect.
 - a. "Mortar Break DT" by Advanced Building Products Inc.
 - b. "Mortar Net" by Mortar Net, Inc.
 - c. "Mortar Trap" by Hohmann & Barnard, Inc.
 - d. "Cavity Net DT" # 3611 by Wire-Bond.

J. Reinforcing Steel

1. Deformed bars conforming to ASTM A615, Grade 60. Reinforcement to be welded shall conform to the requirements of ASTM A706, Grade 60.
2. Reinforcement in exterior construction, such as parapets, shall be galvanized in accordance with ASTM A767 or epoxy coated in accordance with ASTM A775. Touch up coating for galvanized material shall be in accordance with ASTM A780. Touch-up epoxy coating in accordance with coating manufacturer's instructions.

K. Insulation

1. Extruded polystyrene, rigid, ASTM C578 Type X with R-value (aged) of 5.0/inch at 75°F mean temperature when tested in accordance with ASTM C518.
 - a. Minimum compressive strength: 15 psi in vertical direction when tested in accordance with ASTM D1621.
 - b. Maximum water absorption: 0.3% by volume when tested in accordance with ASTM C272.
 - c. Surface Burning Characteristics in accordance with UL tests): Flame Spread - 15, Smoke Developed - 165.

2. Product shall not be produced with or contain any of the U.S. EPA regulated CFC compounds which are listed in the Montreal Protocol.
3. Provide Styrofoam Brand Cavity-mate by Dow Chemical.

Panel size: 16" x 96". Thickness: as shown on the Drawings. Provide each panel of full thickness indicated.
4. Adhesive: Type recommended by insulation manufacturer and air barrier manufacturer. Compatible with insulation and substrates.

L. Masonry Cleaner

Masonry cleaner capable of cleaning masonry without degrading the masonry material or mortar. Cleaner must be approved by the masonry manufacturer.

M. Precast Concrete Lintel

Cast lintel units, using same type cement (ASTM C150) and aggregate ASTM C331) as for CMU; compressive strength: 3,500 psi. Refer to Drawing Details for sizes, reinforcing, and other requirements.

N. Electrodes for Welding

Electrodes for welding stainless steel to carbon steel: E309-16.

2.4 MIXES

A. Mortar (basic)

Shall conform to ASTM C270 and BIA M1-88. Provide Type I Portland cement (Type II Portland Cement when used for manholes). Masonry cement shall not be used as a substitute. Preconstruction testing with the proportions carefully monitored is to be used to establish the upper end of the strength range, which may be near or slightly above the minimum strength of the next higher strength mortar (e.g. Type N many times is in the 2000 to 2500 range).

1. Type M: 1 part gray cement, 1/4 part lime, 3³/₄ parts dry sand. Minimum compressive strength shall be 2500 psi at 28 days.
2. Type S: 1 part gray cement, 1/2 part lime, 4¹/₂ parts dry sand. Minimum compressive strength shall be 1800 psi at 28 days.
3. Type N: 1 part gray cement, 1 part lime, 6 parts dry sand. Minimum compressive strength shall be 750 psi at 28 days.
4. Type N "White": 1 part white cement, 1 part lime, 6 parts dry white sand. Minimum compressive strength shall be 750 psi at 28 days.

B. Mortar Color

Proportion mortar coloring with other mortar mix ingredients to obtain desired color, as approved by the Project Architect. Provide white cement instead of gray cement where required to meet the desired color. Do not exceed 1 part pigment to 10 parts cement, by weight. If consistent color cannot be obtained, provide as a minimum premixed Portland cement and coloring from major cement manufacturer.

C. Refractory Mortar

Manufactured from fire clay as defined in ASTM C1232. Shall be "Sairset" by A. P. Green Refractories Co.

D. Grout for Masonry

1. Mixes

- a. Fine Grout: 1 part Portland Cement, 0-1/10 part Hydrated Lime, 2¹/₄-3 times the sum of volumes of cementitious materials of fine aggregate (Proportions by volumes).
- b. Coarse Grout: 1 part Portland Cement, 0-1/10 part Hydrated Lime, 2¹/₄-3 times the sum of volumes of cementitious materials of fine aggregate, and 1-2 times the sum of the volumes of cementitious materials of coarse aggregate (Portions by volume).
- c. Aggregates for Mixes: ASTM C 404.
- d. Slump: 8" minimum, 11" maximum.
- e. Compressive Strength: At least equal to the strength of the masonry, and not less than 2000 psi as determined by ASTM C1019 - Method of Sampling and Testing Grout.

2. Location

- a. For spaces less than 2" in any direction, use fine grout.
- b. For spaces 2" and more in any direction, use coarse grout.

2.5 SOURCE QUALITY CONTROL

A. The Authority will assign a Special Inspector who will inspect the masonry construction under the requirements of Section BC 1704.5.

B. Preconstruction Testing

1. Preconstruction testing of mortar properties will be done in accordance with ASTM C780. The Contractor shall assist the Authority's laboratory by any means necessary and shall provide the mock-up prior to beginning the installation work to allow for adjustments of the mix if necessary. Do not proceed with masonry work

until the preconstruction testing is completed. Contractor shall mix mortar as it intends for the actual construction.

2. Compressive strength tests of field mixed mortar and factory batched/prepackaged mortar are to be done during construction of the mock-up, or earlier if desired by the Contractor, to provide a benchmark for the strength based on actual field conditions and proportioning of the mortar. If mortar strengths are too high or too low, proportions and material source may be required to be modified if directed by the Architect or Engineer of Record.
3. Preconstruction testing of masonry grout properties will be done in accordance with ASTM C1019. The Contractor shall assist the Authority's laboratory by any means necessary and shall provide the mock-up prior to beginning the installation work to allow for adjustments of the mix if necessary. Do not proceed with masonry work until the preconstruction testing is completed. Contractor shall mix mortar as it intends for the actual construction.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine all adjoining Work on which this Work is in any way dependent for proper installation and workmanship. Report to the Authority any conditions that prevent the performance of this Work.

3.2 PROTECTION

- A. Cover top of masonry wall with waterproof plastic membrane at the end of the work period, when work is not in progress, and at other times when Work needs to be protected from rain and other precipitation. Extend cover down sides as needed to thoroughly protect the Work.
- B. During cold weather, do not use wet masonry units and frozen masonry units.
- C. Do not use frozen materials or lay masonry on frozen materials; remove frozen materials from wall. Refer to Part 1 of this Section, "Environmental Requirements" for temperature restrictions.
- D. Remove excess mortar from walls as soon after laying units as practicable to prevent staining and to facilitate cleaning of wall.
- E. Brace walls as needed until sufficiently set, or until intersecting walls provide lateral support.
- F. Prevent masonry cleaners from coming in contact with adjacent glass, metal, and other masonry surfaces such as cast stone. Protect adjoining glass and metal surfaces and all other adjacent materials and property from masonry operations.

3.3 MIXING PROCEDURES FOR MORTAR

- A. Measure material by volume or equivalent weight. In measuring by volume, measure ingredients by container. Do not measure by shovel.

- B. Mix ingredients in a clean mechanical mixer for a minimum of 3 minutes, maximum of 5, with the minimum amount of water to produce a workable consistency. Water retentivity must be appropriate for the IRA of the brick. Bricks of 3 grams per minute per 30 sq in require a lower water retentivity property to maintain production by allowing the mortar to give up the water easier to the brick.
- C. Mortar that has stiffened because of evaporation of water from the mortar may be retempered only once, and only during the first hour of placement to restore the required consistency. Do not over water to make mortar "soupy" as water retentivity must be appropriate for the IRA of the brick. Mortar shall be used within 2¹/₂ hours after initial mixing. Limit amount of mortar batched at one time to stay within these requirements.

3.4 LAYING - GENERAL

- A. Lay units true to dimensions, plumb and level, square; exterior and interior bond work in bond indicated on the Drawings or specified herein. Lay courses level and in plane with joints uniform; vertical joints spaced properly for plumb alignment. Provide masonry lines, plumb bobs, and utilize a 4 foot level to maintain wall within 1/4" of theoretical dimensions. Adjoining faces of brickwork sections, such as at expansion joints, relieving angles, etc, shall be flush with each other, unless specifically indicated otherwise on drawings.
- B. Fill bed joints and cross joints solid with mortar. Furrowed bed and spotted cross joints not permitted. For hollow block units, apply mortar full length on all bearing surfaces.
- C. "Tooth" temporary openings in exposed masonry walls, to maintain proper bond when closed.
- D. Tool joints in exposed masonry with a concave jointer to provide a neat, smooth, compacted surface.
- E. Rough cut joints in masonry that are to receive plaster, to provide good plaster bond.
- F. Remove excess mortar, leaving masonry surface clean.
- G. Cut brick and concrete masonry units with circular masonry wet saw.
- H. Build-in miscellaneous metal inserts and other items not furnished under this Section but specified to be installed under this Section.
- I. Lay brick in bond patterns as shown on the Drawings. If bond is not indicated on Drawings, use running bond, all stretchers.

3.5 FACE BRICK WORK

- A. Lay face brick from scaffolding erected on face brick side of wall. Do not build or attach scaffolding into the brick face.
- B. Use face brick for exterior walls, chimneys, bulkheads, and backs of parapets, except where concrete parapets are indicated.

- C. At exterior relieving angles/lintels or other brick projections on exterior face of building, brick shall be placed such that the cores are not visible. Ensure lintels and relieving angles are placed such that cores will not be visible when brick is placed at its correct location.
- D. Wet clay and shale brick which have initial rates of absorption of more than 30 grams for each 30 square inches per minute (ASTM C67). Wet brick sufficiently to prevent excess absorption of mortar moisture, but keep surface dry enough to obtain bond.
- E. Lay with shoved joints, avoiding dry contacts between brick.
- F. Lay not more than 5 courses before setting backup units.
- G. Clean loose mortar from wall as brick is laid.
- H. Leave openings for mechanical trades work, then close up solid after mechanical installations are completed.
- I. Provide weep holes in the head joints of the first two courses of masonry above wall flashing (space at 24" o.c. linear in each course, staggering the first course with the second course). Provide weep holes at other locations as denoted on the Drawings.
- J. Construct 1/2" wide vertical expansion joints at locations indicated on the drawings. If not indicated, provide at approximately 25'-0" o.c. and within 5'-4" from the corners.

3.6 CAVITY WALL

- A. Keep the cavity free of mortar droppings. Do not permit mortar to collect on ties and bridge across the cavity.
- B. Provide continuous row of mortar mesh at base of wall, over relieving angles and lintels, at all locations with flashing and weep holes, and as indicated, directly on flashing. Flashing shall extend above top of mortar mesh except where indicated otherwise. Trim mortar mesh to size indicated on the Drawings.
- C. In laying up the wall, keep the cavity clean of mortar droppings by temporarily placing a wood strip 2" high and full width of cavity on each succeeding course of anchors as they are installed, removing the strip, cleaning it off, and reinserting it on the next course of anchors before laying up the next portion of wall. Do not leave any wood strips in the cavity.
- D. Prepare CMU backup for application of fluid applied membrane air/vapor barrier specified in Division 7. Mortar joints shall be completely filled and struck flush with unit masonry. Leave surfaces clean, and without projections, voids, cracks, contaminants, or other irregularities that would hinder proper application of the membrane. Clean mortar droppings from surfaces and brick ties.
- E. Provide reinforcement between brick and backing.
- F. Upon inspection and when directed by the Authority after the wall has been topped out at each level below the flashing or lintel line, flood the cavity with water prior to installation of the brick above to verify that all weeps drain freely and no water passes the backing.

3.7 INSULATION

- A. Prior to installation of cavity insulation verify that:
 - 1. Substrate is properly prepared.
 - 2. Wall is clean.
 - 3. Air barrier membrane provided under Section 072500 has sufficiently cured, as recommended by the membrane manufacturer.
- B. Application
 - 1. Install insulation horizontally within cavity space, against concrete block wall and other substrates, butt edges tightly, with vertical joints staggered. Cover wall completely, forming a continuous enclosure of the building envelope without gaps.
 - 2. Adhere insulation as recommended in writing by the air barrier manufacturer for the specific air barrier system provided for this Project:
 - a. Upon completion of the air barrier membrane system, and after a curing period recommended by the membrane manufacturer, apply insulation adhesive in a serpentine pattern over the air barrier membrane using a notched trowel. Immediately after application of the adhesive, or within the time period recommended by the manufacturer, embed insulation board into the adhesive and press firmly into place to ensure full contact and adhesion over entire area of board. Apply additional adhesive if allowed to skin over.
 - 3. In addition to adhesive attachment of insulation to all substrates, provide an insulation retainer washer at each brick tie.
 - 4. Fabricate insulation panels by means of saw, knife or other sharp tool to fit around obstructions across cavity such as vents, louvers, piping, conduits, and other penetrations. Make insulation continuous, filling all voids. Use largest pieces of insulation possible to minimize joints. Fill cracks with material compatible with insulation, air barrier, and masonry.

3.8 BUILDING BRICK (COMMON BRICK) WORK

- A. Use building brick or face brick for infilling walls of solid brick construction such as at piers, filling around structural members, solid brick parapets, and for all masonry where brick work is indicated, and for which face brick, SFT, concrete block, or other material is not shown or specified. All joints within the solid masonry construction shall be filled solid.
- B. Lay up with Type N mortar, except when within 8" of cut stone work, use Type N "White" mortar.
- C. When exterior door frames are not in place at the time adjacent walls are being erected, set hot-dip galvanized steel anchors in masonry every sixth course to provide adequate anchorage for door frames to masonry when door frames are installed.

- D. When brick is used for back-up wall for limestone, laying of brick shall not commence until parging for limestone is dry.
- E. Provide weep holes or open side joint as required.

3.9 CONCRETE MASONRY UNITS (CMU)

A. General

1. Lay blocks with cells vertical. Provide running bond unless shown otherwise on the Drawings or as indicated below, bonded at corner angles. Fill cores containing vertical reinforcement with masonry grout for full height, as the wall is erected.
2. Where interior partitions intersect other partitions or walls, bond together with metal wall ties spaced 2'-0" o.c. min., vertically. Refer to Article on "Reinforcement".
3. Where interior walls are to be furred with soap units, secure furring with steel ties, spaced one for each 4-square feet.
4. Provide grout in cores of blocks at jambs, parapets, under lintels, and where indicated on the Drawings.
5. Bond beam units shall be filled with lightweight concrete having a minimum compressive strength of 3000 psi and reinforced as shown on details.

B. Horizontal and Vertical Face Joints

1. Make joints uniform and 3/8" thick, unless otherwise indicated.
2. Shove vertical joints tight.
3. Tool joints with a concave smooth, non-staining tool, when thumb print hard, at surfaces to be painted or exposed.
4. Point joints tight with a trowel, in unparged masonry below grade.
5. Strike mortar joints flush in surfaces to be plastered, stuccoed, covered with other masonry, or which are otherwise concealed from view. Prepare masonry for application of fluid applied membrane air/vapor barrier as indicated herein in Article titled "Cavity Wall".

C. Exposed and Painted Surfaces

1. Smooth, even texture, free of chips, cracks, or other imperfections and free from any material that will stain paint.
2. External corners in all rooms and spaces, except for utility and service areas, shall be formed with bull-nose blocks. Bull-nose blocks shall be factory fabricated.

D. Control Joints

1. Construct 1/2" wide vertical control joints in partitions. Provide control joints at a distance not more than 1.5 times the height of the wall or 25'-0" on center, whichever is less, and where indicated on the Drawings.
2. Joints to extend full height of partition (floor to underside of slab or beam).
3. Continue control joints through wainscoting.
4. Filler
 - a. Polyethylene Foam Bar, or
 - b. Polyurethane Type Filler
 - c. Width as required for partition thickness, minus 1".
 - d. Install filler as partition is erected.
 - e. Filler to extend full height of joint.

3.10 GENERAL - CUTTING, FITTING AND LAYING (SFT, CMU, GCB, ACOUSTIC BLOCKS)

- A. Cut units with motor-driven carborundum wet-saw; provide smooth, straight edges.
- B. Provide necessary cuts to fit tightly in and around mechanical installations.
- C. Where split block units are used to conceal piping or other installations, provide reinforcement for bonding the split units together.
- D. Drill holes neatly for attachment of handrail brackets and for other items to be attached.
- E. Reinforce first two courses above all door openings with a layer of truss type reinforcement extending 12" beyond jambs, in addition to the rebars required for seismic reinforcement.
- F. Remove mortar protrusions that extend into cells or cavities which are to be reinforced and filled.
- G. Set block up with special care for plane, jointing, pattern, and cutting.
- H. Keep faces of units clean; clean off mortar droppings on block face immediately.
- I. Defective units will be rejected. Replace defective units with perfect units at no extra cost to the Authority.
- J. At exposed surfaces tool joints with a smooth, non-staining tool to produce a smooth and slightly concave surface.
- K. See Drawings for thickness of block.

- L. Maintain the rating of fire-rated partitions. Provide openings of minimal size to limit the amount of required firestopping. Firestopping systems shall be provided under Section 078400.
- M. Extend interior partitions and furring up to underside of slabs, arches, and beams. Leave sufficient space between partition and slab/arch/beam to install firestopping materials as specified in Section 078400. If firestopping is not required, provide resilient material such as mineral wool packing with backer rod and sealant (See Section 078400) at each side of partition.
- N. Where units meet metal door frames, leave vertical joint open to receive caulking.
- O. Control joints shall extend full height of partition (floor to underside of slab or beam). Joints shall not intersect any structural members in the wall. Wall joint reinforcement shall not continue through the control joints.

3.11 REINFORCEMENT

A. General

- 1. Brick ties: Shall be embedded a minimum of the midpoint of the brick to 2" into brick, exclusive of the seismic clip and wire. Wire shall be 3/4" to 1" back from the face of the joint.
- 2. Block ties: Shall be embedded a minimum of 2/3 the block width

B. Exterior Walls - Brick with concrete back-up:

Provide ties at 16" o.c. vertical spacing, 24" o.c. horizontal spacing.

C. Exterior Walls - Brick with concrete masonry unit (CMU) back up:

- 1. Provide truss/ladder type horizontal joint reinforcement/box tie system between block and veneer brick, continuous at alternate block courses (16" o.c.), with loops spaced at 16" o.c. horizontally, maximum. Provide seismic interlock system, including seismic clips, and continuous wire. Provide retainer washer at each set of loops to lock insulation in place.
- 2. Provide column anchor to anchor block masonry to steel columns when columns are not encased in concrete. Provide anchors in pairs, spaced 16" o.c. maximum vertically.
- 3. Provide ties with interior partitions at 16" o.c.
- 4. Provide spandrel anchor to anchor block masonry to steel spandrels. Provide anchors spaced 16" o.c. maximum vertically.
- 5. Install reinforcing bars in cells and bond beams at locations and spacing indicated on Drawings.

- D. Interior Concrete Masonry Units and Glazed Concrete Block Walls:
1. Provide mesh continuous at every third block course.
 2. Provide ties at 24" o.c. vertical spacing. Embed in masonry 4" minimum each wall.
 3. Provide straps at 48" o.c. vertical spacing.
- E. Structural Facing Tile (SFT - 2-wythe):
- Provide ties at 16" o.c. vertical spacing, 36" o.c. horizontal spacing.
- F. Structural Facing Tile (SFT - with C.M.U. back-up):
- Provide ties at 16" o.c. vertical spacing, 36" o.c. horizontal spacing.
- G. Exterior Brick Walls (multi-wythe with no cavity):
1. At multi-wythe walls without cavity, provide truss/ladder type joint reinforcement at 16" o.c. vertical spacing.
 2. Install reinforcing bars at locations and spacing indicated on Drawings.
- H. Exterior Walls – Veneer Brick with multi-wythe solid brick back-up:
1. Provide truss type horizontal joint reinforcement/box tie system between multi wythe brick back-up and veneer brick, continuous at 16" o.c., with loops spaced at 16" o.c. horizontally, maximum. Provide seismic interlock system, including seismic clips, and continuous wire. Provide retainer washer at each set of loops to lock insulation in place.
 2. Install reinforcing bars at locations and spacing indicated on Drawings.
- I. Exterior Brick with steel back-up:
- Provide ties at 16" o.c. vertical spacing, 24" o.c. horizontal spacing. Provide seismic interlock system, including seismic clips, and continuous wire.
- K. Expansion joints and control joints
- Install "slip-set" stabilizer at 24" o.c. vertically in all masonry control and expansion joints of masonry partitions, CMU walls, and multi-wythe brick walls/parapets.
- L. Lap ends of adjoining strips of continuous reinforcement 6".
- M. Size (width) of reinforcement as required for 4", 6", 8", 10" partitions.
- N. In partitions where control joints are indicated, keep reinforcement 1" short of each end of blocks at control joint.

- O. Install continuous reinforcement over all door openings in first and second mortar joints above doorframe or lintels.
- P. Provide galvanized steel bent straps secured to slab, to brace tops of interior masonry partitions. Installation shall permit vertical deflection of slab. Refer to Drawing details.
- Q. For bonding of SFT or other facing materials to block construction: set ties and anchors at proper height to coincide with horizontal joints of facing materials.
- R. Structural Reinforcement Installation
 - 1. Where reinforcement is anchored to slab, drill hole 1/8" larger than bar diameter and set in epoxy similar to Sikadur 31 by Sika Corp. Holes are to be brushed and air-blown clean prior to pouring of epoxy. Hole depths to be 3" minimum unless indicated otherwise in Contract Documents. Adhesive anchor systems with ICC certification in cracked concrete are acceptable and are to be installed in accordance with the ICC certification. Submit product data to Engineer of Record for approval
 - 2. Provide a minimum 20" lap at splices, tying bars together or using mechanical fasteners.
 - 3. Cells of hollow masonry units containing reinforcing bars are to be filled completely with masonry grout.
 - 4. Install reinforcing bars in bond beam units at depths indicated on drawings. Bars are to be continuous lengths in bond beams over masonry openings.
 - 5. Where indicated, weld reinforcement to steel in accordance with AWS D1.4 and the manufacturer's written instructions. Keep electrode dry. Oven dry electrode after exposing it for more than 6 hours. Touch-up damaged coatings and weld area upon completion.
 - 6. For reinforcement in solid wythe brick, ensure bars are completely surrounded with grout. Cut brick in inner wythe as required.

3.12 BUILT-IN WORK

- A. Where sleeves are required in brick walls or in partitions, furnish standard wrought iron pipes of necessary sizes and lengths and build in where shown.
- D. Maintain bucks, frames, and other built-in work in their proper position. Do not remove any braces or stays from these items until they are securely supported by and fastened to masonry.
- E. Set all loose lintels (exterior and interior), bolts, plates, and other items furnished under Section 051200 and specified to be installed in this Section.
- F. Build into partitions and walls: Frames for grilles, convectors, access doors, and boxes for electrical equipment.

- G. Do not build wood blocks into walls for securing of grounds. Grounds shall be secured to the masonry by carpenter, nailing directly into masonry units or joints.
- I. Provide necessary special jamb blocks, regular and irregular angle blocks where required to obtain smooth, evenly jointed and regular block patterns.

3.13 FIELD QUALITY CONTROL

- A. The Authority will assign under the requirements of Section BC 1704.5 a Special Inspector who will inspect the masonry construction. Where post-installed anchors are utilized, the Special Inspector will perform Special Inspection on post-installed anchors as per Section BC 1704.32. Adhesive anchors installed in concrete in a horizontal or upwardly inclined position supporting sustained tension loads shall be installed under continuous Special Inspection as required by paragraph D9.2.4 of ACI 318-11.
- B. The Special Inspector will make inspections and any testing deemed necessary. Testing of mortar properties shall be in accordance with ASTM C780. Mortar suspected or tested to be too strong or too weak will be subject to petrographic analysis or other methods deemed necessary by the Engineer of Record and Special Inspector. Testing of masonry grout shall be in accordance with ASTM C1019. The Contractor shall pay for all tests if they verify improper work. Inspections will include, but not be limited to, the following:
 - 1. Proper installation of reinforcement and placement of brick on angles.
 - 2. Proper installation of mortar, including proportioning and mixing. Those mortar properties listed in the Appendix of ASTM C780 are to be tested at the discretion of the Special Inspector or the Architect/Engineer of Record. Mortar strengths, when tested, will be determined in accordance with ASTM C780 using cylinders.
 - 3. Proper installation of weeps, flashing, drip edges, mortar mesh, cleaning of cavity (if cavity wall construction), etc.
 - 4. For cavity wall construction, all bed and head joints are filled completely. At solid masonry construction, all bed, head, and collar joints are filled completely.
- D. If any results are found to be not in conformance with the applicable ASTM, industry practice, and the Specifications, the masonry in question shall be removed and redone. Pay for testing if results of testing verify improper workmanship or proportions not in conformance with the specifications and ASTM standards.

3.14 CLEANING

- A. Before cleaning masonry walls, examine faces for holes, cracks, and other defects. If corrections cannot be made to provide an appearance acceptable to the Project Architect, replace defective units.

B. Exterior Masonry

1. After completion of laying and the completion of other adjacent work liable to soil masonry, clean face work and point all open joints.
2. Start cleaning operations at top and proceed downward, using solution not detrimental to material or mortar.
3. Use only masonry cleaners approved by the manufacturer of the specific face brick and follow the brick manufacturer's instruction for use of the product. Perform a mock-up of the cleaning procedure in the presence of the cleaner manufacturer's representative and Authority's field representative. The use of muriatic acid is not approved.

C. Concrete Masonry Units

1. Clean wall surfaces to be painted; rub with carborundum stone: remove mortar from surfaces; remove rough edges from joints.
2. Point up holes and joints. Brush with stiff bristle brush. Leave surface in condition to receive paint.
3. Clean other wall surfaces with stiff-bristle brush.
4. Do not use wire brush.

END OF SECTION 04 20 00

LIST OF SUBMITTALS

SUBMITTAL	DATE SUBMITTED	DATE APPROVED
Product Data:	_____	_____
1. Masonry unit data		
2. List of max. dry wt. Each Type CMU		
3. Reinforcement, anchors & ties		
4. Portland Cement Mfr & Brand		
5. Lime Mfr & brand		
6. Mortar Pigments Mfr & Brand		
7. Packaged Products: Mfr's specs & application instructions		
8. Sand: Location of pit, Owner's name, & previous test data		
Samples:	_____	_____
1. Face Brick		
2. CMU		

SECTION 05 12 00

STRUCTURAL STEEL

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

- A. Furnish and erect all steel as shown on Drawings.
- B. Provide shop painting and/or galvanizing as specified.

1.2 REFERENCES

References and industry standards listed in this Section are applicable to the Work. Unless more restrictive criteria or differing requirements are explicitly stated in the Specifications, or mandated by governing codes or regulations, the recommendations, suggestions, and requirements described in the referenced standards shall be deemed mandatory and applicable to the Work.

- A. American Society of Testing and Materials (ASTM) standards, latest editions.
 - A6 Standard Specification for General Requirements for Rolled Steel Bars, Plates, Shapes, and Sheet Piling.
 - A29 Standard Specification for Steel Bars, Carbon and Alloy, Hot-Wrought, General Requirements for
 - A36 Standard Specification for Carbon Structural Steel.
 - A108 Standard Specification for Steel Bars, Carbon, Cold-Finished, Standard Quality.
 - A123 Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
 - A153 Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
 - A194 Standard Specification for Carbon and Alloy Steel Nuts for Bolts for High-Pressure and High-Temperature Service, or Both.
 - A307 Standard Specification for Carbon Steel Bolts and Studs, 60000 psi Tensile Strength.
 - A325 Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength.
 - A490 Standard Specification for Structural Bolts, Alloy Steel, Heat Treated, 150 ksi Minimum Tensile Strength.
 - A563 Standard Specification for Carbon and Alloy Steel Nuts.

- A780 Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coating.
- A992 Standard Specification for Steel for Structural Shapes for Use in Building Framing
- F436 Standard Specification for Hardened Steel Washers
- F1554 Standard Specification for Anchor Bolts, Steel, 36, 55, and 105-ksi Yield Strength
- B. "Standard Welding Symbols - A2.0" - American Welding Society (AWS).
- C. "Specification for Mild Steel Covered Arc-Welding Electrodes - A5.1" - AWS.
- D. "Structural Welding Code - D1.1" - AWS.

1.3 DEFINITIONS

A. Structural Steel

Structural Steel consists of the steel elements of the structural steel frame essential to support the design loads. These elements consist of material as shown on the structural steel plan and listed in Article 2.1 of the AISC "Code of Standard Practice for Steel Buildings and Bridges."

B. Other Steel

Structural steel does not apply to those elements listed in Article 2.2 of the AISC "Code of Standard Practice for Steel Buildings and Bridges."

1.4 SUBMITTALS

A. Product Data

Submit manufacturers' specifications for the following products:

1. Primer paints, galvanizing repair paint
2. Stud shear connectors
3. Expansion/adhesive anchors
4. Zinc Metallizing

B. Shop Drawings

1. Failure to submit legible shop drawings will be cause for return without review.
2. All connections shall be designed by and all drawings shall be prepared under supervision of a Professional Engineer licensed in the State of New York. Do not submit unchecked shop drawings. First submissions of all job standards, shop drawings of connections not shown on, or that are in deviation of, the job standards, and calculations shall have one set sealed and signed by the Engineer. After final approval of all shop drawings, submit a final set sealed and signed by the Professional Engineer.
3. Shear connections (framed beam, seated beam, single plate, etc.) shall be designed by the detailer's licensed engineer and detailed by the structural steel detailer, unless otherwise shown on Drawings. All wind and seismic connections (moment connections, bracing, etc.) are generally detailed on the Drawings. Based on the indicated loads (axial force, moment, etc.), the structural steel detailer's engineer shall design the connections. Those not detailed shall be detailed by the structural steel detailer.
4. Immediately after award of Contract and before preparing steel shop drawings, submit for review a set of job standards showing all necessary joint details with full particulars of connection pieces, shop and field welds, and holes for erection bolts and permanent bolts. These shall include any moment and shear connection designed by the Engineer of Record as well as those designed by the detailer. Appropriate marks for designating all types and sizes of joint details shall be included. Submit all calculations pertaining to the job standards. After approval of these job standards, the erection plans are to be submitted and shall be marked to indicate unmistakably the type and size of joint to be used for every beam connection. Do not order steel in advance of approval of the job standards and the erection plans with joint marks, except at own risk.
5. Prepare remainder of steel shop drawings after approval of job standards and erection plans. Drawings submitted prior to approval of job standards will be returned without review. Submit drawings gradually and not all at the same time so that sufficient time is allowed for checking and approval. No more than 100 drawings are to be submitted within a 14-day period to allow for checking and approval of package before submittal of next package. Shop Drawings for MEP equipment dunnage and access platforms shall not be submitted until after approval of the submitted MEP units. Ensure shop drawings submitted for MEP equipment dunnage and access platforms are coordinated and based on unit approved, which may vary substantially from the Basis of Design. The Contractor shall take into account in their schedule the potential time impact in the sequencing of the steel drawings.
6. Steel shop drawings shall include framing plans, bolted and welded work, and details such as camber and other pertinent data not shown on job standards. Detail openings and reinforcement due to other Work. Coordinate with Drawings of other Work.

7. Indicate welds by standard AWS symbols and show size, length, and type of each weld in accordance with AWS A2.0.
8. Identify columns using same identification system shown on Drawings.
9. Provide setting drawings, templates, and directions for installation of anchor bolts and other anchorages to be installed under other Sections.
10. Shop drawings will be checked for size of material and strength of connection by the Engineer of Record, which shall not render the Engineer of Record responsible for any errors in construction dimensions, etc. that have been made in preparation of shop drawings. The Contractor shall assume full responsibility for the correctness of dimensions and fit.
11. Submit calculations for design of connections on job standard and all other connections such as moment, brace, and trusses.
12. After shop drawings are 100% complete and approved and all field changes have been made, a CD rom of the as-built drawings are to be submitted to Ownership in an AutoCad format.

C. Quality Control Submittals

1. Certificates and Affidavits
 - a. Furnish bolt manufacturer's test reports, covering physical and chemical tests, for each lot of high strength bolts submitted.
 - b. Furnish steel manufacturer's certificate certifying welders employed on the Work are current with their AWS qualifications (including having their required maintenance forms from their employer) and for work performed in the field are NYC licensed welders as per Section §28-407.1 of the NYC Administrative Code.
 - c. Furnish complete listing of ASTM's of materials listed in Part 2 of this Section and certification that materials supplied meet those listed.
 - d. For mechanical and adhesive anchors installed in concrete, submit ICC certification for use in cracked concrete.
2. Contractor Qualifications
 - a. Provide proof of Fabricator, Erector, Detailer/Engineer, and Adhesive Anchor Installer specified under "Quality Assurance".

D. Sustainability Submittals

1. Recycled Content

- a. Submit documentation of recycled content of structural steel; product data or manufacturer's statement as applicable.

2. Regional Content

- a. Submit documentation of regional materials for structural steel; product data or manufacturer's statement as applicable

1.5 QUALITY ASSURANCE

A. Qualifications

1. Fabricator: Company specializing in the fabrication of steel products to be used in this Contract shall have a minimum of five years experience. The fabricator is to be AISC certified.
2. Erector: Company specializing in performing the Work of this Section shall have a minimum of three years experience and have done at least three projects with similar quantity of material.
3. Detailer: Company shall be specialized in the detailing and design of structural steel shop drawings with a minimum of three years experience. Connections shall be designed by and shop drawings prepared under direct supervision of a Professional Structural Engineer experienced in design of this Work and licensed by the State of NY engaged.
4. Adhesive Anchor Installer: Installer for adhesive anchors installed in a horizontal or upwardly inclined position supporting sustained tension loads shall be certified per ACI Appendix D9.2.2 as per Section BC 1912 of the 2014 NYC Building Code.

B. Regulatory Requirements

1. Building Code: Work of this Section shall conform to all requirements of the 2014 NYC Building Code and all applicable regulations of governmental authorities having jurisdiction, including safety, health, noise, and anti-pollution regulations. Where more severe requirements than those contained in the Building Code are given in this Section, the requirements of this Section shall govern.
2. Industry Standards: Standards specified herein apply to Work of this Section. Where more severe requirements than those contained in the Standards are given in this Section or the Building Code, requirements of this Section or the Building Code shall govern.

- a. AISC 360 as modified by the 2014 NYC Building Code.
 - b. "Specifications for Structural Joints using ASTM A325 or A490 Bolts" approved by the Research Council on Riveted and Bolted Structural Joints of the Engineering Foundation (RCRBSJ) – AISC-2000.
 - c. "Structural Welding Code" - AWS.
3. Recommendations or suggestions in the codes and references listed in this Article and under "References" shall be deemed to be mandatory unless they are in violation of the Building Code.

C. Certifications

1. Structural steel shall conform to the material acceptance, certification, and inspection requirements of Section BC 1701.
2. Qualify welding processes and welding operators in accordance with AWS "Standard Qualification Procedure".

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials to the site at such intervals as to ensure uninterrupted progress of Work.
- B. Deliver anchor bolts and other anchorage devices, which are to be embedded in cast-in-place concrete or masonry, in ample time so as not to delay Work.
- C. Store materials to permit easy access for inspection and identification.
 1. Shop-primed steel. (Painted or galvanized): Primed steel stored in the field or shop shall be kept off ground (using pallets, platforms, or other supports) and so positioned as to minimize water-holding pockets, dust, and other contamination of the primer. Repair damage to primed surfaces due to improper storage in a manner approved by Ownership.
 2. Unpainted Steel: Steel stored in field or shop shall be kept off ground (using pallets, platforms or other supports), kept clean and in general protected against damage and corrosion.
- D. Do not store materials on erected structure in a manner that might cause distortion or damage to the members or supporting structures. Repair or replace damaged materials or structures as directed by Ownership.

1.7 FIELD MEASUREMENTS

- A. Take field measurements as required by Drawings. Where possible take field measurements of existing conditions prior to fabrication. Verify that field measurements

are the same as those shown on Drawings and shop drawings. Report all deviations to Ownership in writing.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Paint
 - 1. Tnemec Co.
 - 2. Sherwin Williams

- B. Expansion/Screw/Adhesive Anchors, Fasteners
 - 1. Hilti, Inc.
 - 2. Powers Fasteners

2.2 MATERIAL

- A. Structural Steel Shapes, Plates, and Bars
 - 1. Structural steel W shapes shall have a minimum yield strength of 50 ksi conforming to the provisions of ASTM A992. For other shapes not available in ASTM A992, steel shall have a minimum yield strength of 36 ksi conforming to the provisions of ASTM A36.
 - 2. Tube steel shall conform to the provisions of ASTM A500, Grade B, and pipe steel to the provisions of ASTM A53, Grade B.
 - 3. Structural steel shall contain a minimum of 30% post consumer content and 15% pre-consumer content.

- B. Bolts
 - 1. Anchor Bolts (Anchor Rods): Shall conform to the provisions of ASTM F1554, Grade 36, unless different grade is specified elsewhere. Size and detailing indicated on Drawings.
 - 2. High-Strength Bolts: Shall conform to the requirements of ASTM A325 or F1852 unless otherwise indicated on Drawings.
 - 3. Expansion/Screw/Adhesive Anchors: Provide types as indicated on Drawings. The anchor specified shall be considered the basis of design.
 - a. As a minimum, all anchors exposed to weather or embedded in masonry are to be Type 316 stainless steel.

- b. Anchors installed in concrete shall have current ICC-ES listing for performance in cracked concrete as per Section BC 1912.
 - 1) Wedge Expansion and Undercut Anchors/ expansion bolts shall have an ICC-ES Evaluation Service Report (ESR) issued in accordance with ACI 355.2 or ICC-ES AC 193 for use in cracked concrete, including seismic applicability loading, and pursuant to the Office of Technical Certification and Research (OTCR) Building Bulletin 2014-018. Anchors installed in grouted masonry shall have a report issued in accordance with AC 01.
 - 2) Adhesive anchors in concrete shall have an ICC-ES Evaluation Service report (ESR) issued in accordance with ACI 355.4 or ICC-ES AC 308 for use in cracked concrete, including seismic applicability loading, and pursuant to the Office of Technical Certification and Research (OTCR) Building Bulletin 2014-018. Anchors installed in grouted masonry shall have a report issued in accordance with AC 58.
 - 3) Concrete Screw Anchors shall have an ICC-ES Evaluation Service report (ESR) issued in accordance with ICC-ES AC193 for use in cracked concrete and seismic loading and pursuant to the Office of Technical Certification and Research (OTCR) Building Bulletin 2014-019. Anchors installed in grouted masonry shall have a report issued in accordance with AC 106.
- c. Design and installation provisions shall be based on current ICC-ES ESR report and ACI 318 Appendix D.

D. Hardware

- 1. Nuts for anchor bolts and unfinished bolts shall conform to the requirements of ASTM A563.
- 2. Nuts for high-strength bolts shall conform to the provisions of ASTM A194 or ASTM A563.
- 3. Washers shall conform to the provisions of ASTM F436.

E. Filler Metal for Welding

- 1. Welding electrode shall conform to E70XX classification of AWS A5.1, except as described below.
- 2. Welding electrode shall be compatible with existing steel where connections are made to steel of existing building. Electrode shall be E7018 unless determined otherwise. E7018 are low hydrogen electrodes that must be kept extremely dry.

F. Structural Steel Primer Paint

Provide type of primer indicated on steel under the following application conditions.

1. General application: Acrylic rust-inhibitive type containing no lead equal to Tnemec 115 Unibond. Paint must meet SCAQMD standards for VOC emissions.
2. Cavity wall (including steel within the exterior block back-up or not separated from the cavity by a full block), exterior application, and as a primer after zinc metallizing: Epoxy paint equal to Tnemec Co. Series FC27 Typoxy or Carboline Carboguard 888.
3. Touch-up primer for cavity wall and exterior application: High adhesion high-solids epoxy coating equal to Tnemec Co. Series 135 Chembuild or Carboline Carboguard.

G. Galvanizing by the Hot-dip Method – No Finish Coating

1. Galvanize structural shapes in accordance with ASTM 123.
2. Galvanize hardware in accordance with ASTM A153.
2. Galvanizing repair paint for regalvanizing welds and damaged areas shall conform to ASTM A780 and comply with Military Specification MIL-P-21035, such as ZRC Cold Galvanizing Compound.

2.3 SHOP ASSEMBLY - FABRICATION

A. General

1. Do not fabricate until shop drawings have been approved.
2. Fabricate and assemble steel in shop to greatest extent possible. Fabricate items and assemblies in accordance with AISC Specifications and the shop drawings.
3. Properly mark members for field assembly. Fabricate items in order to match delivery sequence that will expedite erection.
4. Mill column ends at base plates, cap plates, and splices to a common plane by means of an approved milling machine.

B. Shop Connections

1. Weld or high-strength bolt shop connections as indicated on Drawings.
2. High-strength bolt connections are friction (slip-critical) connections. Install high-strength bolts in accordance with "Specification for Structural Joints using ASTM A325 or A490 Bolts" (RCRBSJ). Utilize Class A connections. If steel surface of connection area is prepared to SSPC-SP5 surface preparation, Class B

may be utilized pending inspection by the Authority's Special Inspection lab that surface meets the required preparation. Pay all costs to Ownership incurred for this inspection.

3. Welding: Comply with "Structural Welding Code" for procedures, appearance, and quality of welds and methods used in correcting welded work.
4. Holes for other Work
 - a. Provide holes and openings required for securing other Work to steel framing and for passage of other Work through framing members. Coordinate with Drawings of other Work.
 - b. Provide threaded nuts welded to framing, and other specialty items as indicated to receive other Work.
 - c. Cut, drill, or punch holes perpendicular to metal surfaces. Method of cutting must not produce a roughness of over 1000 microinches. Surfaces exceeding these limits must be repaired by machine grinding.
 - d. Reinforce all openings with steel shapes as shown on shop drawings.

2.4 SHOP PAINTING

A. General

Apply one shop coat of primer paint on structural steel except as follows:

1. Structural steel that is encased in concrete.
2. Steelwork or portions of such to receive sprayed fireproofing. Steel that is exposed to the cavity and within the block back-up is to be painted, unless indicated to be galvanized.
3. Top flanges of structural steel members requiring stud shear connectors or supporting metal deck.
4. Contact surfaces of structural steel that are to be bolted or welded together.
5. Surfaces of structural steel within 2" of field welds.
6. Contact milled bearing surfaces.
7. Steel members, hardware, and miscellaneous pieces to be galvanized and not specified or indicated to be painted.

B. Cleaning and Surface Preparation

1. Clean all steel first in accordance with SSPC-SP1.
2. Clean steelwork not to be painted (except steel work to be galvanized) in accordance with SSPC-SP2.
3. Clean steelwork to be painted within the same day as it will be applied and in accordance with the following methods, determined by location and exposure:
 - a. Interior steel not exposed to view: SSPC-SP2.
 - b. Interior steel exposed to view: SSPC-SP3.
 - c. Cavity wall and exterior steel exposed to weather: SSPC-SP6.

C. Shop Coat

1. Apply structural steel primer paint (general application) at a rate to provide dry film thickness of 2.0 to 3.5 mils. Apply primer paint (cavity wall and exterior application) at a rate to provide dry film thickness of 4.0 to 6.0 mils. Provide full coverage of joints, corners, edges, and exposed surfaces.
2. Apply to dry surfaces only, when surface temperatures are above dew-point, by brush, spray, or roller, thoroughly and evenly, in strict accord with manufacturer's instructions for every detail of handling.
3. Apply second coat of the approved primer, in a darker shade, to surfaces inaccessible to painting after assembly or erection.
4. Protect machined surfaces with an approved rust-inhibiting coating that is readily removable prior to erection.

D. Concrete Contact Surfaces

Paint steelwork at least two inches into the area in contact with concrete, where applicable.

2.5 GALVANIZING

A. General

Galvanize the following members:

1. All angles supporting exterior masonry or exposed to the weather, including shelf, arch, relieving angles.

2. All connections between the above angles and the supporting structural member, including WT's, hangers, clip angles, hardware, etc.
3. All exterior steel supporting mechanical equipment (dunnage steel) and any other steel members indicated on Drawings.

B. Cleaning and Surface Preparation

1. Hardware (bolts, nuts, etc.): Clean and leave free of mill scale before galvanizing.
2. Clean all steel first in accordance with SSPC-SP1 if needed.
3. Steel members: Clean in accordance with SSPC-SP8 before hot-dip galvanizing.
4. Steel members: Clean in accordance with SSPC-SP10 before zinc metallizing. Surface shall have a 3-4 mil anchor pattern. Moisture cannot be present on steel and temperature cannot be less than 5°F above the dew point. Thermal spray must be applied within 4 hours of blasting.

C. Shop Coat - Hot-dip Galvanizing Only – Provide for galvanized items not to have finish paint coat.

1. Galvanize hardware in accordance with ASTM A153.
2. Galvanize steel shapes in accordance with ASTM A123. Apply zinc coating as per Thickness Grade specified in ASTM A123.

2.6 SOURCE QUALITY CONTROL

A. Testing

1. General
 - a. Structural steel work is subject to all tests required by the Special Inspection requirements of the 2014 NYC Building Code.
 - b. Cooperate with the Testing Laboratory in making all required tests.
2. Tests: To be performed by Ownership's Testing Laboratory.
 - a. Shop bolted connections: Tested in accordance with AISC specifications.
 - b. Shop welding: The laboratory will perform the following functions:
 - 1) Certify welders.

- 2) Visually inspect all welds, record type and locations of defects, and perform tests if necessary. Check all corrected work.
- 3) Perform following non-destructive tests if necessary or as required by the Special Inspector. Tests used shall be at the Special Inspector's option:
 - a) Liquid Penetrant Inspection: ASTM E165.
 - b) Magnetic Particle Inspection: ASTM E709. Perform on roof pass and on finished weld.
 - c) Radiographic Inspection: ASTM E94 or E149. Minimum quality level 2-2T.
 - d) Ultrasonic Inspection: ASTM E164.

3. Welding of Critical Joints

- a. All welded joints that are critical to the integrity of the structure, and require non-destructive testing to assure the adequacy of the critical weld, are indicated on the Drawings.
- b. To insure general weld quality of less critical groove and butt welds, a quality control program may be required to check the welds by non-destructive testing. The Drawings specify whether non-destructive testing is required and, if necessary, the method of inspection.
- c. Requirements of critical welds and non-destructive testing shall be in conformance with NYC BSA Rules for Arc and Gas Welding, Rules 16.5 through 16.5.3, and Rule 17.

B. Inspection

1. Testing Laboratory

- a. Ownership will engage a Testing Laboratory or Special Inspection Agency to assist in the inspection of steel fabrication and conduct tests at the mill, shop, or foundry. The laboratory will assist in checking erection tolerances and provide shop and field testing required for all structural steel work, including metal deck and studs.
- b. The Testing Laboratory will be responsible to and under the supervision of a Special Inspector.

2. Special Inspector
 - a. Ownership will assign, under the requirements of Section BC 1704.3, a Special Inspector to supervise the Work listed above under "Testing Laboratory".
3. Notification: Notify Ownership before beginning fabrication of the structural steel and supply laboratory with copies of agreements, approved drawings, approved prints of all shop details, etc., and all necessary information relating thereto. Do not ship material to job site until after inspection and approval by the Testing Laboratory.
4. Discretionary Inspections: No mill, shop, foundry, or field inspection, such as is above provided for, shall be held to prohibit or preclude inspection of such materials during delivery and erection at the building by such other persons as Ownership shall direct.
5. Reports: Shop and field reports, including shipments, will be submitted by the Testing Laboratory to Ownership as the work proceeds at the shop or job site. A final report will be submitted by the Testing Laboratory when work is completed at the shop, and again when work is completed in the field. The Special Inspector reserves right to reject material not in compliance with specified requirements at any time.
6. Corrections: Correct deficiencies in work which inspections and tests have indicated to not be in compliance with requirements. Pay for additional tests, at own expense, necessary to reconfirm any non-compliance of original work and as necessary to show compliance of corrected work.
7. Contractor's Responsibility: Inspection and acceptance or failure to inspect shall in no way relieve the Contractor or the mill and shops from their responsibility to furnish satisfactory material strictly in accordance with Drawings and Specifications.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that field conditions are acceptable and that erection may proceed. Notify Ownership in writing of conditions that adversely affect the Work. Do not proceed with erection until conditions have been corrected. Beginning of installation means the erector accepts existing conditions.

3.2 ERECTION

A. General

1. Erection shall conform to Sections BC 2205.6.3 and BC 3305.2.

2. All work shall be erected plumb, square, and true to lines and levels in strict accordance with the structural requirements of the building.
 3. Provide all machinery, apparatus, and staging required for the erection of steelwork in a thoroughly safe and efficient manner. Install, maintain and remove, without injury to other Work, such temporary bracing, scaffolding, etc. as may be necessary or required. Care shall be taken that no part of the structure is overloaded during construction.
 4. Arrange for deliveries of material to facilitate the rapid and continuous progress of operation, but the site or streets adjacent to same shall not be used for the storage of material unless absolutely necessary and then only with special permission of Ownership and other authorities having jurisdiction.
 5. Employ a Licensed Professional Engineer to ensure accurate erection of the steel.
 6. Do not alter or cut structural members without written approval of the Engineer of Record.
- B. Temporary Shoring and Bracing
1. Provide temporary shoring and bracing members with connections of sufficient strength to bear erection loads and guy wires to maintain structure plumb and in true alignment until completion of erection. Remove temporary work when permanent members and bracing are in place and final connections are made.
- C. Anchors Bolts
1. Furnish to the concrete and brick masons anchor bolts and other connectors required for securing structural steel to the foundation and other in-place concrete work, together with instructions, templates, etc. necessary for setting them. Anchor bolts are to be surveyed and any approved modifications made prior to placement of columns.
 2. Tighten anchor bolts after support members have been positioned and plumbed. Cut off protruding edges of wedges or shims flush with edge of base or bearing plate prior to packing with grout.
- D. Base and Bearing Plates
1. Clean concrete and masonry bearing surfaces of loose and bond-reducing materials.
 2. Set loose and attached base plates and bearing plates for structural members on shims and other adjusting devices, such as leveling plates, within specified tolerances. Elevations of shims and leveling plates shall be surveyed and adjusted to the correct elevation prior to placement of column or beam. Plates are to have grout holes.

3. Grouting under plates is part of the Work of Section 03610. Grouting is to be done prior to placement of any concrete on the structure.

E. Field Assembly

1. Erect structural frames accurately to lines and elevations indicated. Align and adjust members forming a part of a complete frame or structure before permanently fastening.
2. Clean bearing surfaces and other surfaces that will be in permanent contact before assembly.
3. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.
4. Level and plumb individual members of the structure within specified tolerances. Do not tighten structure until surveys verify that structure is within allowable tolerances.
5. Establish required leveling and plumbing measurements on mean operating temperature of structure. Make allowances for difference between temperature at time of erection and mean temperature at which structure will be when completed and in service.
6. Splice members only where indicated and accepted on shop drawings.

F. Connections

1. Field connections shall be welded or bolted, except where welding is specifically called for on the Drawing.
 - a. Provide high-strength bolts for bolted connections except where unfinished bolts are indicated on the Drawings. High-strength bolt connections are friction (slip-critical) connections. Install high-strength bolts in accordance with "Specification for Structural Joints using ASTM A325 or A490 Bolts."
 - b. Provide unfinished bolts where indicated on Drawings. Lock nuts by upsetting bolt end or by similar method when unfinished bolts are not encased in concrete. Tighten all bolts and nuts fully.
 - c. For ASTM A307 bolts, hardened washer shall be installed under the turned element. For ASTM A325, F1852, A490 and F2280 bolts, hardened washer shall be installed under the head and nut. This washer is not required under the head for oversized or short-slotted holes for bolts conforming to F1852 bolts (from 1/2" to 1½" in diameter) and for bolts conforming to F2280 bolts when the bolt diameter is < 1".

- d. Expansion/screw/adhesive anchors shall be installed in accordance with the manufacturer's installation instructions. Holes shall be cleaned completely using wire brush and compressed air following manufacturer's guidelines. Tighten to the torque values specified by the manufacturer. For installation in existing substrates not installed as part of the Work, have bolt manufacturer perform pullout test in each substrate to verify capacity and quality of substrate prior to final approval of anchor to be utilized.

2. Holes

- a. The size of boltholes shall be in accordance with AISC "Specification for the Design, Fabrication and Erection of Structural Steel for Buildings."
- b. Ream holes that must be enlarged to admit bolts. Burning or use of drift pins is not permitted.

G. Erection Holes

Fill erection bolt holes on exposed to view members with plug welds and grind smooth.

I. Field Touch-Up

1. Painted Members: After erection, clean all damaged areas in shop coat, exposed surfaces of bolts, bolt heads, nuts and washers, abrasions, and all field welds and unpainted areas adjacent to field welds to the same standards as the shop coat and paint with primer paint to same thickness as the shop coat. Finish painting is specified in Section 099000.
2. Galvanized Members: After erection, clean and paint all damaged areas to the galvanizing, welds, and areas adjacent to welds with the galvanizing repair paint. For galvanized members to be painted, finish painting is specified in Section 099000 and shall be the final two coats of the epoxy paint system.

3.3 TOLERANCES

- A. Erection tolerances shall be in accordance with "Code of Standard Practice for Steel Buildings and Bridges", except as indicated in B below.
- B. The following overall maximum deviations (tolerances) from theoretical are permitted:
 - a. Column location @ base plate: 1/2"
 - b. Base Plate, bearing plate and column splice elevation: +1/8"
 - c. Column Plumbness: in or out 3/4" in column length, 1/4" for total building height

- d. Beam or girder elevation: +1/2"
- e. Beam camber: 1/8"

3.4 FIELD QUALITY CONTROL

- A. The Contractor shall cooperate with the Special Inspector and the Testing Laboratory performing Special Inspection testing by providing adequate notification for when work is performed that will require the inspection and provide all required access and means for the laboratory to perform the inspection and testing.
- B. As per Section BC 1704.3, the Special Inspector will inspect erection of the structural framework and test field bolting and welding as listed in Part 2 of this Section. Where post-installed anchors are utilized, the Special Inspector will perform Special Inspection on post-installed anchors as per Section BC 1704.32. Adhesive anchors installed in concrete in a horizontal or upwardly inclined position supporting sustained tension loads shall be installed under continuous Special Inspection as required by paragraph D9.2.4 of ACI 318-11.
- C. The Contractor shall engage an engineer licensed in the state of New York to check tolerances and inspect the erection.

END OF SECTION 05 12 00

LIST OF SUBMITTALS

SUBMITTAL	DATE SUBMITTED	DATE APPROVED
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Product Data:

1. Primer paint, repair paint
2. Stud shear connectors
3. Expansion/adhesive anchors
4. Zinc metallizing

Shop Drawings:

1. Job standards
2. Erection drawings
3. Steel shop drawings
4. Calculations
5. DVD/CD rom of final approved drawings

Certificates:

1. Bolt test reports
2. Welders qualifications & license
3. Material listing
4. ICC Certification for Mechanical/Adhesive Anchors

Qualifications

1. Fabricator
2. Erector
3. Detailer/Engineer
4. Adhesive anchor installer
5. Zinc Metallizer/galvanizer-coater

Surveys:

1. Anchor bolt and base plate
2. Column splice elevation
3. Column plumbness
4. Bottom of beams before
concrete placement
5. Bottom of beams after
concrete placement

Test Reports:

Zinc metallizing and
epoxy coating

Sustainability:

1. Mfr's printed literature
or statement on
 - a. Recycled material content
 - b. Regionally extracted and
manufactured material content
2. Contractor's Sustainable
Materials Form

* * *

SECTION 07 25 00

SPRAYED-ON FIREPROOFING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Patch existing fireproofing

1.2 DESCRIPTION OF THE WORK.

- A. Repair to existing structural member fireproofing disturbed by the work or addition of fireproofing missing, uncovered as a field condition.

1.3 SUBMITTALS

- A. Evidence of Acceptable Testing: Submit for each fire-resistance rated assembly to be constructed. Listing of the assembly to be used in the current edition of the Underwriters Laboratories Inc. "Fire Resistance Directory" will be considered evidence of acceptable testing. In lieu of such a directory listing, official printed notification from Underwriters Laboratories Inc., stating that the assembly in question has been tested and approved, will also be considered evidence of acceptable testing.
- B. Product Data: Submit complete product and system description, including installation instructions and limitations on use.
- C. Certificate of Acceptability of Substrates: Submit fireproofing manufacturer's certification that substrates to receive fireproofing are acceptable to fireproofing manufacturer. Where fireproofing manufacturer recommends use of a bonding agent to ensure adequate bond for fireproofing, follow manufacturer's instructions.
- D. Materials Certificate: Submit fireproofing manufacturer's certification that products to be supplied conform to requirements of the contract documents and are recommended by the manufacturer for application indicated.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Store products in dry, protected area in manufacturer's original shipping containers bearing labels which include UL fire resistance ratings, manufacturer's name, product name, date of manufacture, and shelf life instructions where required.
- B. Do not use products beyond manufacturer's indicated shelf life.

1.6 PROJECT CONDITIONS

A. Environmental Requirements:

1. Minimum ambient and substrate temperatures for 24 hours immediately preceding, during, and for 24 hours after fireproofing installation: 40 degrees F.
2. Provide adequate air circulation to ensure proper curing of fireproofing materials.

1.7 SEQUENCING AND SCHEDULING

- A. Coordinate work of this section with other work as required to ensure that installed materials are not damaged during construction period and that fire resistance ratings are not compromised by work of other trades.
- B. Schedule fireproofing installation sufficiently in advance of other work to permit field quality control testing and any required corrective procedures to be completed before construction which might interfere with these operations is started.

1.8 GUARANTEE

- A. Submit a guarantee, executed by the Contractor and co-signed by the installer, agreeing to repair/ replace fireproofing work performed under this Contract which has cracked, flaked, dusted excessively, peeled, or has fallen from the substrate due to defective workmanship for a period of two (2) years from the date of acceptance of the building.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. For all of each distinct fireproofing product indicated, provide materials produced by one manufacturer, factory-mixed, suitable for sprayed application, and requiring addition at the site of no other materials other than water.
- B. Fireproofing: Provide products as specified for the UL (Underwriters Laboratories Inc.) designs indicated, or provide acceptable substitutes listed by UL, having equivalent fire resistance ratings, and approved by the Architect and by authorities having jurisdiction.
- C. Prohibited Products:
 1. Mineral fiber fireproofing, i.e, spray fireproofing assemblies classified in the "800 Series" in the UL Fire Resistance Directory, will not be considered for substitution.

2.2 ACCESSORIES

- A. Provide products which strictly comply with UL requirements for fire resistance rated designs indicated, including the following items where required:

1. Bonding agent/substrate primer.
2. Topcoat/sealer: Provide where needed to comply with performance requirements indicated or where recommended by fireproofing manufacturer for application.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that substrates are in satisfactory condition to receive fireproofing.
- B. Verify that items required to penetrate fireproofing are in place and properly fastened.
- C. Perform fireproofing manufacturer's recommended test procedures wherever substances which might affect adhesion of fireproofing are suspected on substrates.
- D. Notify the Architect in writing of any substrate conditions requiring correction by other than normal cleaning methods, prior to installation of fireproofing.
- E. Do not begin work until unsatisfactory conditions have been corrected; commencement of fireproofing installation indicates acceptance of conditions.

3.2 PREPARATION

- A. Provide drop cloths, masking, or other suitable coverings for materials not to receive fireproofing.
- B. Take necessary precautions to protect workmen, the public, and the environment during installation.
- C. Prepare substrates as required to result in permanent bonding of fireproofing material. Strictly follow fireproofing manufacturer's instructions for cleaning and preparation of substrates.
- D. Primed Steel: Where required by fireproofing manufacturer for proper bond, apply fireproofing manufacturer's recommended bonding agent/substrate primer.

3.3 INSTALLATION

- A. Install in strict accordance with UL (Underwriters Laboratories Inc.) "Fire Resistance Directory" instructions for designs indicated and with fireproofing manufacturer's instructions.
- B. Install fireproofing in a manner which will maximize adhesion between fireproofing and substrate and continuity of fire-resistive protection; use a single course of fireproofing unless otherwise recommended by fireproofing manufacturer.
- C. Spray material on substrate wherever conditions permit.

3.4 PATCH EXISTING FIREPROOFING

- A. Patch existing fireproofing material where existing fireproofing has been damaged due to demolition or construction operations.

3.5 FIELD QUALITY CONTROL

- A. Measure thickness and density in accordance with ASTM E 605 procedures for rating required.

3.6 CLEANING

- A. Completely remove fireproofing from surfaces not designated to receive fireproofing while material is still wet and before it has begun to set.

3.7 PROTECTION

- A. Follow instructions of fireproofing manufacturer to prevent damage to fireproofing.

END OF SECTION 07 25 00

SECTION 07 84 00

FIRESTOPPING/SMOKE SEALS

PART 1 – GENERAL

1.1 DESCRIPTION OF WORK

- A. Provide firestopping at all penetrations and juncture joints of fire-rated walls, floors and ceilings in accordance with the requirements of the NYC Building Code.

1.2 REFERENCES

- A. References and industry standards listed in this Section are applicable to the Work. Unless more restrictive criteria or differing requirements are explicitly stated in the Specifications, or mandated by governing codes or regulations, the recommendations, suggestions, and requirements described in the referenced standards shall be deemed mandatory and applicable to the Work.
 1. American Society for Testing and Materials (ASTM)
 2. Underwriters Laboratories, Inc. (UL)
 3. National Fire Protection Association (NFPA)
 4. Warnock Hersey

1.3 DESIGN REQUIREMENTS

- A. Technical Requirements
 1. Firestopping materials shall be UL Classified as "Fill, Void or Cavity Material" for use in Through-Penetration Firestop Systems.
 2. Firestop Systems shall provide a fire resistance rating at least equal to the hourly resistance rating of the fire-rated barrier and resist passage of smoke and other gases.

1.4 SUBMITTALS

- A. Product Data: Submit manufacturer's product information for each type of firestopping/smoke seal and assembly installed, including application instructions and specifications.
- B. Quality Control Submittals
 1. Certificates
 - a. Furnish manufacturer's certification that materials meet or exceed specification requirements for each of the performance tests specified in Part 2.
 2. Provide testing certification.
 - b. Furnish applicator's certification that material has been completed as specified to meet fire resistance ratings, thickness requirements, and application requirements of the applicable assembly.
 - c. Furnish UL, BSA, MEA, or OTCR approval of material.
 - d. Furnish certificate stating each material is 100% asbestos free.
 2. Contractor Qualifications

- a. Provide proof of Manufacturer and Applicator qualifications specified under "Quality Assurance".
- C. Guarantee
 1. Contractor and installer's installation guarantee.

1.5 QUALITY ASSURANCE

- A. Qualifications
 1. Manufacturer
Company specializing in the manufacture of firestopping/smoke seal materials to be used in this Contract shall have a minimum of five years experience.
 2. Installer: All firestopping Work shall be performed by the general contractor or Subcontractor who will be acceptable to the firestopping manufacturer in the application of its products and systems and have a minimum of three years experience and shall have worked on at least two projects with similar quantities of materials used.
- B. Regulatory Requirements
 1. Building Code: Material and application shall meet the requirements for firestopping materials in accordance with the NYC Building Code.
 2. Material must have UL or NYC BSA, MEA or OTCR approval for each assembly utilized. Comply with the following for firestopping that is required to be in compliance with BC 712 of the 2008 NYC Building Code:
 - a. ASTM E84 - Surface Burning Characteristics of Building Materials.
 - b. ASTM E814 - Fire Tests of Through Penetration Firestops.
 - c. U.L. 1479 - Fire Tests of Through-penetration `Firestops.
 - d. U.L. - Fire Resistance Directory; Through-Penetration Firestop Systems (XHEZ), and Fill, Void or Cavity Materials (XHHW).
 - e. U.L. 723 - Standard Test Method for Surface Burning Characteristics of Building Materials.
- C. Manufacturer's Certification
 1. Manufacturer shall provide written certification stipulating that its products and systems used in this Project, if installed in accordance with the manufacturer's recommendations, shall provide the firestopping specified in this Section, as indicated by its UL rating for that specific installation.
 2. The certification shall not include either or both of the following statements, or variations thereof:
"Owner or User shall determine suitability of the product or system for its intended use and assume all risks and liabilities connected therewith" and, "Owner or User shall test application of product or system for its specific use".

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials in original, unopened packages bearing name of manufacturer, product identification, and the proper UL labels for fire hazard and fire-resistance classification.
- B. Store materials off ground, under cover, and away from damp surfaces, keep dry.

1.7 ENVIRONMENTAL REQUIREMENTS

- A. Maintain air and substrate temperature at a minimum temperature of 50°F for 24 hours before, during, and for 24 hours after application of the material or as required by the product literature, which ever is more stringent. Contractor shall provide enclosures with heat to maintain temperatures.

1.8 GUARANTEE

- A. Submit a guarantee, executed by the Contractor and co-signed by the installer, agreeing to repair/replace firestopping work performed under this Contract which has cracked, flaked, dusted excessively, peeled, or has separated or fallen from the substrate due to defective workmanship for a period of two (2) years from the date of substantial completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Hilti Construction Chemicals, Inc., Tulsa, OK.
- B. The Carborundum Company, Niagara Falls, NY.
- C. 3M Fire Protection Products, St. Paul, MN.
- D. Bio Fireshield, Inc., Concord, MA
- E. Tremco Sealant Division, Tremco LTD, Toronto, Ontario, Canada.
- F. Specified Technologies, Inc., Somerville, NJ
- G. W. R. Grace & Co., Macungie, PA
- H. RectorSeal Corp., Houston, TX

2.2 MATERIALS

- A. Grout and sealant systems, as well as integral firestopping sleeves and membranes, shall meet or exceed requirements as specified in Part 1 of this Section and shall be acceptable to the Architect.
- B. Firestopping systems shall meet the requirements of ASTM E814, which include, but are not limited to, the following:
 - 1. Prevent flame pass-through.
 - 2. Restrict temperature to not exceed 325°F over ambient on side of assembly opposite flames.
 - 3. Provide a positive smoke seal.
 - 4. Withstand hose stream test with a minimum positive pressure differential of 0.01 inch (2.49 pa.)
 - 5. Provide an F rating of not less than the required fire rating of the wall penetrated.
- C. Firestopping materials shall be asbestos-free, emit no toxic or combustible fumes and be capable of maintaining an effective barrier against flame, smoke, gas, and water in compliance with requirements of this Section.

- D. Firestopping materials/systems shall be flexible to allow for normal movement of building structure and penetrating items(s) without affecting the adhesion or integrity of the system.
- E. Firestopping materials shall not require hazardous waste disposal of used containers/packages.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine and confirm the compatibility of surfaces to receive firestopping materials. Verify that surfaces are sound, clean and dry and are ready to receive the firestopping.
- B. Verify that penetration elements are properly located and securely fixed, with the proper space between the penetration element and surfaces of the opening.

3.2 PREPARATION

- A. Protect adjacent surfaces and equipment from damage.
- B. Clean surfaces of opening.

3.3 INSTALLATION

- A. Install firestopping system in strict accordance with the manufacturer's instructions to obtain the fire-rating required at the specific location
- B. Provide escutcheons for piping at each side of penetration.

3.4 FIELD QUALITY CONTROL

- A. Contractors Responsibility for Quality Control
 1. Inspect all installations to ensure that all work meets the requirements specified as the Work progresses.
 2. Do not cover firestopping work until it is accepted and approved by the independent inspector provided by the College.

3.5 CLEANING

- A. Remove excess materials, droppings, and debris; remove excess materials from adjacent surfaces.

3.6 PROTECTION

- A. Protect firestopping installations from damage until completion of all Project Work.

END OF SECTION 07 84 00

SECTION 09 90 00

PAINTING

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

- A. This Section includes surface preparation and field painting of the following:
 - 1. Exposed exterior items and surfaces.
 - 2. Exposed interior items and surfaces.
 - 3. Surface preparation, priming and finish coats specified in this Section are in addition to shop priming and surface treatment specified in other Sections.
- B. Paint exposed surfaces, except where the paint schedules indicate that a surface or material is not to be painted or is to remain natural. If the paint schedules do not specifically mention an item or a surface, paint the item or surface as directed by the Architect. If the schedules do not indicate color or finish, the Architect will select from standard colors and finishes available.
 - 1. Painting includes field painting of exposed bare and covered pipes and ducts (including color coding), hangers, exposed steel and iron work, and primed metal surfaces of mechanical and electrical equipment.
- C. Do not paint prefinished items, concealed surfaces, finished metal surfaces, operating parts, and labels as described in Article 2.05A.

1.2 REFERENCES

- A. References and industry standards listed in this Section are applicable to the Work. Unless more restrictive criteria or differing requirements are explicitly stated in the Specifications, or mandated by governing codes or regulations, the recommendations, suggestions, and requirements described in the referenced standards shall be deemed mandatory and applicable to the Work.
 - 1. Federal Specifications (FS)
 - 2. American Society of Testing and Materials (ASTM)
 - 3. N.Y.S. Department of Environmental Conservation
 - 4. U.S. Department of Labor
 - 5. Occupational Safety and Health Administration (OSHA)
 - 6. Steel Structures Painting Council (SSPC)

1.3 DEFINITIONS

- A. The term "Painting" as used in this Section, means the application of all coatings such as paint, primer, enamel, varnish, shellac, oil, etc. as listed in the Painting Schedules.
- B. The term "Painting" also includes preparation of surfaces for such applications, and the clean-up as hereinafter specified.
- E. Finishes:
 - 1. Flat refers to a lusterless or matte finish with a gloss range below 15 when measured at an 85-degree meter.
 - 2. Satin refers to low-sheen finish with a gloss range between 15 and 35 when measured at a 60-degree meter.
 - 3. Semigloss refers to medium-sheen finish with a gloss range between 30 and 65 when measured at a 60-degree meter.
 - 4. Full gloss refers to high-sheen finish with a gloss range more than 65 when measured at a 60-degree meter.
- F. Concealed: The term "concealed" refers to surfaces, piping, ducts or conduit which cannot be accessed without moving a building element such as within a chase, wall or ceiling.
 - 1. Concealed surfaces include walls or ceilings in the following generally inaccessible spaces:
 - a. Furred areas.
 - b. Ceiling plenums.
 - c. Duct shafts.
 - d. Elevator shafts.
- H. The term "exposed" refers to any item which is not concealed.
 - 1. The term "exposed to public view" means situated so that it can be seen from eye level from a public location. A public location is that which is accessible to persons not responsible for operation or maintenance of the building.

1.4 SUBMITTALS

A. Product Data

Provide manufacturers' product literature for all materials specified and material manufacturer's printed directions and recommendations for environmental conditions,

surface preparation, priming, mixing, reduction, spreading rate, application, storage and VOC content, as applicable for each of the materials specified.

B. Samples

1. Initial Selection

- a. Submit manufacturer's color charts for each type of finish for approval by the Project Architect. Verify colors specified with manufacturers' color charts for availability and notify the Project Architect if any discrepancies should occur.

2. Verification prior to installation

- a. Contractor shall furnish color chips for surfaces to be painted.
- b. Submit two samples of each color and finish selected on 12" x 12" hardboard.
- c. Two samples of finish on concrete masonry and metal surfaces where applicable.

3. All samples of cabinetry and/or other woodwork shall be labeled; and include the following information:

- a. Manufacturer's name
- b. Type of paint/stain/hardener
- c. Manufacturer's stock number
- d. Color: name and number
- e. Federal Specification number, as specified
- f. Federal regulations for amount of lead in paint.
- g. VOC content

C. Quality Assurance

1. Certification that materials for each system are obtained from a single manufacturer.
2. Certification that Work shall be performed by personnel with a minimum of three years experience who meet the qualifications set forth in OSHA, 29 CFR 1926.62 (Lead In Construction Standard).
3. Certification that material meets or exceeds the performance requirements of Federal Specifications.

4. Certification that materials comply with N.Y.C. and N.Y.S. regulations for Volatile Organic Compounds.
- D. Guarantee
- Provide Guarantee per Article 1.08.
- E. Low Emitting Materials Compliance Submittals:
1. Provide documentation for each coating to be used on the building interior indicating that the coatings comply with low V.O.C. requirements.

1.5 QUALITY ASSURANCE

- A. General
1. All painting materials shall arrive at the job ready-mixed.
 2. Varnish containers shall not exceed 5-gallon capacity.
 3. Remove all rejected materials from the premises immediately.
 4. All thinning and tinting materials shall be as recommended by the manufacturer (Wood frames and stains). Generally, all paints shall not require additional thinning.
 5. Verify that the specified shop prime paint for each applicable item in this Project is compatible with the total coating system, prior to application.
 6. Materials selected for each system type shall be products of a single manufacturer.
- B. Qualifications
1. Work of this Section shall be performed by personnel with a minimum of three years experience in performing this type of Work.
 2. The Contractor shall ensure that all employees meet the qualifications set forth in OSHA, 29 CFR 1926.62 (Lead In Construction Standard).
- C. Source Limitations: Obtain block fillers, primers, and undercoat materials for each coating system from the same manufacturer as the finish coats.
- D. Regulatory Requirements
1. N.Y.C. Building Code, latest edition
 2. N.Y.S. Department of Environmental Conservation -Part 205 on "Architectural Surface Coatings" - for (VOC) Volatile Organic Compounds.
 3. Steel Structures Painting Council (SSPC).

4. U.S. Department of Labor, Occupational Safety and Health Administration, Construction Industry Standards (29 CFR 1926/1910) Revised 10/1/79, Washington, D.C.
5. Occupational Safety and Health Administration (OSHA) 29 CFR 1926.62 (Lead In Construction Standard).
6. New York State Department of Environmental Conservation regulations, 6 NYCRR part 364.
7. New York City Department of Environmental Protection Waste water disposal permitting requirements.

E. Certifications

Federal Specifications: When materials are specified to comply with Federal Specifications, products will be accepted which meet or exceed the performance requirements of such Federal Specifications and comply with all regulations currently in effect.

1. Indicate that material complies with Federal Specifications by including the Federal Specifications number on the container label or on the product literature, or submit a statement with the Product Data stating that material meets or exceeds the performance requirements of the Federal Specifications.

F. Field Samples

1. Provide samples of each color and finish, under natural lighting conditions, in a location where each finish is to be applied.
2. Authority will request review of first completed room, space or item of each color scheme required by the Project Architect for color, texture and workmanship.
3. First acceptable room, space or item will be used as project standard for each color scheme, or finish.
4. Primer coat is to be inspected and approved in all locations before any subsequent finish coats are applied.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Delivery

Deliver materials to the site in original, unopened containers bearing manufacturers name and label containing the following information:

1. Product name or title of material

2. Manufacturer's stock number, batch number, VOC content in grams per liter and date of manufacture.
3. Manufacturer's name
4. Federal Specification number, if applicable.
5. Federal regulations for amount of lead in paint (less the 0.06% lead in non-volatile ingredients)
6. Contents by volume for major pigment and vehicle constitutions
7. Thinning instructions
8. Application instructions
9. Color name and number

B. Storage

1. Owner/Architect's representative will designate space on premises with the coordination of the Contractor for storage of materials. Contractor shall restrict storage in this area to paint materials and related equipment, and provide the following:
 - a. Provide one (1) approved chemical dry fire extinguisher equal to 20 lb. CO₂ rating in all assigned rooms or locations where painting materials are stored. Fire extinguisher shall bear the label of the National Board of Fire Underwriters and tag of most recent inspection.
 - b. Provide three (3) standard size red fire pails with clean sand in above locations. At the completion of project, fire extinguishers and pails shall become property of Contractor.
2. Maintain storage area in clean condition, store materials not in use in tightly covered containers. Remove oily rags, waste and empty containers from site each night.
3. Provide Owner/Architect's Representative with one key for each space if spaces are to be kept locked when not in use.
4. Protect all materials from freezing.

1.7 PROJECT CONDITIONS

A. Environmental Requirements

1. Comply with manufacturer's recommendations as to environmental conditions under which coatings and coating systems can be applied.

2. Do not apply finish in areas where dust is being generated or will be generated while the material is drying.
3. Provide paint and coating products to comply with applicable environmental regulations, VOC requirements and local authorities.
4. In all areas, spaces and rooms being painted, the Contractor shall ensure that there is adequate ventilation to ensure proper paint drying, along with minimizing paint odors.
5. The Contractor shall ensure that all requirements of OSHA 29 CFR 1926.62 (Lead in Construction Standard) are adhered to during the project. In addition, the Contractor shall ensure that proper work area protection and clean-up procedures (as described in this Section) are strictly adhered to during all phases on the project.

1.8 GUARANTEES

- A. Adherence of workmanship and materials to Specifications requirements shall be maintained for the one-year Contract guarantee period. These requirements shall include the following:
 1. There shall be no evidence of blistering, peeling, crazing, alligatoring, streaking, staining, or chalking.
 2. Dirt shall be removed without blemishing the finish by washing with mild soap and water.
 3. Colors of surfaces shall remain free from serious fading; the variation, if any, shall be uniform.
- B. Correct all defects, appearing within the guarantee period, by removal of the defective work and replacement as directed.
- C. All corrective measures shall be the Contractor's responsibility, and shall be made at no extra cost to the Owner. The requirements set forth in Part 3 of these Specifications shall be strictly adhered to.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Subject to compliance with specified requirements, provide "First Line" or "Top Quality" products of one of the following manufacturers:
 1. Benjamin Moore and Co.
 2. PPG Industries, Pittsburgh Paints Inc.
 3. Pratt and Lambert
 4. The Sherwin-Williams Co.

2.2 MATERIALS

- A. Provide products which meet all N.Y.S. Part 205-VOC requirements for applications outlined herein and comply with low V.O.C. requirements.
- B. Provide products which meet all Federal regulations for amount of lead in paint (less than 0.06% lead in non-volatile ingredients).
- C. Provide best quality grade of various types of coatings as regularly manufactured by the paint materials manufacturers. Materials not displaying manufacturers' identification as a standard, best-grade product will not be acceptable.
- D. Use only thinners approved by paint manufacturers for applications intended and use only within recommended limits.

2.3 REFERENCE STANDARDS

- A. Paint materials shall meet or exceed the requirements of the following standards:

Federal Specifications

- 1. Primers, Sealers, Undercoats
 - a. Metal Primer for Galvanized surfaces:
FS TT-P-001984
FS TT-P-650-C
 - b. Metal Primer Aluminum or Steel surfaces:
FS TT-P-57B
 - c. Primer Sealer, Latex Base:
FS TT-P-650C
 - d. Alkyd Primer (Corrosion Inhibiting)
Lead and Chromate Free,
VOC Complying
FS TT-P664C
 - e. Acrylic Primer
TT-P-650-C
- 2. Finish Paints
 - a. Exterior Alkyd Modified Paint; Gloss:
FS TT-P-102E,
Type II and
Type III
 - b. Ext. Acrylic Latex Paint; Flat: FS TT-P-19
 - c. Gloss Acrylic Latex Enamel:
FS TT-P-1511-B

- d. Flat Vinyl Acrylic Latex
Interior: TT-P-29J
 - e. Semi-Gloss Vinyl Acrylic
Latex Enamel, Interior: TT-P-1511-B
 - f. Alkyd Odorless Semi-Gloss
Enamel: FS TT-E-509C for white
and tints; Class A for deep colors. FS TT-E-529
 - g. Aluminum Paint (where applicable)
(Ready Mixed): FS TT-P-38D.
 - h. Heat Resistant Semi-Gloss
Enamel (400°F max. surface
temperature): FS TT-E-496
 - i. Smokestack Black Paint: FS TT-E-496
4. Floor Finishing Systems (applications where applicable)
- a. Rubber Base Paint: FS TT-P-91
For use over concrete and masonry
 - b. Cement Floor Hardener - Magnesium Zinc and Fluosilicate type as
specified in Section 03300 of this Specification.
 - c. Urethane Floor Paint: FS TT-C-542,
Type II
 - d. Polyamide Epoxy Paint FS TT-C535B
Type II
5. Lettering Enamel: Interior/Exterior full gloss enamel: FS TT-E-489
6. Fire Retardant Paint: Latex Fire Retardant Paint: FS TT-P-26P Rated Class A by
Underwriters Laboratories.
7. Miscellaneous Materials: (where applicable where wood finishes are used on site)
- a. Mineral Spirits (Petroleum Paint Thinner):
FS TT-T-291
 - b. Color Pigments: Pure, non-fading, finely ground pigments, at least 99
percent passing a 325 mesh sieve. Color pigments that are to be used on
masonry, concrete and plaster shall be lime proof - FS-TT-P-381.
 - c. Putty: Linseed-Oil type for Wood Sash Glazing -FS-TT-P-791B.
 - d. Shellac: Two pound cut shellac, FS TT-S-300

- e. Paste Wood Filler: FS TT-F-336
- f. Plastic Wood Filler: FS TT-F-340C.
- c. Surface Sealer: Pigmented Oil for Plaster & Wallboard - FS-TT-S-179.
- d. Linseed Oil: (Boiled) FS A-A-371A
- e. Linseed Oil: aw) FS A-A-379A
- f. Lacquer (Brushing) Clear and Pigmented: FS-TT-L-26C.
- g. Lacquer, Rubbing, Clear: FS-TT-L-57C
- h. Lacquer, Spraying Clear and Pigmented for Interior and Exterior Use: FS-TT-L-58E.

B. Miscellaneous Standards and Requirements

- 1. Turpentine: ASTM D13.
- 2. Cold Galvanizing Compound: Single component material conforming to ASTM A780 giving 96% pure zinc in the dried film.
- 3. Cleaning Solvents: Low toxicity; flash point in excess of 100°F.
- 4. Spackling Compound: ASTM C475.
- 5. Polyester Filler: Polyester resin base autobody filler standard weight or finishing grade required by conditions; Marson's "White Lightning" and "Topcoat."

2.4 COLORS

A. Selection

- 1. Paint colors, surface treatments and finishes will be selected by the Project Architect.
- 2. Color Schedule will be issued to the Contractor by the Architect's representative.
 - a. Final acceptance of colors will be from actual job applications.

B. Maximum Number of Colors and Tints

- 1. Number of colors selected by the Project Architect will not exceed those listed in Schedule below.

2.5 INTERIOR PAINT SYSTEMS

F. Ferrous Metal (where applicable)

1. Flat Finish: jamb and head sections, coat and hat rack, metal shelves.

*1st Coat - Alkyd Modified Acrylic Rust Preventive

Latex Primer -- 1.6 Mils DFT

2nd & 3rd Coats

Flat Acrylic Latex -- 1.3 Mils DFT

each coat

2. Flat Finish (only as approved at shop drawing submittal review by the Owner/Architect's representative): Convector enclosures, grilles, access doors, frames, Steel Doors and Frames, Trim, Partitions (where applicable and approved by the Owner/Architect's representative)

*1st Coat - Alkyd Modified Acrylic Rust Preventive

Latex Primer -- 1.6 Mils DFT

2nd & 3rd Coats -

Semi-Gloss Vinyl Acrylic Latex

Flat -- 1.3 Mils DFT

each coat

3. Flat Finish:

*1st Coat - Alkyd Modified Acrylic Rust Preventive

Latex Primer -- 1.6 Mils DFT

2nd & 3rd Coats -

Flat Acrylic Latex Enamel -- 1.2 Mils DFT

each coat

* Provide full prime coat on new surfaces. Items shop primed with modified alkyd equal to Tnemec 10-99 primer shall be touched up with same primer. See related specification sections.

G. Zinc-Coated Metal

1. Flat Finish:

1st Coat (New) - Alkyd Modified Vinyl Acrylic

Latex Primer -- 1.2 Mils DFT

*1st Coat (Repaint) - Alkyd Modified Acrylic Rust

Preventive Latex Primer

-- 1.6 Mils DFT

2nd & 3rd Coats

Flat Vinyl Acrylic Latex -- 1.3 Mils DFT

each coat

2. Flat Finish: (only as approved at shop drawing submittal review by the Owner/Architect's representative) Railings, wire-mesh work.

1st Coat (New) - Alkyd Modified Vinyl Acrylic
Latex Primer -- 1.2 Mils DFT

*1st Coat (Repaint) - Alkyd Modified Acrylic Rust
Preventive Latex Primer
-- 1.6 Mils DFT

2nd & 3rd Coats
Flat Vinyl Acrylic Latex
Enamel -- 1.3 Mils DFT

each coat

* Spot prime as needed.

2.6 EXTERIOR PAINT SYSTEMS

A. New Ferrous Metal

Structural steel, all ferrous metals, and steel window trim.

1st Coat – Touch up with epoxy Polyamide Paint

2nd Coat - Polyamide Epoxy Paint
applied at the rate of -- 4.0 to 6.0

Mils DFT.
SSPC-PS
Guide 13.01

3rd Coat (Top Coat) - Acrylic Aliphatic
Polyurethane applied at rate of -- 1.5 to 2.0

Mils DFT.
SSPC-PS
Guide 17.00
Type 5.

B. Zinc Coated Metal Exposed to Public View

Provide for all galvanized surfaces (Zinc metallizing) exposed to public view (not just on the exposed face), except chain link fences:

1st Coat - Epoxy polyamide -- 4.0 Mils DFT

2nd Coat - Exterior Aliphatic polyurethane semi-gloss enamel --
4.0 Mils DFT

C. Existing steel members embedded in masonry or concrete.

1st Coat - Epoxy polyamide equal to Tnemec Series 135 Chembuild (capable of painting on an SSPC-SP3 surface prep. -- 7
to 9 Mils DFT

D. Existing steel members exposed to view or the elements.

Provide the epoxy coat system, except the first coat shall be an Epoxy polyamide equal to Tnemec Series 135 Chembuild (capable of painting on an SSPC-SP3 surface prep.

E. Epoxy Coat System

1st Coat (Primer) - Epoxy organic zinc rich Primer with 85% zinc applied at rate of -- 2.0 to 4.0
Mils DFT.
SSPC - PS
Guide 12.00
(Organic
Zinc Rich).

2nd Coat - Polyamide Epoxy Paint applied at the rate of -- 4.0 to 6.0
Mils DFT.
SSPC-PS
Guide 13.01

3rd Coat (Top Coat) - Acrylic Aliphatic Polyurethane applied at rate of -- 1.5 to 2.0
Mils DFT.
SSPC-PS
Guide 17.00
Type 5.

For factory painted items, Manufacturer/Fabricator shall provide touch-up paint in sufficient amount for Project. -- 5.0 Mils
DFT

G. Aluminum – Mill Finished

1st Coat - Aluminum metal primer -- 3.0 Mils DFT

2nd and 3rd Coats - Enamel gloss paint -- 2.0 Mils
DFT/each
Coat

sufficient amount for Project.

2.7 LETTERING (Inscriptions where applicable)

A. Use "Normal Block" letters on all inscriptions.

B. Inscriptions shall have letter heights as indicated below.

1. Gas Valve: On doors to gas control valve enclosures. (2"high)
2. (only as approved by the Owner/Architect's representative and as necessary in the NYC Building Code) - On stair enclosures, doors across corridors and doors between stairs and passages, there shall be painted on the lock stile on the side opposite the pull (both sides of double acting doors), and at the same height as the pull, a black panel full width of stile and 18" high on paneled doors and 5" wide on flush doors. The painting at top and bottom edge of plate shall be extended as is necessary in order to surround the hardware which otherwise will be partly in and partly out of painted area. These painted push plates shall terminate in straight edges.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verification of Conditions

1. The application of painter's finish to any surface shall be taken to indicate that the Contractor considers such surfaces suitable for a first-class finish.
2. Do not apply painter's finish in any locations until the Work of other Contractors that might damage the new finish is completed.
3. Notify the Owner/Architect's representative in writing regarding Work by others that does not provide a suitable surface for the new finish.
4. In case of dispute regarding the suitability of any surface, the Owner/Architect's representative's decision shall be final and conclusive upon all concerned.
5. Contractor shall check the compatibility of previously painted surface with the new coating by applying a test panel 4 foot wide x wall height. Allow test panel to dry thoroughly; verify proper adhesion before proceeding with painting Work.

3.2 PREPARATION AND APPLICATION - EXISTING BUILDING

A. Protection (where applicable)

1. In cases where the painting of surfaces does not involve the removal or disturbance of existing paint or the paint is not lead-based as determined by testing by the Owner/Architect's representative, the following protection requirements shall apply:
 - a. In each area to be painted, cover and protect furniture, equipment and floors from damage with clean cloths, heavy building paper or clean plastic covering secured in place. All protection is to be carefully removed, cleaned or discarded after painting is complete.

B. Surface Preparation

1. Gently wet mist the surface to be scraped with water, then remove all loose paint with scraper and putty knife.
2. Sand surfaces to dull sheen and gloss (where applicable). Before sanding, wet mist the area to be sanded. (Power sanding without a HEPA-filtered vacuum recovery system is not allowed).
3. Remove dust by washing with water, using damp sponge or cloth.
4. After washing, spot prime grease and water stains; magic markers marks, crayon marks, lipstick marks, etc; with a quick-drying alcohol base primer sealer to prevent bleeding.
5. Fill all cracks and holes with appropriate filler material, wet mist and sand flush with adjacent surfaces and spot prime. (Power sanding without a HEPA-filtered vacuum recovery system is not allowed).
6. Apply number of finish coats specified herein or as many as may be necessary to obtain the proper finish and completely cover the substrate.

3.3 PREPARATION

A. Protection

Cover or otherwise protect finished Work of other trades and surfaces not to be painted concurrently or not to be painted.

B. Surface Preparation

1. Perform preparation and cleaning procedures in accordance with the paint manufacturer's instructions and as specified.
 - a. Clean surfaces to be painted before applying paint or surface treatments. Remove oil and grease with clean cloths and cleaning solvents prior to other cleaning procedures. Program the cleaning and painting so that dust and other contaminants from the cleaning process will not fall on wet, newly painted surfaces.
2. Ferrous Metals (where applicable)
 - a. Remove dirt and grease with cleaning solvents that will not affect shop prime coat. Wipe off with clean cloths.
 - b. Remove rust, mill scale and defective paint down to bare metal, using scraper, sandpaper, or wire brush. Grind if necessary to remove shoulders at edge of sound paint to prevent flaws from photographing finish coats.

3. Galvanized Metal

- a. Remove dust and oil with mineral spirits and wipe dry with clean cloth. Repair welded and abraded surfaces with a 2 mil (dry) minimum thick coating of cold galvanizing compound in conformance with ASTM A780; comply with manufacturer's application instructions.
- b. Repair steel decks and cold-formed metal framing immediately following installation.
- c. For hot-dipped galvanized surfaces, allow 6 months of weathering prior to cleaning specified in a. above. Immediately before painting, roughen surface with course sandpaper. Zinc metallized surfaces do not require sanding.

C. Materials Preparation

1. Mix and prepare painting materials in accordance with the manufacturer's directions.
2. Stir materials before and during application to produce and maintain a mixture of uniform density. Do not stir any film that may form on the surface of materials into the material; remove the film and strain the material before using.
3. Thinning: Use only thinners recommended by the paint manufacturer and use only within the recommended or specified limits.

D. Moisture Meter Test

1. Do not apply initial coating until moisture content of surface is within limitations recommended by paint manufacturer.
2. Reading shall be approximately 8% on meter.
3. Test surfaces with moisture meter at various areas e.g.: Top, bottom and middle of wall, especially where piping occurs and at exterior walls, in the presence of the Architect's representative.
4. Moisture content shall be approved by the Owner/Architect's representative before any Work is started.

3.4 APPLICATION

A. General

1. No Work shall be performed where cement or plaster is being applied or is in the process of drying.
2. No Work shall be performed in spaces that are not broom clean and free of dust and waste.

3. Apply paint materials to produce smooth finished surfaces, free of brush or roller marks, drops, runs, or sags.
4. Paint materials shall be kept at a proper and uniform consistency.
5. Thin only when necessary to achieve best results.
6. Thinners shall be material recommended by manufacturer of paint, and in quantity as recommended.
7. Excessive use of thinner as indicated by variation in absorption, lack of "hide", thickness of dry film, mottled or streaky coat, shall be cause for rejection. Correct as directed.
8. Thinning of varnish or aluminum paint prohibited.
9. Apply all coats with brush or roller, varying slightly the color of succeeding coats. Spraying will not be permitted.
 - a. If recommended by manufacturer, 100% acrylic resin concrete block filler may be spray applied and shall be backrolled as necessary to work material into substrate surface.
10. Brush out or roll on first or prime coat; work well into surface.
11. Each coat shall be inspected, approved and dry before proceeding with additional coats.
12. (where applicable) Allow at least 48 hrs for enamels and exterior oil paint to dry.
13. The surfaces of interior woods and metals shall be sanded or rubbed between coats to assure smooth finish and proper adhesion of subsequent coats.
14. Avoid lapping of paint on glass, hardware, or other adjoining surfaces.
15. Apply no paint to operating units where sliding contact of metals is necessary for proper functioning of unit.
16. Painting is not required on walls or ceilings in concealed and inaccessible areas.
17. Moving parts of operating units will not require finish painting unless otherwise required.
18. Do not paint over any code-required labels, such as Underwriter's Laboratories and Factory Mutual, or any equipment identification, performance rating, name or nomenclature plate.
19. Finish doors (where applicable not being supplied with manufacturer's pre finish or veneer) on tops, bottoms and side edges same as exterior faces.

3.5 FIELD QUALITY CONTROL

- A. The Owner/Architect Representative reserves the right to require the following material testing procedures at any time, and any number of times during period of field painting:
1. Measurement of dry film thickness (DFT) by use of a dry film thickness gauge in accordance with use and calibration requirements of Structural Steel Painting Council [SSPC], "Method of Measurement of Dry Paint Thickness with Magnetic Gauges".
 2. Engage services of an independent testing laboratory, to sample paint being used. Samples of materials delivered to construction site will be taken, identified and sealed, and certified in presence of Contractor
 3. Testing laboratory will perform appropriate tests for any or all of the following characteristics: Abrasion resistance, apparent reflectivity, flexibility, washability, absorption, accelerated weathering, dry opacity, accelerated yellowness, recoating, skinning, color retention, alkali resistance and quantitative materials analysis.
 4. If test results show that material being used does not comply with specified requirements, Contractor shall be directed to stop painting Work, and remove non-complying paint; repaint surfaces coated with rejected paint; remove rejected paint from previously painted surfaces if, upon repainting with specified paint, the two coatings are non-compatible.
 - a. If the samples do not comply with requirements of the Specifications, costs of testing and remediation of rejected work shall be borne by Contractor.
 - b. If the tests find that the samples do comply with the requirements of the Specifications, the cost of the testing will be borne by the Owner.

3.6 CLEANING

A. General

Contractor shall clean-up behind each paint crew such that painting and clean-up will be a continuous uninterrupted operation. The practice of one general clean-up after completion of all painting will be strictly prohibited. This clean-up will include, but not be limited to the following:

1. Remove spots or defacement resulting from Work of this Section.
2. Retouch all damaged surfaces to leave Work in perfect finished condition.
3. If spots or defacement cannot be satisfactorily removed and retouched, re-finish the surfaces as directed.
4. Within the three foot work area created for removal and painting where existing paint is known or assumed to be lead-based all objects and surfaces shall be thoroughly HEPA vacuumed, wet-cleaned and HEPA vacuumed again. In rooms

where the ceiling has been painted all surfaces and objects in the room shall be cleaned in this manner.

5. The contractor shall ensure that the objects and surfaces under protective covering are free of any dust or debris created during painting activities. If necessary, these objects and surfaces shall be wet cleaned and HEPA vacuumed.
6. The contractor shall conduct any cleaning deemed necessary by the independent environmental consultant.
7. Free all operating units of painted materials and leave them clean and in proper working order.
8. Remove from premises all surplus paint materials, debris and any other rubbish resulting from the Work.
9. Leave storage space clean and in condition required for equivalent spaces in project.

3.7 PROTECTION

- A. Provide "Wet Paint" signs to protect newly-painted finishes. Remove temporary protective wrappings provided by others for protection of their Work after completion of painting operations.
- C. At the completion of Work of other trades, touch-up and restore all damaged or defaced painted surfaces as directed by the Architect's representative.

END OF SECTION 09 90 00

SECTION 23 05 12

GENERAL PROVISIONS FOR HVAC WORK

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

- A. This Section is coordinated with and complementary to the General Conditions and Supplementary General Conditions of the Work, wherever applicable to Mechanical Work.
- B. Section 01 31 46 - Special Requirements for Mechanical and Electrical Work shall apply.

1.2 DESCRIPTION OF WORK INCLUDED

A. Work Included:

- 1. The work includes providing all labor, materials, equipment, accessories, services and tests necessary to complete and make ready for operation by the Owner, all Heating, Ventilating, and Air Conditioning Work as shown on the Drawings and hereinafter specified, including, but not limited to the following:
 - a. All motor starters and controllers for equipment are furnished by this Contractor. Packaged type units shall be furnished completely prewired with panels mounted on the units as specified. All other motor starters and controllers will be turned over to the Electrical Contractor for installation and wiring.
 - b. Coils, pumps and controls.
 - c. Filters.
 - d. Humidifiers.
 - e. Fans.
 - f. Provide isolation valves where tying new piping into the existing system. Refer to the valve specifications for the proper valve type for the service. Refer to the Drawings for the pipe/valve size. In addition to the isolation valves at the tie-in points, also provide a balancing valve on the supply side for chilled water, chilled glycol/brine, condenser water, and heating/reheat hot water system tie-ins.
 - g. Hot water specialties such as expansion tanks, air vents, air separators, reducing and safety valves, etc.
 - h. Accessories such as V-belt drives, flow measuring devices, draft gauges, machinery guards, thermostats, pressure gauges.
 - i. Water treatment for chilled and hot water systems.
 - j. Inertia blocks and vibration isolation equipment.
 - k. Piping, fittings, and valves.
 - l. Sheet metal ductwork and accessories such as dampers, access doors, etc.
 - m. Registers, grilles and diffusers.
 - n. Fire dampers and smoke dampers.
 - o. Installation of smoke detectors in ductwork.
 - p. Acoustical duct lining.
 - q. Pipe, duct and equipment insulation.
 - r. Temperature Control: A complete system of temperature control shall be installed in connection with the HVAC systems, including all thermostats, control valves, damper motors and dampers for the outdoor air intakes and fan discharges. All

control wiring for automatic temperature controls, including interlocking wiring for fans, chillers, pumps, etc. by this Contractor.

- s. Painting and pipe, duct and equipment identification for all work by this Contractor is previously specified under "Special Requirements for Mechanical and Electrical Work".
- t. Test and balancing.
- u. Sleeves, pipe inserts and anchor bolts, escutcheons, prefabricated roof curbs, etc., as hereinafter specified.
- v. Identification, name plates, tags and charts.
- w. Cutting and rough patching.
- x. Furnishing and setting of electric motors.
- y. Furnishing of starters and motor control devices as specified under "Special Requirements for Mechanical and Electrical Work".
- z. Templates and anchor bolts for equipment bases.
- aa. Cap flashing for pipe and duct passing through roof.
- bb. Energy Management Building Automation System.
- cc. Concrete pads for all HVAC work.
- dd. All demolition work associated with HVAC systems.
- ee. Installation of fire and smoke dampers in the existing ductwork and fan systems.

1.3 WORK INCLUDED UNDER OTHER SECTIONS OF THE SPECIFICATIONS

- A. The following work is included under other Sections of the Specifications:
 - 1. Framed openings as shown on the Drawings.
 - 2. Outside air inlets, exhaust outlets, louvers, and screens through walls, and elsewhere as noted on the Drawings. Motorized dampers are furnished and installed under this Contract.
 - 3. Base flashing of curbs and sleeves at roofs.
 - 4. Power wiring for all motors except where otherwise noted.
 - 5. Setting of access doors furnished by this Contractor.
 - 6. All motor disconnect switches, except where in combination starters and where otherwise noted.
 - 7. Dunnage beams for cooling towers.
 - 8. Finish painting.
 - 9. Access doors in ceiling and walls.
 - 10. Finish patching.
 - 11. Fan shutdown system.
 - 12. Mounting of all starters, motor control centers, starter panelboards, and motor control devices: Division 26.
 - 13. Cooling tower electric pipe tracing: Division 26.

1.4 QUALITY ASSURANCE

- A. Perform work in accordance with quality established in Section 01 31 46 "Special Requirements for Mechanical and Electrical Work", and hereinafter specified. All work performed shall comply with local codes.

1.5 SUBMITTALS

- A. Submit shop drawings covering the following items:
 - 1. Coordination drawings.

2. Internal cleaning and treating of piping.
 3. Sleeve and ductwork penetration drawings.
 4. Identification schedule and samples.
 5. Air handling units.
 6. Air filters and draft gauges.
 7. Coils.
 8. Humidifiers.
 9. Heat exchangers.
 10. Expansion joints, anchors and guides, including details of installation.
 11. Schedule of ductwork, joints, gauges, supports, flexible connections, fire dampers, access doors, etc.
 12. Utility fans, centrifugal fans, and power roof ventilators and propeller fans.
 13. Sheet metal fabrication drawings.
 14. Schedule of piping and fitting materials.
 15. Piping shop drawings.
 16. Schedule of valves, strainers, vacuum breakers.
 17. Flow metering devices and systems.
 18. Thermometers and pressure gauges.
 19. Schedule of pipe and ductwork supports, including inserts, escutcheons, etc.
 20. Water pumps include pump curves.
 21. All motor starters, motor control devices and motor control centers.
 22. Cooling towers including sound criteria.
 23. Water treatment equipment and systems.
 24. Schedule of insulation types and samples of each type.
 25. Vibration isolation schedule including inertia block details.
 26. Templates for equipment bases.
 27. Acoustic material.
 28. Energy Management and Building Automation System.
 29. Air vents, air separators, water strainers, reducing and safety valves for water systems.
 30. Automatic Temperature Control System.
 31. Concrete pad locations and sizes.
- B. All shop drawings being submitted that include electrical work shall be submitted with all internal and external wiring diagrams.
- C. The previously listed items are major equipment and do not limit this Division's responsibility to submit shop drawings for all equipment and accessories which are to be provided under this Division of Specifications.

PART 2 - PRODUCTS

2.1 SPARE PARTS

- A. Chilled water, condenser water - For each pump listed, unless otherwise specified:
1. One set of rings.
 2. One set of bearings.
 3. One set of packing glands complete with rings, nuts and bolts.
 4. Three gaskets for the casing joint.
 5. Sufficient stuffing box packing for four packings.

Where pump specifications do not require packing glands or stuffing boxes, items #3 & 5 shall be omitted. Inline pumps w/stuffing box design, items #1 & 2 shall be omitted. Inline pumps with standard mechanical seal spaces listed above except item #4 shall be omitted.

- B. Filters:
 - 1. The Contractor shall furnish a minimum of two complete spare filter sets for the filters for all air handling and package AC units.
- C. Spare Lamps:
 - 1. Furnish ten (10) spare lamps for each size and type of lamp on instrument panels.
- D. Miscellaneous Spare Parts:
 - 1. Water column glasses shall be provided for each tank utilizing one.
 - 2. One complete set of gaskets shall be provided for each of the following pieces of equipment:
 - a. All manhole and handhole openings for the expansion tank and blow-down tank.
 - b. Converters (oil and hot water).
 - 3. Furnish one complete set of V-belts for each belt-driven unit installed.
 - 4. Electrical equipment - two spare starter fuses identified for each type and size for all starters including pumps, supply, return, and exhaust fan.
 - 5. One set of bearings properly identified for each type and size supply, return, and exhaust fan.
 - 6. For each type and size pump furnished under this section of the contract, furnish as applicable for each type and size of the pump, one set of wearing rings, one set of mechanical seals, one set of bearings, one set of shaft sleeves, one set of stuffing box bushings, one set of packing glands with rings, nuts, and bolts and sufficient stuffing box packing for four packings.
- E. Furnish tools required for equipment as follows:
 - 1. One set of high-grade tools as recommended and approved by the respective manufacturer for pumps, fans, refrigeration equipment, and other equipment. Tools shall be furnished in a suitable hardwood or other approved container with a lock and two (2) keys. Pasted on the inside cover shall be a list of all tools provided in the container.
 - 2. One pressure grease gun of approved design and size, complete with necessary adaptors to fit all lubricating fittings on installed equipment.
 - 3. One pitot tube, complete with required manometers, to read static pressure and velocity pressure simultaneously. Provide 6'-0" rubber tubing.

2.2 LIST OF MANUFACTURERS

- A. The manufacturer's name appearing first on this list is the manufacturer the project design was based upon. However, the additional manufacturers listed herein are also acceptable with the provision that they meet the requirements of these Specifications, ratings, and/or space allocations listed in the Specifications or shown on the Drawings.
 - 1. Water Pumps
 - a. Bell & Gossett
 - b. Weinman
 - c. Goulds
 - d. Paco
 - e. Grundfos

- f. Patterson
 - g. Armstrong
 - h. Taco
 - i. or approved equal
 2. Air Conditioning Units
 - a. Coolbreeze
 - b. Venmar
 - c. York
 - d. Trane
 - e. Carrier
 - f. Envirotech
 - g. or approved equal
3. Diffuser Section for Air Handling Units
 - a. American Air Filter
 - b. Cambridge
 - c. York
 - d. or approved equal
4. Air Filters
 - a. American Air Filter
 - b. Camfill Farr
 - c. Cambridge
 - d. or approved equal
5. Draft Gauges
 - a. Dwyer
 - b. or approved equal
6. Louvers & Dampers
 - a. Greenheck
 - b. Ruskin
 - c. Titus
 - d. or approved equal
7. Expansion Tanks & Flash Tanks
 - a. Amtrol
 - b. Bell & Gossett
 - c. Adamson
 - d. Buffalo
 - e. or approved equal
8. Water Specialties
 - a. Bell & Gossett
 - b. Taco
 - c. Armstrong
 - d. or approved equal
9. Thermometers & Pressure Gauges
 - a. Ashcroft
 - b. Weiss Instruments
 - c. or as specified in Section 23 05 80
10. Motors
 - a. Toshiba
 - b. General Electric
 - c. Westinghouse
 - d. Allis Chalmers

- e. or approved equal
- 11. Starters, Motor Control Centers, Switches
 - a. Allen Bradley / Rockwell
 - b. Square D
 - c. General Electric
 - d. Westinghouse
 - e. Cutler-Hammer
 - f. or approved equal
- 12. Valves
 - a. Milwaukee Valve
 - b. Crane
 - c. Hammond Valve
 - d. or as specified under paragraph on "Valves".
- 13. Insulation and Acoustic Lining
 - a. Owens-Corning Fiberglass Corp.
 - b. CSG Snap-on
 - c. Johns Manville
 - d. or approved equal
- 14. Vibration Isolation
 - a. VMC East
 - b. Mason Industries
 - c. Korfund Corp
 - d. or approved equal
- 15. Automatic Temperature Controls
 - a. Distech Controls
- 16. Water Treatment
 - a. Heating Economy Services, Co., Inc.
 - b. Astro Pak Corp.
 - c. Okite Chemical Corp.
 - d. Drew Chemical Corp.
- 17. Product Refrigeration
 - a. Dunham-Bush
 - b. or approved equal
- 18. Internal Cleaning & Treating of Piping
 - a. Heating Economy Services Co., Inc.
 - b. Tower Water Management
 - c. The Metro Group, Inc.
 - d. Drew Chemical Co.

PART 3 - EXECUTION (NOT APPLICABLE)

END OF SECTION 23 05 12

SECTION 23 05 23

VALVES FOR HVAC

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

- A. This Section is coordinated with and complementary to the General Conditions and Supplementary General Conditions of the Work, wherever applicable to Mechanical Work.
- B. Section 01 31 46 - Special Requirements for Mechanical and Electrical Work shall apply.
- C. Section 23 20 00 – Piping for HVAC.

1.2 DESCRIPTION OF WORK

- A. The work includes the providing of all labor, materials, equipment, accessories, services and tests necessary to complete and make ready for operation by the Owner, all Valves as shown on the drawings and hereinafter specified.

1.3 QUALITY ASSURANCE

- A. "Manufacturers" - Firms regularly engaged in the manufacture of valves, whose products have been in satisfactory use in similar service for not less than 10 years.
- B. Provide valves produced by the manufacturers, which are listed in Section 23 05 12, "Approved Manufacturer's List".
- C. Provide valves whose performance under specified conditions, is certified by the manufacturer.
- D. To assure uniformity and compatibility, all grooved end valves and adjoining couplings shall be supplied by a single manufacturer.

1.4 SUBMITTALS

- A. Refer to Section 01 31 46 - Special Requirements for Mechanical and Electrical Work and submit shop drawings.

1.5 GUARANTEE

- A. Refer to Section 01 31 46 - Special Requirements for Mechanical and Electrical Work.

PART 2 - PRODUCTS

2.1 VALVES

- A. Valves- General: All valves shall be of a design which the manufacturer lists for the service and shall be of materials allowed by the latest edition of the ASME Code for pressure piping for the

pressure and temperature contemplated, unless a higher grade or quality is herein specified. All valves of the same type shall be of the same manufacturer, except for special applications.

- B. The system shall be supplied with valves in all branch mains and risers, at all pumps, tanks, reducing and control valves, heating and cooling surfaces, and at all apparatus; so located, arranged, and operated as to give complete shut-off. Except where flanged valves are used, each connection to the equipment shall be made with screwed unions, flanged unions, or grooved couplings on the equipment or discharge side of the valve.
- C. All valves shall be installed and arranged so that they are easily accessible.
- D. Each valve shall have the maker's name or brand, the figure or list number, and the guaranteed working pressure cast on the body or stamped on the bonnet or shall be provided with other means of easy identification.
- E. Provide valve stem handle extensions on all ball valves and/or butterfly valves, where insulated, when insulation thickness would otherwise cause the insulation to be damaged as a result of the 90-degree handle movement.
- F. Check valves installed in the horizontal position shall be swing checks; valves installed in the vertical position shall be silent checks for 2½" and above, and lift checks for 2" and smaller, except that all check valves in pump discharges shall be silent checks.
- G. Provide isolation valves where tying new piping into the existing system. Refer to the valve specifications for the proper valve type for the service. Refer to the Drawings for the pipe/valve size. In addition to the isolation valves at the tie-in points, also provide a balancing valve on the supply side for chilled water, chilled glycol/brine, condenser water, and heating/reheat hot water system tie-ins.
- H. Provide capped blow-off valves at all strainers, and where shown on the Drawings.
- I. Provide valve operating chains on all gate, globe, butterfly, and plug valves in Mechanical Equipment Rooms - 4" and larger, which are more than 7'-0" above the operating floor. Unit shall be complete with adjustable sprocket, chain and guide (Crane "Babbit" type). Provide hook to keep chain out of the way.
- J. Generally, all valves are to be of the gate type, except that globe valves shall be used for balancing service, throttling services and on traps, and pressure reducing and control valve bypasses. Globe valves used on bypasses shall have monel metal mountings. Pumps shall have globe type balancing flow measuring & shut off valves on discharge piping.
- K. All valves 2 inches in diameter and smaller shall be all bronze with bronze bodies. Valves 2½ inches in diameter and larger shall have iron bodies with bronze mountings (except where otherwise noted).
- L. All flanged-end valves shall have renewable metal seat rings and discs. On gate valves these parts shall be of bronze, on all globe valves they shall be of bronze and suitable for throttling service.
- M. Grooved-end valves may be used in lieu of threaded, flanged, lug or wafer valves, if and where grooved end piping is used. All grooved-end valves shall be complete with grooved ends for use

with mechanical couplings of the same manufacturer. Valve sealing elastomer shall be of the same composition as the adjoining coupling gaskets.

1. Grooved End Butterfly Valves:
 - a. 2"-12": ASTM A395 and A536 ductile iron body and disc, with integrally cast stem. Disc shall be nickel-plated. Body coated with Black enamel. Victaulic Vic-300 MasterSeal™.
 - b. 14"-24": ASTM A395 and A536 ductile iron body and disc. Disc and body PPS coated. Mounted elastomer seal with stainless steel stem. Victaulic Series-Victaulic Vic-300 AGS (300 psi max).
 - c. 2-1/2"-6": Copper tube dimensioned bronze body, EPDM encapsulated ductile iron disc, integrally cast stem. Victaulic Series 608.
2. Grooved end check valves shall be ASTM A395 and A536 ductile iron body, with stainless steel spring and shaft. Victaulic Series 716H and 716.
 - a. 2" - 3": Ductile iron body with stainless steel disc, mounted elastomer seal, and nickel-plated seat.
 - b. 4"-12": Black enamel coated ductile iron body, elastomer encapsulated ductile iron disc, with welded-in nickel seat.
 - c. 14"-24": ASTM A395 ductile iron body, stainless steel disc, spring, and shaft, EPDM seat bonded to the valve body, AGS grooved ends. Victaulic Series W715.

- N. All screwed-end globe valves shall be of the union bonnet type with renewable Teflon discs.
- O. All valves shall have their bonnets back seated to provide for packing under pressure. All gate valves shall be of the solid tapered wedge type.
- P. Drain valves shall be provided on tanks, receivers, risers, and where they may be required or necessary, for draining the lines and equipment. Drain valves or plug cocks shall be provided at the low points for proper drainage. Cocks and valves shall be provided with threaded ends for those connections.
- Q. All valves up to 2 inches in diameter shall have screw ends, 2½ inches in diameter and over shall have flanged ends. Valves 2½" and larger which are non-rising stem, shall have position indicators.
- R. All bronze and iron valves shall be furnished with Teflon impregnated packing.
- S. All handwheels shall be of malleable iron.
- T. No Asbestos shall be used in construction of valves including the gaskets.
- U. All valves shall be of type and number as specified below: For all services, except as otherwise noted.

<u>TYPE</u>	<u>SIZE</u>	<u>NIBCO NO.</u>	<u>CRANE NO.</u>	<u>VICTAULI C NO.</u>	<u>HAMMON D NO</u>	<u>MILWAUK EE NO.</u>	<u>ABZ No.</u>	<u>REMARKS</u>
Gate Valve	2" & Smaller	T-134	428UB		IB629	1151		150 lb. WSP, Bronze
	2 ½" & Larger	F-617-O	465 ½		IR1140HI	F2885M		Rising Stem 125 lb. WSP, Bronze Trimmed, Iron Body, OS&Y
Globe Valve	2" & Smaller	T-275Y (Teflon) T275-B (Steam) T276-AP (SS Full-Plug)	14 ½ P	786 787 78K	IB444	572 593A		300 lb WSP, Bronze
	2 ½" & Larger	F-718B	351	788 789	IR116	F2981M		125 lb, WSP, Bronze Trimmed, Iron Body OS&Y
Angle Valve	2" & Smaller	T375-Y (Teflon) T375-B (Steam) T376-AP (SS Full-Plug)	16 ½		IB454T	582		300 lb. WSP, Bronze
	2 ½" & Larger	F-818-B	353					125 lb. WSP, Bronze Trimmed, Iron Body, OS&Y
Butterfly Valve (High Performance)	2 ½" & Larger	LCS-6822 LCS-7822		Vic-300 MasterSeal Vic-300 AGS	HP1LCS42 12 HP1LCS42 13	HP1LCS421 2 HP1LCS421 3	400 Series	300 psi Grooved DI, EPDM 285 psi Lug, DI, SS Disc, EPDM
Swing Check	2" & Smaller	T-433-Y	137	789	IB946	515	900	150 lb WSP, Bronze
	2 ½" & Larger	F-918-B	373	712	IR1124HI	F2974M	900	125 lb WSP, Bronze Trimmed, Iron Body

<u>TYPE</u>	<u>SIZE</u>	<u>NIBCO NO.</u>	<u>CRANE NO.</u>	<u>VICTAULI C NO.</u>	<u>HAMMON D NO</u>	<u>MILWAUK EE NO.</u>	<u>ABZ No.</u>	<u>REMARKS</u>
Silent Check	All Sizes	F-910 / w-910 (CI) G-920-W (DI)	-----	716 716H W715	IR9253 IR9354	1400 1800	900	Williams-Hager Fig. 636, 125 WSP Semi-steel.
Drain Valves	2" & Smaller	T-113-HC	451					200 lb. OWG, Non- rising stem, Hose end, Bronze with Bronze Cap & Chain
Blow-Off Valves	2" & Smaller	T-585-70-HC (Ball) T-174-A (Gate)	----		8501H (Ball) IB652 (Gate)	BA100H (Ball) 1182 (Gate)		300 lb. WSP, Bronze Y-Type
Strainers	2" & Smaller	T-221/222-A						125 lb, WSP, Bronze
	2 ½" & Larger	T-751-A F-721-A		730 W730 732 W732				250 lb, WSP, Iron Body, 125 lb, WSP, Iron Body

2.2 VALVES IN COPPER TUBING

A. Except where otherwise noted, all valves for use with copper tubing shall be as follows

<u>TYPE</u>	<u>SIZE</u>	<u>NIBCO NO</u>	<u>CRANE NO</u>	<u>VICTAULI C NO</u>	<u>HAMMOND NO</u>	<u>MILWAUK EE NO</u>	<u>REMARKS</u>
Gate Valve	2" & Smaller	S-111	1320	----	IB635	149	125 lb. WSP, Bronze
	3" & Smaller	S-134	----	----	IB648	1169	300 lb. Non-Shock
	2 ½" & Larger	F-617-O	428	----	IR1140HI	F2885M	125 lb, WSP, Bronze trimmed, rion body, OS&Y

<u>TYPE</u>	<u>SIZE</u>	<u>NIBCO</u> <u>NO</u>	<u>CRANE</u> <u>NO</u>	<u>VICTAULI</u> <u>C</u> <u>NO</u>	<u>HAMMOND</u> <u>NO</u>	<u>MILWAUK</u> <u>EE</u> <u>NO</u>	<u>REMARKS</u>
Globe Valve	2" & Smaller	S-211-Y	1310	----	IB418	1502	125 lb WSP, bronze
	3" & Smaller	S-235-Y	----	----	IB423	1590T	300 lb. Non-shock CW Bronze with solder joint adapter
	2 ½" & Larger	F-718-B	14 ½ P	----	IR116HI	F2981M	125 lb. WSP, bronze trimmed, iron body OS&Y
Angle Valve	2" & Smaller	S-311-Y	1311	----	IB463	504	125 lb WSP, Bronze with solder joint adapter
	3" & Smaller	S-335-Y	----	----	IB454T	595T	300 lb. Non-shock CW Bronze with solder joint adapter
	2 ½" & Larger	F-818-B	16 ½ P	----			125 lb WSP, bronze trimmed, iron body OS&Y
Swing Check	2" & Smaller	S-413-B	1303	----	IB912	1509	125 lb WSP, Bronze
	3" & Smaller	S-433-B	----	----	IB945	1515	300 lb Non-shock CW Bronze with solder joint adapter
	2 ½" & Larger	F-918-B	34	----	IR1124HI	F2974M	125 lb WSP, bronze trimmed, iron body
Balancing Valves	½" to 2"		Tour and Anderson	786 787 78K			125 lb, WSP, bronze body, globe style, integral test, point, thrd or swt.
	2 ½" to 12"						125 lb. WSP, iron body, non-rising stem, flg or grv

2.3 REFRIGERANT VALVES

- A. All refrigerant valves shall be silver brazed joint as follows:
1. Globe Valves - 1/8" O.D. and smaller: packless, Henry type 626; 1/8" O.D. and larger: packed, wing cap, Henry type 203.
 2. Angle Valves - 1/8" O.D. and smaller: packless, Henry type 647 and 642; 1/8" O.D. and larger: packed, wing cap, Henry type 216.
 3. Check Valves - 7/8" O.D. and smaller: brass, Henry type 116A; 1/8" O.D. and larger: bronze, Henry type 205.
 4. Charging and Purging Valves - Line valve, Henry type 623; angle valve, Henry type 643.
 5. Relief Valves - Angle type, brass, Henry type 52.
 6. Gate Valves - All sizes: Globe Valves.

2.4 LUBRICATED PLUG VALVES

- A. Full port opening tapered plug suitable for lubrication under service pressure with plug in any position.

- B. Lubricating Guns:
 - 1. One for every 10 valves.
 - 2. Extra heavy, lever type, hydraulic handgun.
 - 3. 15,000 psi gauge and 12" long connection hose.
- C. Lubricant:
 - 1. Manufacturer's recommendations.
 - 2. One year supply, each valve.
- D. Operators:
 - 1. 4" with wrench, except as noted.
 - 2. Wrench set for each size valve.
 - 3. Wrench for every 10 valves, each size
 - 4. 6" and larger: gear operated.
 - 5. Permanently installed handwheel.

2.5 VALVE CONSTRUCTION

- A. Piping 100 psi to 250 psi: ANSI Class 150, carbon steel.
 - 1. 4" and larger: flanged, ANSI Class 150 rated.
- B. Piping over 250 psi: ANSI Class 300, carbon steel body.
 - 1. Up to 2": screwed
 - 2. 2½" and larger: flanged, ANSI Class 300 rated.

2.6 BALANCING VALVES

- A. All balancing valves shall be combination balancing, flow measuring and shut-off valves. Valves shall be globe-style design and shall have a position indicator and memory stop or locking device so that the valve can be closed without disturbing the setting and returned to the balanced position without further adjustment.
- B. Valves shall be manufactured by Tour and Andersson, Inc. or approved equal.
- C. Nominal working pressure for the valves shall be 250 psig or greater at 250F.
- D. Provide portable flow measuring instruments which shall be turned over to the Owner at the completion of work.
- E. Butterfly valves can be used for only shutoff valves and shall not be used for balancing.
- F. Coil Hook-Up Assembly: Install with Tour & Andersson balancing valves 2" and smaller, Victaulic Series 799 or 79V Koil-Kit™ to complete terminal hookup at coil outlet and to reduce space requirements. Assembly shall consist of Victaulic Series 78U union port fitting, Series 78Y strainer/ball valve or Series 78T union/ball valve combination and flexible hoses.

2.7 BALL VALVES

- A. Ball Valves up to 2½" may be used for all water services as an alternative to gate valves.

- B. Ball valves shall be bronze body, bronze ball and stem, Teflon seats and seals threaded ends, 400 psig cold W.O.G. Worchester No. 411T-SE or equal. "APOLLO" 70 - 100 Series.
- C. Provide valve stem handle extensions per para. 2.01.

2.8 HIGH-PERFORMANCE BUTTERFLY VALVES

- A. Butterfly valves may be used for as an alternative to gate valves for sizes 2½" and above for chilled water, and condenser water only.
- B. Valves shall be similar to Milwaukee HP1LCS (ANSI Class 150) or Fig. HP3LCS (ANSI Class 300) lug type body; or similar to NIBCO Fig. # LCS6822 (ANSI Class 150) or NIBCO Fig. # LCS7822 (ANSI Class 300). Butterfly valves shall not be directly connected to equipment without a spool piece. All valves shall be capable of bi-directional dead-end service.
- C. Valves in insulated piping shall have necks extending 2" above the flange to accommodate the full thickness of insulation.
- D. Operators:
 - 1. Valves to 4" shall have lever operators with 10 locking positions and adjustable memory stops.
 - 2. Valves larger than 4" shall be equipped with manual hand-wheel gear operators.
 - 3. In Mechanical Equipment Rooms, provide chain wheel operators on all valves located at or above 7'-0" AFF.
- E. Bodies: Shall be A216-WCB carbon steel lug style.
- F. Stems: Shall be 17-4PH stainless steel for maximum strength and corrosion resistance and must be blown out.
- G. Discs: This shall be 316 stainless steel and double offset for tight shutoff, ease of operation, and maximum seat life.
- H. Seats: Shall be of reinforced PTFE and held in place by bolted-on seat retainers to assure bi-directional dead-end service. Seats retained by spring clips are not acceptable.
- I. Shaft Bushings: Shall be PTFE-impregnated 316 stainless steels on either side of the disc.
- J. Packing: Shall be underneath drawn design to allow direct mounting of actuators eliminating brackets and couplings. Packing shall be a stack of multiple PTFE rings.
- K. Factory Test Pressure: 120% of above working pressures.
- L. Dead End Test: 100% of above working pressures.
- M. Where high performance butterfly valves are used in piping with mechanical couplings (Victaulic, etc.), provide transition fittings from grooved couplings to flanges.
- N. Provide valve stem handle extensions per para. 2.01.

PART 3 - EXECUTION

3.1 INSPECTION

- A. The contractor shall examine the location where valves are to be installed determine space conditions and notify the architect in writing of conditions determined for proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install valves were shown or specified, in accordance with manufacturer's written instructions, and with recognized industry practices, to ensure that valves comply with requirements and serve intended purposes.
- B. Install a manually operated bypass globe valve around all control valves (motorized or self-contained regulators).¹
- C. The contractor is responsible for the final valve orientation. Valves shall be installed in such a manner to avoid leakage through their stem seals, while still orienting valve handles to provide suitable accessibility and operability. Valve orientation shall be in compliance with the valve manufacturer's installation instructions. Valve handle orientation shall be indicated on the piping shop drawings. Valves orientation and handles not shown on the piping shop drawings will be subject to possible removal and reorientation in the field based on the Engineer's observations following the completion of construction.
- D. Provide chain operators on all isolation valves located in mechanical rooms where the valve is more than 7 feet above the operating floor. Provide hook on nearest wall or column to tie back chain.
- E. Coordinate with other work as necessary to prevent interference of valves with other components of systems.

3.3 FIELD QUALITY CONTROL

- A. Upon completion of installation of valves, test valves to demonstrate compliance with requirements. When possible, the field corrects malfunctioning valves, then retest to demonstrate compliance. Replace units that cannot be satisfactorily corrected.

END OF SECTION 23 05 23

SECTION 23 05 48

VIBRATION ISOLATION

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

- A. This Section is coordinated with and complementary to the General Conditions and Supplementary General Conditions of the Work, wherever applicable to Mechanical Work.
- B. Section 01 31 46 - Special Requirements for Mechanical and Electrical Work shall apply.

1.2 DESCRIPTION OF WORK

- A. The Work includes providing all labor, materials, equipment, accessories, services and tests to complete and make ready for operation by the Owner, all vibration isolations as shown on the Drawings and hereinafter specified.

1.3 QUALITY ASSURANCE

- A. Firms regularly engaged in the manufacture of this equipment with characteristics and capacities required, whose products have been in satisfactory use in similar service for not less than ten (10) years.
- B. Provide products produced by the manufacturers which are listed in Section 23 05 12, "Approved Manufacturer's List".
- C. Provide equipment whose performance under specified conditions is certified by the manufacturer.

1.4 SUBMITTALS

- A. Refer to Section 01 31 46 - Special Requirements for Mechanical and Electrical Work and submit shop drawings.

1.5 COORDINATION

- A. Refer to Section 01 31 46 - Special Requirements for Mechanical and Electrical Work.

1.6 GUARANTEE

- A. Refer to Section 01 31 46 - Special Requirements for Mechanical and Electrical Work.

1.7 TECHNICAL REQUIREMENTS

- A. All mechanical equipment shall be mounted in accordance with the specifications below and for the specific requirements shown in the equipment schedule.

- B. The isolation manufacturer shall supply all unit isolators, complete rails, fan and motor bases and structural steel forms for concrete inertia blocks, where called for and shall be responsible for the selection of all vibration eliminators and shall guarantee to meet the requirements of these Specifications.
- C. Wherever rotational speed is mentioned as the disturbing frequency, the lowest such speed in the system shall be used. All isolation devices shall be selected for uniform static deflections according to distribution of weight. Lateral motion of all isolators shall be ¼" maximum during start-up and shut-down.
- D. All metal parts and hardware on outdoor isolators shall be constructed of Type 304 stainless steel. Galvanized, zinc-coated and painted steel will be rejected.
- E. Isolators shall be equipped with limit stops to resist wind velocity.
- F. All fan units and air handling units (except fans with wheels under 27") shall be isolated as follows:
 - 1. Up to 450 RPM: 75% efficiency (3½" maximum deflection)
 - 2. 450 RPM to 850 RPM: 90%
 - 3. 850 RPM and over: 95%
- G. Submittals shall show disturbing frequency, required efficiency, designed deflection and outside diameter of springs, when pertinent.
- H. Weight of concrete inertia blocks shall be as follows:
 - 1. Fans and air handling units (up to 5" s.p.) driven by 75 HP and larger motors: 1½ times the weight of equipment.
 - 2. High-pressure fans and air handling units (5" s.p. and over) driven by 30 HP motors: 1½ times weight of equipment.
 - 3. High-pressure fans (5" s.p. and over) driven by 75 HP and larger motors: 2 times weight of equipment.
- I. All horizontal pipes run within the mechanical equipment room area, but not less than 50 feet from connected equipment shall be isolated from the building structure by means of units designed for insertion in rods.

PART 2 - PRODUCTS

2.1 VIBRATION ISOLATION

- A. Mountings:
 - 1. Type A:
 - a. Double deflection neoprene mountings shall have a minimum static deflection of 0.35. All metal surfaces shall be neoprene covered to avoid corrosion and have friction pads both top and bottom, so they need not be bolted to the floor.
 - b. Bolt holes shall be provided for those areas where bolting is required. On equipment such as small vent sets and close coupled pumps, steel rails shall be used above the mounts to compensate for the overhang.
 - c. Manufacturer/Type:

Mason Industries, Inc.: ND or Rails RND
Vibration Eliminator Co.: T44 or D-Rails

2. Type B:
 - a. Spring isolators shall be free-standing and laterally stable without any housing and complete with 3" neoprene acoustical friction pads between the base plate and the support. All mountings shall have levelled bolts that must be rigidly bolted to the equipment.
 - b. Spring diameters shall be no less than 0.8 of the compressed height of the spring at rated load. Springs shall have a minimum additional travel to solid equal to 50% of the rated deflection.
 - c. Submittals shall include spring diameters, deflections, compressed spring height and solid spring height.
 - d. Manufacturer/Type:

Mason Industries, Inc.: SLFH, on rails type ICS
Vibration Eliminator Co. OSK
3. Type C:
 - a. Equipment with operating weight different from the installed weight such as chillers, boilers, etc., and equipment exposed to the wind such as cooling towers, shall be mounted on spring mountings as described under Type "B" of this paragraph, but a housing shall be used that includes vertical resilient limit stops to prevent spring extension when weight is removed. The housing shall serve as blocking during erection and cooling tower mounts shall be located between the supporting steel and roof or the grillage and dunnage. The installed and operating heights shall be the same. A minimum clearance of 1/2" shall be maintained around restraining bolts and between the housing and the spring so as not to interfere with the spring action. Limit stops shall be out of contact during normal operation. Mountings used out of doors shall be hot-dipped galvanized.
 - b. Manufacturer/Type:

Mason Industries, Inc. SLR
Vibration Eliminator Co. KW
4. Type D:
 - a. Vibration hangers shall contain a steel spring and a double deflection neoprene element in series. Neoprene elements shall have a minimum deflection of 0.35". The neoprene element shall be molded with a rod isolation bushing that passes through the hanger box. Springs shall have a minimum additional travel to solid equal to 50% of the rated deflection and be seated in a neoprene cup with an integral molded bushing that passes through the lower hanger box.
 - b. Manufacturer/Type:

Mason Industries, Inc. DNHS
Vibration Eliminator Co. SNRC
5. Type E:
 - a. Vibration hangers shall be as described under Type "D" of this paragraph, but they shall be pre-compressed to the rated deflection so as to keep the piping or equipment at a fixed elevation during installation. The hangers shall be designed with a release mechanism to free the spring after installation is complete and the hanger subjected to its full load. Deflection shall be clearly indicated by means of a scale.

Submittals shall include an isolation layout hanger drawing showing the proper location of each isolator, tagging its actual loading.

- b. Manufacturer/Type:
Mason Industries, Inc. PCDNHS
Vibration Eliminator Co. PR

6. Type F:

- a. Vibration hangers shall contain a double deflection neoprene element manufactured as an integral part of the element design to prevent short circuiting of the rod as it penetrates the housing body. Minimum static deflection shall be .35".
- b. Manufacturer/Type:
Mason Industries, Inc. HD
Vibration Eliminator Co. SNC

7. Type DE:

- a. Elastomer hanger rod isolators shall incorporate the following:
- 1) Molded unit type neoprene elements with projecting bushing, lining rod clearance hole.
 - 2) Neoprene element to be minimum 1³/₄" thick.
 - 3) Steel retainer box encasing neoprene mounting.
 - 4) Clearance between mounting hanger rod and neoprene bushing shall be minimum of 1/8".
 - 5) Minimum static deflection of 0.35".
- b. Mason Type HD or approved equal.

B. Bases:

1. Type G:

- a. The vibration isolator manufacturer shall furnish integral structural steel bases for both driver and driven machines.
- b. Bases shall be rectangular in shape for all equipment other than centrifugal refrigeration machines and pump bases which may be "tee" or "L" shaped. Pump bases for split case pumps shall include support for suction and discharge base ells. All perimeter members shall be WF beams with a minimum depth equal to 1/10th of the longest dimension of the base. Beam depth need not exceed 14" provided that the deflection and misalignment is kept within acceptable limits as determined by the manufacturer. Height-saving brackets shall be employed in all mounting locations to provide a base clearance of one inch.
- c. Bases shall be WF bases as manufactured by Mason Industries, Inc. or approved equal.

2. Type H:

- a. Vibration isolator manufacturer shall provide steel members welded to height-saving brackets to cradle machines having legs or bases that do not require a complete supplementary base.
- b. Members shall be sufficiently rigid to prevent strains in the equipment.
- c. Inverted saddles shall be ICS as manufactured by Mason Industries, Inc. or approved equal.

3. Type J:

- a. The vibration isolator manufacturer shall furnish structural channel concrete forms for floating foundations.
- b. Bases for split case pumps shall be large enough to provide support for suction and discharge base ells. The base depth shall be a minimum of 1/10th of the longest span, but not less than 6" or greater than 14". Forms shall include minimum

concrete reinforcement consisting of ½ on 6" centers running both ways a layer 1½" above the bottom and a top layer of reinforcing steel as above for all bases exceeding 120" in one direction. Isolators shall be set into pocket housings which are an integral part of the base construction and set at the proper height to maintain a 1" clearance below the base. Bases shall be furnished with templates and anchor bolt sleeves as part of this system.

- c. Manufacturer/Type:
 - Mason Industries, Inc. KIPWF
 - Vibration Eliminator Co. SN Frames

4. Type Y:

- a. Rooftop packaged air handling units shall be installed on a spring-supported isolation curb which shall combine the manufacturer's curb and the isolation base into one assembly. The system shall be designed with 1", 2" or 3" static deflection steel springs which are both adjustable, removable and interchangeable after the rooftop unit has been installed. The system shall maintain the same operating and installed height both with and without the equipment load and shall be fully restrained during wind load conditions allowing no more than ¼" motion in any direction. The isolation curb shall be designed to accept and utilize outer placement of standard 2" roof insulation to act as a sound attenuation system for the inside of the curb. The entire unit shall become an integral part of the membrane waterproofing. The entire assembly shall be dry galvanized, or PVC coated. The isolation curb shall be model P-6000 as manufactured by Mason Berger East. Options for the system include an elevation kit model EK-1 and a sound barrier pack framing kit complete with offset plenum for lightweight roof deck areas model SBC-3. Note: Where this option is utilized, General Contractor is to furnish and install sound barrier material.

- b. Manufacturer/Type:
 - Mason Industries, Inc.: Model P-6000
 - Vibration Eliminator Co.:

5. Type R:

- a. Rooftop fans, condensing units, exterior ducted air handling units, etc. shall be installed on continuous equipment support piers which shall combine a regular equipment support and an isolation system into one assembly. The system shall be designed with 1", 2" or 3" static deflection steel springs which are both adjustable, removable and interchangeable after equipment has been installed. The system shall maintain the same operating and installed height both with and without the equipment load and shall be fully restrained during wind load conditions allowing no more than ¼" motion in any direction. The isolation pier shall be designed to accept 2" rigid insulation and to be an integral part of the membrane waterproofing. The entire assembly shall be dry galvanized or plastic coated. The isolation rail pier system shall be model R-7000 as manufactured by Mason Berger East, Inc.

- b. Manufacturer/Type:
 - Mason Industries, Inc. R-7000
 - Vibration Eliminator Co.

C. ISOLATION SCHEDULE:

Vibration Eliminator Specification		
Type for Equipment Location:		
Type of Equipment	With No Occupied or Unoccupied Spaces Below	Above Occupied or Unoccupied Spaces
Self-Contained Air Conditioning Units	Type A (0.4" deflection)	Type B (1.0" deflection)
Air Cooled Condensers (Roof Mounted)		Type R (2.0" deflection)
Refrigeration Reciprocating Compressors, Condensing Units or Chillers	Type A (0.4" deflection)	Type B (1.0" deflection)
Cooling Towers	Type A (1.0" deflection)	Type C (3.0" deflection)
Pumps:		
Through 15 HP	Type A (Rail Type) (0.4" deflection)	Type B (Rail Type) (1.0" deflection)
20 HP thru 30 HP	Type G-B (0.4" deflection)	Type G-B (1.0" deflection)
40 HP and over	Type J-B (1.0" deflection)	Type J-B (2.0" deflection)
Factory Assembled, Air Handling Equipment:		
Floor Mounted Units	Type B (1.0" deflection)	Type B (2.0" deflection above 600 rpm)
		Type B-H (2.5" deflection below 600 rpm)
Class I Fans (Arrangement 1 & 3)		
Floor Mounted:	Type B-G (1.0" deflection)	Type B-G (2.0" deflection above 600 rpm)
		(3.0" deflection below 600 rpm)
		(4.0" deflection below 400 rpm)
Suspended:	Type F (1.5" deflection)	Type F (2.0" deflection)
Class I Fans (Arrangement 9)		
Floor Mounted:	Type B (1.0" deflection)	Type B (2.0" deflection)
Suspended:	Type F (1.5" deflection)	Type F (2.0" deflection)
Class II and III Fans	Type B-J (1.0" deflection)	Type B-J (2.0" deflection above 600 rpm)
		(3.0" deflection below 600 rpm)
		(4.0" deflection below 400 rpm)
Outdoor Fan (Arrangement 9 & 10)		
Utility Fans:		Type R (2.0" deflection)
Rooftop Package AC & AHU		Type Y (3.0" deflection)

Vibration Eliminator Specification		
Type for Equipment Location:		
Type of Equipment	With No Occupied or Unoccupied Spaces Below	Above Occupied or Unoccupied Spaces
Piping in Boiler or Mechanical Equipment Rms.	See Spec. Text	See Spec. Text
High Pressure Ductwork in Mechanical Equipment Rms.	Type F	Type F

2.2 FLEXIBLE CONNECTIONS

- A. Provide a flexible pipe connector at pumps, chillers, and other vibrating equipment.
- B. Flexible connector shall be:
 1. Manufacturer of nylon tire cord and EPDM, both molded and cured with hydraulic presses.
 2. Straight connectors to have two spheres reinforced with a mold-in external ductile iron ring between spheres.
 3. The elbow shall be long radius reducing type.
 4. Rated 250 psi at 170°F. Dropping in straight line to 170 psi at 250°F for sizes 1½" to 12". Elbows shall be rated no less than 90% of straight connections.
 5. Sizes 10" and 12" to employ control cables with neoprene end fittings isolated from anchor plates by means of ½" bridge bearing neoprene bushings.
 6. Minimum safety factor, 4 to 1 at maximum pressure ratings.
 7. Submittals to include test reports.
 8. Mason Type MFTNC Superflex or approved equal.

PART 3 - EXECUTION

3.1 INSPECTION AND COORDINATION

- A. Contractor shall examine the location where this equipment is to be installed and determine space conditions and notify the Architect in writing of conditions detrimental to proper and timely completion of the Work.
- B. Do not proceed with the work until unsatisfactory conditions have been corrected.
- C. 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.
- D. Bring to the Architect's attention, prior to installation, any conflicts with other trades which may 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.
- E. 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.

3.2 INSTALLATION

- A. Mount floor-mounted equipment on 4" concrete housekeeping pads over the complete floor area of equipment. Mount vibration isolating devices and related inertia blocks on concrete pad.
- B. Each fan and motor assembly shall be supported on a single structural steel frame. Flexible duct connections shall be provided at inlet and discharge ducts.
- C. The machine to be isolated shall be supported by a structural steel frame or concrete inertial base.
- D. Brackets shall be provided to accommodate the isolator. The vertical position and size of the bracket shall be specified by the isolator manufacturer.
- E. The minimum operating clearance between the equipment frame or rigid steel base frame and the housekeeping pad or floor shall be 1". The minimum operating clearance between concrete inertia base and housekeeping pad or floor shall be 2".
- F. The equipment structural steel or concrete inertia base shall be placed in position and supported temporarily by blocks or shims, as appropriate, prior to the installation of the machine or isolators.
- G. The isolators shall be installed without raising the machine and frame assembly.
- H. After the entire installation is complete and under full operational load, the isolators shall be adjusted so that the load is transferred from the blocks to the isolators. When all isolators are properly adjusted, the blocks or shims shall be barely free and shall be removed.
- I. Isolation mounting deflection shall be (minimum) as specified or scheduled.
- J. Install equipment with flexibility in wiring connection.
- K. Verify that all installed isolator and mounting systems permit equipment motion in all directions. Adjust or provide additional resilient restraints to flexibly limit start-up equipment lateral motion to ¼".
- L. Prior to start-up, clean out all foreign matter between bases and equipment. Verify that there are no isolation short circuits in the base isolators or seismic restraints.
- M. All piping and ductwork to be isolated shall freely pass through walls and floors without rigid connections. Penetration points shall be sleeved or otherwise formed to allow passage of piping or ductwork and maintain ¾" to 1¼" clearance around the outside surfaces. This clearance space shall be tightly packed with firestopping or fiberglass and caulked airtight after installation of piping or duct ductwork.
- N. No rigid connections between equipment and building structure shall be made that degrades the noise and vibration isolation system herein specified.
- O. 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.

- P. Obtain inspection and approval of any installation to be covered or enclosed, prior to such closure.
- Q. Diagonal thrust restraint shall be as described for Type D hanger with the same deflection as specified for the spring mountings. The spring element shall be designed so it can be pre-set for thrust and adjusted to allow for maximum of ¼" movement at start and stop. Diagonal restraints shall be attached at the centerline of thrust. Restraint shall be Mason Type WB or approved equal.

3.3 PIPING ISOLATOR INSTALLATION

- A. The isolators shall be installed with the isolator hanger box attached to, or hung as close as possible to, the structure.
- B. The isolators shall be suspended from substantial structural members only.
- C. Hanger rods shall be aligned to clear the hanger box.
- D. Horizontal suspended pipe 2" and smaller and all steam piping shall be suspended by Type DE isolator with a minimum 3/8" deflection. Water pipe larger than 2" shall be supported by Type E isolator with minimum 1" or same static deflection as isolated equipment to which pipe connects, whichever is greater.
- E. Horizontal pipe floor supported at slab shall be supported via Type B, with a minimum static deflection of 1" or same deflection as isolated equipment to which pipe connects, whichever is greater.
- F. Vertical riser pipe supports shall utilize neoprene elements.
- G. Vertical riser guides, if required, shall avoid direct contact of piping with building.
- H. Pipe sway braces, where required shall utilize two (2) neoprene elements.

3.4 FIELD QUALITY CONTROL

- A. Obtain inspection and approval of any installation to be covered or enclosed, prior to such closure.
- B. Upon completion of installation of all vibration isolation devices herein specified, the local representative of the isolation materials manufacturer shall inspect the completed system and report, in writing, any installation error, improperly selected isolation devices, or other faults in the system 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 improperly installed or requiring correction, and include a report by the Contractor on steps taken to properly complete the isolation work.

END OF SECTION 23 05 48

SECTION 23 05 80

HVAC SPECIALTIES

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

- A. This Section is coordinated with and complementary to the General Conditions and Supplementary General Conditions of the Work, wherever applicable to Mechanical Work.
- B. Section 01 31 46 - Special Requirements for Mechanical and Electrical Work shall apply.

1.2 DESCRIPTION OF WORK

- A. The work includes the providing of all labor, materials, equipment, accessories, services and tests necessary to complete and make ready for operation by the Owner, all HVAC Specialties as shown on the Drawings and hereinafter specified.

1.3 QUALITY ASSURANCE

- A. Firms regularly engaged in manufacturer of this equipment with characteristics and capacities required, whose products have been in satisfactory use in similar service for not less than ten (10) years.
- B. Provide products produced by the manufacturers, which are listed in Section 23 05 12, entitled "Approved Manufacturers List".
- C. Provide equipment whose performance under specified conditions is certified by the manufacturer.

1.4 SUBMITTALS

- A. Refer to Section 01 31 46 - Special Requirements for Mechanical and Electrical Work and submit shop drawings.

1.5 COORDINATION

- A. Refer to Section 01 31 46 - Special Requirements for Mechanical and Electrical Work.

1.6 GUARANTEE

- A. Refer to Section 01 31 46 - Special Requirements for Mechanical and Electrical Work.

PART 2 - PRODUCTS

2.1 THERMOMETERS

- A. Furnish and install, where indicated on the Drawings and where specified herein, separable well-type dial or 9" mercury adjustable angle type in glass stem, thermometers, Model 50 EI60E as manufactured by Ashcroft or approved equal.

- B. All thermometers shall be installed in such a manner as to cause a minimum of restriction to flow in the pipes and so that they can easily be read from the floor.
- C. Dial thermometers shall be 5 inch hermetically sealed, bimetal with stainless steel cases, antiparallax dials with raised jet black figures, stainless steel stems, and separable sockets (wells) unless otherwise specified.
- D. Thermometers for duct mounting shall have union connections in lieu of separable wells.
- E. Separable wells shall be stainless steel for use in steel pipe and brass for use in copper pipe. Separable wells shall be standard type for uninsulated pipe and lagging extension type of proper length for insulated pipe. Stem shall extend a minimum of 3½" into the fluid, or 75% of inside clear diameter for smaller size pipes.
- F. The accuracy of all thermometers shall be within 1% of the full scale range.
- G. All instrument wells for controls and indicators furnished by the temperature control manufacturer shall be installed under this Section.
- H. Where conditions are such that thermometers would not be readable from the floor, remote bulb dial thermometers shall be mounted on panelboards. The thermometers shall be 5 inch dials and shall be vapor actuated. The thermometers shall have separable wells. Panel mounted thermometers shall be provided with an engraved nameplate mounted below each thermometer to identify its service. The nameplates shall be chrome plated with black filled letters.
- I. A thermometer shall be installed in the hot water inlet and outlet of each heat exchanger. A thermometer shall be installed in the chilled water and condenser water inlet and outlet of each refrigeration machine. Additional thermometers shall be installed where indicated on the Drawings.
- J. The scale range for the thermometers shall be as follows:

Service	Temperature Range	Remarks
Chilled Water	0 deg. F to 120 deg. F	
Condenser Water	0 deg. F to 120 deg. F	
Dual Temperature Water	30 deg. F to 300 deg. F	

2.2 PRESSURE GAUGES

- A. Furnish and install where indicated on the Drawings and where specified herein, 4½" Model 1279 pressure gauges with phenolic casings as manufactured by Ashcroft. Process connection shall be ½" MNPT. Acceptable equals include Weiss Model 4UGY1 or Noshok Model 660.
- B. Gauges shall be liquid-filled for systems under 150°F (chilled water, condenser water, fuel oil, etc.) and shall be dry for all heating systems (hot water, steam, condensate, etc.).
- C. All gauges shall have black phenolic casings. The gauges shall have white faces with black filled engraved numerals and adjustable pointer. The diameter of the dial shall be 4½ inches. Gauges shall have brass bronzed brushed rotary type movement.

- D. The accuracy of all gauges shall be within ½% of the scale range.
- E. All gauges on water lines shall be fitted with filter type pressure snubbers consisting of ¾" dia. x ⅛" thick, micro metallic stainless steel filter, as manufactured by Operating and Maintenance Specialties or approved equal. All gauges on steam lines shall be fitted with water-filled siphon tubes.
- F. A stainless-steel bar stock block-and-bleed type needle valve shall be installed on the fluid side of each gauge, similar to Noshok Model Series 704MFS (size ½"). A stainless-steel bar stock block-and-bleed type needle valve with a water-filled siphon tube shall be installed on the system side of each steam and HTHW gauge.
- G. All gauges shall be installed so as to be easily readable from the floor. Where conditions are such that gauges on piping would not be readable from the floor, the gauges shall be installed on panelboards.
- H. Panel-mounted gauges shall be designed for flush mounting with back connections and shall be provided with an engraved nameplate mounted below each gauge to identify its service. The nameplates shall be chrome plated with black-filled letters.
- I. Differential pressure switches, and pressure sensing pipe taps, furnished by temperature control manufacturers shall be installed under this Section.
- J. Pressure gauges shall be installed in the suction and discharge of each hot water, chilled water, condenser water, condensate return, boiler feed and fuel oil pump. A pressure gauge shall be installed in the chilled water and condenser water inlet and outlet of each refrigeration machine. A pressure gauge shall be installed in the inlet and outlet of each heat exchanger and each air handler coil. A pressure gauge shall be installed at the inlet and outlet of each water, steam or fuel oil strainer. Additional pressure gauges shall be installed where indicated on the Drawings.
- K. The scale range of pressure gauges shall be as follows:

Service	Pressure Range
Chilled Water	0 to 100 PSIG
Condenser Water	0 to 100 PSIG
Hot Water	0 to 100 PSIG
Discharge Side of Water Pressure Reducing Valve	0 to 100 PSIG

- L. All other pressure gauges shall have a range at least twice the working pressure, but in no case less than 0 to 30 PSIG.

2.3 MACHINERY GUARDS

- A. Moving parts of machinery exposed to contact by personnel shall be guarded by steel barrier type which complies with OSHA.
- B. Exposed moving parts such as belts and couplings shall have not less than ¾" No. 16 gauge steel guards with all edges rounded and gauge, material and construction shall be in accordance with OSHA standards - paragraphs 7173.3, 7173.5 and 7174.1. Guards shall have 1¼" x 1¼" x ⅛" angle iron frame properly supported.

- C. All machinery guards covering the ends of motor or equipment shafts shall have openings for the insertion of a tachometer. Machinery guards shall be painted with two coats of machinery orange enamel.

2.4 EXPANSION TANKS

- A. Furnish and install as shown on the Drawings, EX-TROL Pressurized Diagram Type Expansion Tanks as manufactured by AMTROL INC. It shall be air-precharged to the initial fill pressure of the system. It shall be suitable for a maximum working pressure of 125 psi and shall be furnished with an ASME stamp and certification papers. It shall have a sealed-in elastomer diaphragm suitable for an operating temperature of 240 deg. F. (EX-TROL to be furnished with saddles for horizontal installation).

2.5 DRAFT GAUGES

- A. Furnish and install at each filter, draft gauges for measuring the resistance of the air through the filters.
- B. Each draft gauge shall be an inclined tube differential type for indoor units, equipped with a shut-off cock opening to the atmosphere for checking zero setting, and with a shut-off cock in the lines to points where the draft is measured. The scale shall have a white background with heavy black divisions and figures; shall not be less than 8" long and shall be graduated to read by hundredths of an inch up to resistances to be encountered. Each gauge shall be provided with a bubble level gauge and with screw adjustment for zero settings.
- C. Draft gauge for AC units shall be 2000 Series Magnehelic as made by Dwyer or approved equal. Gauges shall be provided complete with two static pressure tips case, fittings and means of mounting. Scale shall be as required. Set gauges to be easily readable from floor level. Gauges shall be of Dwyer make or approved equal.

2.6 AIR VENTS

- A. In installing water piping systems and all equipment, carefully plan the actual installation in such a manner that high points and air pockets are kept to a minimum and are properly vented where they are unavoidable. All air elimination devices called for on the Drawings and in these Specifications shall be provided and properly installed. In addition, furnish and install all other air elimination devices which may be required due to job conditions. Assume responsibility for proper, continuous and automatic air elimination to assure even and balanced distribution of water to all equipment.
- B. Furnish and install an Armstrong No. 1 AV or Sarco 13W automatic air vent with test petcock at each high point in the water piping mains and were indicated on the Drawings. Furnish and install a 125 psig rated valve on the system side of each automatic air vent. Vents on hot water, dual temperature water, and chilled water lines shall have Hoke Fig. No. PY-271 valves or approved equal. Vents on all other water lines shall have Hoke Fig. No. RB-271 valves or approved equal.
- C. Furnish and install a 125 psig rated ball valve on the system side of each manual air vent. Provide access to all air vents.

2.7 V-BELT DRIVES

- A. All V-belt drives furnished under this Section shall be Gates Rubber Co., Woods, or approved equal. Drives shall be designed with an overload factor of twice the fan brake horsepower but in no case less than 125% of motor horsepower rating. Machined cast iron pulleys shall be used. Manufacturer's shop drawings shall state actual transmission capacity of each drive. Provide companion sheaves for adjustable sheave drives. Companion sheaves shall be selected such that the individual belts shall not exceed a two-degree misalignment of the groove center lines between the driving and driven sheaves. Sheaves shall be complete with flanges and locking devices. All sheaves shall be selected with a 1.5 minimum service factor.
- B. Provide matching belts.
- C. All motors up to 2½ HP shall have variable speed drives.
- D. All motors 10 HP to 25 HP for speeds below 1000 RPM shall have variable speed drives.

2.8 STRAINERS FOR WATER SYSTEM

- A. Furnish and install a full size Y-pattern strainer on the inlet of each control valve and each water pump, and where indicated on the Drawings. For pumps, the Contractor shall install either a Y-strainer or a suction diffuser with internal screened basket. Contractor shall not install both a Y-strainer and a suction diffuser.
- B. The strainers shall be as manufactured by Spence, Sarco, Barnes and Jones, Elliott, Crane or Mueller.
- C. All strainers, except where otherwise noted, shall have bronze body up to 2½", semi-steel above 2½", rated at 125 psig for all systems with 50 psig max. pressure and 250 psig for all others. Strainers 2-inch diameter and smaller shall have screwed ends. Strainers 2½ inch diameter and larger shall have flanged ends.
- D. All strainers shall have removable cylindrical or conical screens of brass construction. They shall be designed to allow blowing out of accumulated sediment and to facilitate removal and replacement of the screen without disconnecting the main piping.
- E. Screens for water 1/16" for 3" inclusive, 1/8" for 4" and above.
- F. An approved blow-out connection with gate valve shall be made to each strainer. The valves shall be located not higher than 8 feet above the floor. All drain connections shall be piped to floor drains.

2.9 REDUCING AND SAFETY VALVES FOR THE WATER SYSTEM

- A. Furnish and install pressure reducing and safety valves for makeup water systems and where indicated on the drawings.
- B. The reducing valve shall be Model 7 pressure reducing valve with field adjustable setting as manufactured by Bell & Gossett or equal as approved by the Architect.
- C. The safety valves shall be of size and capacity as indicated on the Drawings. The valves shall be made by Bell and Gossett or approved equal and shall have 150 pound raised face flange on the inlet and discharge for all sizes 2½" and above 2" and below shall be screwed.

- D. The safety valves shall be steel valves with stainless steel trim. The bonnet shall be enclosed and equipped with a packed lifting lever. The spring shall be carbon steel rated for 450 deg. F.
- E. The vertical discharge line from the safety valves shall be installed as close to the safety valves as possible and piped to drain.

2.10 PRESSURE AND TEMPERATURE TEST STATIONS

- A. Furnish and install in each supply and return runout to each reheat coil and where indicated on the Drawings, a ¼" MPT fitting to receive either a temperature or pressure probe ⅛" OD. Fitting shall be stainless steel with valve core of Nordel (Max. 275 deg. F), fitted with a color coded and marked cap with gasket, and shall be rated at 1000 psig.
- B. In addition, the installing Contractor shall supply the Owner with six pressure gauge adapters with ⅛" OD probe and 6 five-inch stem pocket testing thermometers: 25-125 deg. F for chilled water and six 0-220 deg. F for hot water.
- C. Provide one pressure and temperature test kit consisting of one 0-60 PSI, water pressure gauge and one 0-30 psi water pressure gauge each with No. 500 gauge adapter attached, a 25-125 deg. F pocket testing thermometer, a 0-220 deg. F pocket test thermometer, a No. 500 gauge adapter, and a protective carrying case. Provide one additional 0-60 psi pressure gauge and one additional 0 to 30 psi pressure gauge.
- D. Test kit shall be used by the Balancing Contractor to balance the systems and then it shall be turned over to the Owner.
- E. Test stations and test kit shall be manufactured by Paterson Engineering Company, Inc. or approved equal.

2.11 REFRIGERATION ACCESSORIES

- A. Refrigerant Filter-Dryer: Provide, refrigerant filter-dryers. Refrigerant filter-dryers shall be replaceable core "Catch All" type, as manufactured by Sporlan Valve Company.
- B. Moisture and Liquid Indicator: Provide a combination liquid and moisture indicators type "See All", as manufactured by Sporlan Valve Company.
- C. Refrigerant Strainers: Provide Refrigerant Strainers. Strainers shall be as manufactured by Henry Valve Company, Type 895.
- D. Thermal Expansion Valves: Provide Thermal Expansion Valves. Thermal expansion valves shall be Type "MVE-G", as manufactured by Sporlan Valve Company, or approved equal, with external equalizer and remote bulb.
 - 1. The Contractor shall submit manufacturer rating tables and/or selection charts for approval.
- E. Liquid Line Solenoid Valves: Provide Liquid Line Solenoid Valves. Valves to have stainless steel diaphragm-welded and lead-proof construction, replaceable thermostatic element and tight seating. Valve shall be as manufactured by Sporlan Valve Company or approved equal.
- F. Flexible Pipe Connections: Provide flexible pipe connections. Flexible pipe connectors to be all bronze construction, metal braided type suitable for the Refrigerant.

2.12 EVACUATION OF REFRIGERATION PIPING

- A. When testing of refrigerant piping is completed as specified hereinafter, blow off the pressure in the system to atmosphere and provide final evacuation. Provide a vacuum pump capable of pulling vacuum of at least 1 mm Hg. absolute. Use a Zimmerli gauge to read vacuum. Remove all moisture from the system. Operate the vacuum pump until a vacuum of 2.5 mm Hg. is achieved.
- B. When the system is evacuated, break the vacuum with oil pumped, dry nitrogen, open the compressor suction and discharge service valves and re-evacuate the system to 2.5 mm Hg. absolute. Stop vacuum pump and allow system to stand under a vacuum for a minimum of 24 hours. If no noticeable rise in pressure has taken place after 24 hours, the system shall be charged.

2.13 REFRIGERANT LEAK DETECTION MONITOR

- A. General – Contractor shall provide a refrigerant leak detection system to measure and display refrigerant concentration. The system shall provide relay and analog outputs for alarm and HVAC interlocks as described herein.
 - 1. The monitor shall detect refrigerant R-_* in the range of 0-1000 PPM at *_ sample location(s).
 - 2. The monitor shall be a single enclosure, NEMA 4 wall mount design, and shall operate on 120 VAC.
 - 3. Readout Display - A 4 x 25-character vacuum fluorescent display shall be provided for the purpose of displaying the refrigerant concentration, all programming prompts, and systems messages.
 - 4. Alarm Set Point Levels - Three separate alarm set point levels shall be provided (caution, warning, and alarm). The set points shall be independently adjustable for any value within the full scale range of the monitor. Each set point shall have an associated SPDT relay output. The relays contact shall be rated for 8 amps, 120 volts, resistive load.
 - 5. The system shall provide a source of 4-20 mA output proportional to the instantaneous gas concentration. The output shall be capable of driving a 250-ohm load.
 - 6. Audible and Visual Alarms - An audible buzzer and red strobe light shall be integral to the monitor panel.
 - 7. Sample Gas Filter – An end-of-line filter shall be provided for installation at the pick-up end of the sample tubing.
 - 8. A remote strobe / buzzer combination unit shall be supplied and installed outside each door to the chiller room and shall be energized from the refrigerant monitor panel at the initial (caution) level set point.
 - 9. Start-Up and Training Assistance - the vendor shall provide on-site start-up and training service to verify proper installation and function of the system, as well as train the owner's personnel on system operation.
- B. The Refrigerant Leak Detection Monitor shall be the Mine Safety Appliances Company (MSA) CHILLGARD RT; local distributor – Vanguard Controls Inc. at 973-691-2246.
- C. SCBA and Chiller Room Signage
 - 1. Installation Identification:
 - a. Each refrigerating system erected on the premises shall be provided with a legible permanent sign, securely attached and easily accessible, indicating

- 1) The name and address of the installer,
 - 2) The refrigerant number and amount of refrigerant;
 - 3) The lubricant identity and amount, and
 - 4) The field test pressure applied
- b. Provide such signs near each chiller, and on the outside of each door to the chiller room. See example of sign below.

WARNING

REFRIGERANT _____ *

When alarm sounds, **DO NOT ENTER MECHANICAL ROOM** without
Self Contained Breathing Apparatus (SCBA)

Installer: _____ *

Refrigerant: _____ * Charge: _____ * Lbs.

Lubricant: _____ * GAL of _____ * Oil

Field Test Pressure: _____ * PSIG

2. Controls and Piping Identification
 - a. Systems containing more than 110 lb (50 kg) of refrigerant shall be provided with durable signs having letters not less than 0.5 in. (12.7 mm) in height, designating:
 - 1) Valves or switches for controlling the refrigerant flow, the ventilation and the refrigeration compressor(s) and
 - 2) The kind of refrigerant or secondary coolant contained in exposed piping outside the machinery room. Valves or piping adjacent to valves shall be identified in accordance with ANSI A13.1, Scheme for Identification of Piping Systems.
 3. Self-Containing Breathing Apparatus
 - a. Two approved, self-contained breathing apparatus (SCBA) shall be provided by the Mechanical Contractor and shall be mounted outside of, but close to, the machinery room.
- D. Sequence of Operation
1. The refrigerant leak detection monitoring system in the Chiller Plant shall be directly wired (not through the BAS) to shut down the chiller, activate the emergency ventilation systems and sound a local and a remote alarm upon activation. The local alarm shall be visual and audible. The remote alarm shall be a dry contact closure at multiple local panels and shall be wired to the BAS. A silencing switch shall be provided for silencing the audible alarm. Provide visual and audible alarms both inside and outside of the Chiller Plant.
 2. In general, when the room temperature exceeds the setpoint of the room thermostat, the exhaust fan shall start at low speed. The H&V unit shall also start at low speed.
 3. Under an emergency refrigerant leak condition, the ventilation system shall activate and the chiller plant exhaust fan shall start and automatically switch to high speed, if not already doing so. The motorized dampers shall change position in order to draw the Chiller Plant exhaust from the low pickup points, rather than the normal high pickup points. Supply air

from the H&V unit shall start and run at high speed, if not already doing so. The ventilation system shall remain on until the building operator manually deactivates the system after an alarm condition has been cleared.

PART 3 - EXECUTION

3.1 INSPECTION

- A. Contractor shall examine the location where these specialties are to be installed and determine space conditions and notify the Architect in writing of conditions detrimental to proper and timely completion of the work.
- B. Do not proceed with the work until unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install HVAC Specialties where shown, in accordance with manufacturer's written instructions and with recognized industry practices, to ensure that HVAC Specialties comply with requirements and serve intended purposes.
- B. Coordinate with other work as necessary to interface installation of HVAC Specialties with other components of systems.

3.3 FIELD QUALITY CONTROL

- A. Upon completion of installation of HVAC Specialties, test HVAC Specialties to demonstrate compliance with requirements. When possible, field correct malfunctioning units, then retest to demonstrate compliance. Replace units that cannot be satisfactorily corrected.

END OF SECTION 23 05 80

SECTION 23 05 93

TESTING AND BALANCING

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

- A. This Section is coordinated with and complementary to the General Conditions and Supplementary General Conditions of the Work, wherever applicable to Mechanical Work.
- B. Section 01 31 46 - Special Requirements for Mechanical and Electrical Work shall apply.

1.2 DESCRIPTION OF WORK

- A. All piping and equipment shall be tested. Labor including standby electrician, materials, instruments and power required for testing shall be furnished unless otherwise indicated under the particular Section of the Specification.
- B. Tests shall be performed in the presence of and to the satisfaction of the Architect and such other parties as may have legal jurisdiction.
- C. In no case shall piping, equipment, or accessories be subjected to pressure exceeding their ratings.
- D. All defective work shall be promptly repaired or replaced, and the tests shall be repeated until the particular system and component parts thereof receive the approval of the Architects.
- E. Any damage resulting from tests to any and all trades shall be repaired and damaged materials replaced, all to the satisfaction of the Architect.
- F. The duration of tests shall be as determined by all authorities having jurisdiction, but in no case less than the time prescribed below.
- G. Equipment and systems which normally operate during certain seasons of the year shall be tested during the appropriate season. Tests shall be performed on individual equipment, systems, and their controls. Whenever the equipment or system under test is interrelated and depends upon the operation of other equipment, systems and controls for proper operation, functioning and performance, the latter shall be operated simultaneously with the equipment or system being tested.
- H. All fans and duct systems shall be completely balanced by the adjustment of sheaves, dampers, registers and other volume and diverting control devices, to obtain the air quantities indicated on the design drawings. Replace sheaves if required to meet design conditions.
- I. All pumps and piping systems shall be completely balanced by the adjustment of plug cocks, globe valves or other control devices, to obtain flow quantities indicated on the design drawings.
- J. Tests shall be performed in presence and to satisfaction of Architect, and such other parties as may have legal jurisdiction. Submit completed reports for approval. If air and water balance

cannot be verified in two, four-hour tests (total of eight hours) the Contractor shall pay the Architect or his representative for any additional time spent to balance the system.

- K. Upon completion of the work, a test shall be conducted in the presence and under the direction of a NYS Licensed Professional Engineer, retained by the Contractor, and qualified to conduct such tests. The tests shall show compliance with the code requirements for ventilation and the proper functioning of operating devices, before the system is approved. Tests shall also be conducted under the direction of the same Licensed Professional Engineer to demonstrate that all installed fire and fire smoke dampers operate properly. The Contractor shall submit a letter signed and sealed by the Licensed Professional Engineer indicating that such testing has been successfully conducted and shall make all associated controlled Special Inspections and other submissions to the Authority Having Jurisdiction (AHJ).

1.3 QUALITY ASSURANCE

- A. Prior to installation of the mechanical systems, engage the services of an independent air and water balancing firm that shall be subject to the approval of the Architect. The firm shall have no affiliation with a mechanical contracting or Sheetmetal company. Balancing and testing company shall be a member of the Associated Air Balance Council (AABC), National Environmental Balance Bureau (NEBB) or Testing, Adjusting and Balancing Bureau (TABB). The balancing firm shall have at least one member of its full-time staff who is a licensed professional engineer who shall supervise the balancing work. Prior to balancing, a list of instruments to be used shall be submitted to the Architect. All instruments shall be calibrated within six months before tests.
- B. Prior to installation of the mechanical systems, the licensed Professional Engineer for the Balancing and Testing Company shall review the contract documents to confirm that all balancing devices are provided to allow for complete balancing of the air and water systems for the project. The Balancing and Testing Company shall submit a letter confirming that they have performed this review and identifying any issues.
- C. After the mechanical systems are installed and before the systems are enclosed behind walls and ceilings, the PE for the Balancing and Testing Company shall perform a review of the installation to verify that the required balancing devices have been installed and that the systems are ready for balancing. The Balancing and Testing Company shall submit a letter confirming that the inspection has been performed and that the system is ready for balancing.

Both letters shall be signed and sealed by the Balancing and Testing Company's Professional Engineer.
- D. When all specified testing and balancing procedures have been completed, a written report shall be submitted to the Architect for review. The report shall be tabulated in standard AABC/TABB format. As part of the Architect's review process, the accuracy of the balancing report shall be field spot checked on a random basis, with the assistance of the balancing firm's project supervisor. The HVAC Contractor shall reimburse the Architect for all time spent in excess of eight working hours, to demonstrate the accuracy of the balancing report.

1.4 SUBMITTALS

- A. Refer to Section 01 31 46 "Special Requirements for Mechanical and Electrical Work". Submit all test and balance reports as described hereinafter.

PART 2 - PRODUCTS (NOT APPLICABLE)

PART 3 - EXECUTION

3.1 FIELD TEST OF PIPING

- A. During construction properly cap or plug all lines to prevent the entrance of sand, dirt, etc. The system of piping shall be blown through wherever necessary after completion (for the purpose of removing grit, dirt, sand, etc., from all equipment and piping), for as long a time as is required to thoroughly clean the apparatus.
- B. Use anti-freeze solution for piping to be tested in winter.
- C. All piping shall be tested as hereinafter specified. Tests shall be made after erection and before covering is applied or piping painted or concealed, and as sections of mains and groups of risers are completed. The extent of the work completed before pressure tests are made shall be determined by the Architect.
- D. All piping, unless otherwise specified, shall be tested to a hydrostatic pressure at least 1-1/2 times the maximum designed working pressure (but not less than 50 lbs. per square inch) for a sufficiently long time to detect all leaks and defects; and after testing shall be made tight in the most approved manner. Tests shall be repeated once after leaks and defects have been repaired. When automatic control valves, equipment and similar devices which are incapable of withstanding test pressures applied to piping, such devices shall be removed, or otherwise protected during tests. After approval of such tests, devices shall be installed and tested with operating medium to operating pressures. The following shall be tested for four consecutive hours and proved tight. Leaks shall be remedied by replacing defective work.

Hydrostatic

<u>Item</u>	<u>Field Test</u>
Overflow and drain	50 psi
Cold Water (domestic)	100 psi
Condenser water/glycol	100 psi

- E. Leaks appearing during the various pressure tests shall be corrected by replacing all defective materials or welds and subsequent tests shall be made until the piping is found perfect. Caulking of screwed joints or pending of welds is prohibited. Wherever it is necessary to cut out a weld and the ends of the pipe cannot be conveniently brought together, then a short piece of pipe shall be fitted in and welded as approved by the Architect.
- F. Provide all other tests required by the Building Department, Fire Department and all other Authorities Having Jurisdiction (AHJ).

3.2 RUNNING TEST OF PIPING SYSTEMS

- A. When directed, any section of the work, after it has been completed and otherwise satisfactorily tested, shall be put in actual operation and operated for a period of two (2) days of 24 hours each,

during which time any defects which may appear shall be remedied and any adjustment which may be necessary shall be made.

- B. During the time of the tests, repack all valves, make all adjustments and otherwise put the apparatus in perfect condition for operation, and instruct the Owner's representative in the use and management of the apparatus.

3.3 TESTING, EVACUATION AND CHARGING OF REFRIGERATION PIPING

- A. The Contractor shall notify the owner 24 hours in advance of any test so that the owner and/or manufacturer's representative may be present for the test if desired.
- B. When the refrigeration connections have been completed, the system shall be tested at 240 psig on the low-pressure side and 430 psig on the high-pressure side or in accordance with the recommendation of the refrigerant equipment manufacturer. Liquid refrigerant shall be charged into the system to raise the pressure to 35 psig, and dry nitrogen added to obtain the desired test pressure. Leak testing shall be performed with an electronic leak detector. Refrigeration piping will not be acceptable unless it is gas tight. If any leaks are found, isolate the defective area, discharge the gas and repair the leaks, and then repeat the test.
- C. The system shall be evacuated with a vacuum pump specifically manufactured for vacuum duty, having a capability of pulling a vacuum of 50 microns or less. The pump should be connected to both the low and the high side evacuation valves with copper or high vacuum hoses. The compressor service valves should remain closed. A high vacuum gauge capable of registering pressure in microns should be attached to the system for pressure readings. To check the system pressure, a hand valve must be provided between the pressure gauge and the vacuum pump which can be closed to isolate the system and check the pressure.
- D. Evacuate each system to an absolute pressure not exceeding 1,500 microns. Break the vacuum to 2 psig with the refrigerant to be used in the system. Repeat the evacuation process, again breaking the vacuum with refrigerant. Install a drier of the required size in the liquid line, open the compressor suction and discharge valves, and evacuate to an absolute pressure not exceeding 500 microns. Leave the vacuum pump running for not less than two hours without interruption. Raise the system pressure to 2 psig with refrigerant and remove the vacuum pump.
- E. Refrigerant shall be charged directly from the original drums through a combination filter-drier each drier may be used for a maximum of three cylinders of refrigerant, and then must be replaced with a fresh drier charge the system by means of a charging fitting in the liquid line. Weight the refrigerant drum before charging so that an accurate record can be kept of the weight of refrigerant put in the system. If refrigerant is added to the system through the suction side of the compressor charge in vapor form only.
- F. Condensing units will be delivered to the job with sufficient oil for the average installation. Check all compressors for proper oil level, and if necessary, add sufficient oil to bring the level to the center of the crankcase sight glass. Use only the refrigeration oil recommended by the condensing unit manufacturer all oil must be delivered to the job in factory-sealed, unopened containers.
- G. Refrigeration piping shall be tested in accordance with the recommendations of the refrigeration equipment manufacturer or in the following sequence in the absence of manufacturer requirements, for a period of 24 hours.

- High Side - Nitrogen at 300 psi
- Low Side - Nitrogen at 150 psi
- Entire System - Refrigerant at 5 psi

H. No visible leaks, losses in pressure or increase in vacuum occur during test period.

3.4 AIR LEAKAGE TEST FOR MEDIUM PRESSURE DUCT

- A. The testing of all joints for air leakage after erection and the repair of any leaks are positive requirements. Leakage must be kept to a specified minimum. The test for air leakage is divided into two phases: namely, testing of individual vertical risers and testing of all branches. Provide all required instruments.
- B. Test shall be made at 6 inches water gauge static pressure. All risers, branches and runouts shall be tested after installation before insulation is applied and before the air mixing units are installed. The total allowable leakage for the entire system shall be no more than one (1) percent of the total system capacity.
- C. Equipment necessary for performing this test shall include a rotary hand blower calibrated orifice section and a "U" tube gauge board complete with cocks and rubber tubing. The test hookup, as well as details for the fabrication of the orifice section shall be in accordance with the recommendation of the "High Velocity Duct Manual" of Sheetmetal and Air Conditioning Contractors National Association, Inc.

3.5 EQUIPMENT TEST

- A. Demonstrate that all equipment and apparatus fulfill the requirements of the Specifications and that all equipment shall be operated and tested for rated capacities and specified characteristics. Voltage and amperage readings shall be taken on all electric motors.
- B. Operate air handlers and fans for 40 hours and demonstrate fans operating at maximum capacity, with all variable volume dampers to be at the fully open position.

3.6 FIRE DAMPER AND FIRE SMOKE DAMPER TEST (REQUIRED FOR NYC PROJECTS)

- A. Under this section test each and every fire damper by removing the fusible link to demonstrate that the damper properly closed.
- B. Under this section test each and every fire smoke damper by removing the fusible link or alternately applying heat to the heat detector for dampers utilizing heat detectors) to demonstrate full closure. Also demonstrate that the damper opens and closes properly under automatic control through the operator.
- C. After the successful completion of such tests reinstall fusible links and reset heat detectors.
- D. All such tests shall be conducted under direction of a NYS Professional Engineer retained by the Contractor.

3.7 TEST PREPARATION AND PROCEDURE

- A. On initial startup, prior to any tests, check the rotation and running amperage of all fan and pump motors to prevent damage to equipment by overload.
- B. Final balancing must be done with all systems completely installed and operating, and after the automatic temperature controls have had their final adjustment.
- C. New, clean filters must be installed in all supply systems prior to balancing.
- D. All water systems shall be completely filled and vented, and all strainers cleaned prior to balancing. Inspect expansion tanks for proper water level and operating of makeup water valves.
- E. All main supply air ducts shall be traversed, using a pitot tube and manometer. The manometer shall be calibrated to read two significant figures in all velocity pressure ranges. Duct traverses shall be conducted using the log-Tchebycheff method. The equal area method is not acceptable.
- F. A main duct is defined as either of the following:
 - 1. A duct serving five or more outlets.
 - 2. A duct serving two or more branch ducts.
 - 3. A duct serving a reheat coil.
 - 4. A zone duct from a multi-zone unit.
 - 5. A duct emanating from a fan discharge or plenum and terminating at one or more outlets.
- G. The intent of this operation is to measure by traverse the total air quantity supplied by the fan and to verify the distribution of air to zones.
- H. Submit data in support of all supply fan deliveries by the following four methods:
 - 1. By summation of the air quantity readings at all outlets.
 - 2. By duct traverse of main supply ducts and directly at the air handler or fan discharge.
 - 3. By a rotating vane traverse across a filter or coil bank.
 - 4. By plotting RPM and static pressure readings on the fan curve. Air density corrections must be indicated.
- I. For return air and exhaust fans, the rotating vane traverse is not required.
- J. Inspect all fan scrolls and remove objects or debris. Inspect all coils and remove debris or obstructions. Verify that all fire dampers are open.
- K. The supply air systems shall be completely balanced prior to the final balancing of the water systems.
- L. Upon completion of all air and water balancing, all duct dampers, plug valves and other throttling devices shall be permanently marked in the final adjusted position.

3.8 AIR BALANCE

- A. Record the following design requirements for all fans and fan motors from the approved shop drawings.
 - 1. Air quantities - CFM
 - 2. Approximate fan speed - RPM

3. Fan static pressure (total or external) - inches of water.
 4. Maximum tip speed - FPM
 5. Outlet velocity - FPM
 6. Fan brake horsepower
 7. Motor horsepower
 8. Volts, phases, cycles and amps at design conditions.
- B. Record the following data from all fans and fan motors installed at the project:
1. Manufacturer, model and size
 2. Motor horsepower, service factor and RPM
 3. Volts, phases, cycles and full load amps
 4. Motor starter and heaters size
 5. Equipment location
- C. All fans and duct systems shall be completely balanced by the adjustment of sheaves, dampers, registers and other volume and diverting control devices, to obtain the air quantities indicated on the Drawings. Outside air and return air modulating dampers shall be adjusted to admit the specified quantities of air under all cycles of operation. All final adjusted air quantities shall be within 10% of the design requirements while adhering to positive or negative pressure roof design conditions. Replace sheaves if required to meet design conditions.
- D. Record the following test data for all fans and motors installed at the Project at final balanced conditions:
1. Fan speed RPM.
 2. Fan static pressure (external and total) inches of water.
 3. Static pressure drop across all filters, dampers, coils and other items in the supply fan casings.
 4. Motor operating amps. (Measure, record and report all motor amps at minimum outside air volume and at maximum outside air volume.) This requirement applies to both constant volume and variable air volume systems where economizers are present.
 5. Actual voltage
 6. Fan CFM
 7. Calculated brake horsepower.
- E. Submit single line diagrams of all duct systems indicating all terminal outlets identified by number. Data sheets shall list all such outlets denoted by the same numbers, including the outlet's size, "K" factor, location, CFM and jet velocity.
- F. Submit this data for all supply, return and exhaust air systems.
- G. Adjust the outside air, relief air and return air dampers to admit the required amounts of outside air. Record and submit outside air flow measurement and the outside, return and mixed air temperatures for both cycles after final adjustments.
- H. Air balancing shall be performed with filters partially blocked to simulate a pressure drop across the filters equal to that midway between the clean and the dirty condition.

3.9 WATER BALANCE

- A. Record the following design requirements for all pumps and pump motors from the approved shop drawings:
 - 1. Water quantity - GPM
 - 2. Total head - feet of water
 - 3. Pump speed - RPM
 - 4. Impeller size
 - 5. NPSH (if required)
 - 6. Motor horsepower
 - 7. Volts, phases, cycles and amps at design conditions
- B. Record the following data from all pumps motors installed at the project:
 - 1. Manufacturer, model and size.
 - 2. Impeller size
 - 3. Motor horsepower, service factor and RPM
 - 4. Volts, phases, cycles and full load amps
 - 5. Motor starter and heaters size
 - 6. Equipment location
- C. All pumps and piping systems shall be completely balanced by the adjustment of plug cocks, globe valves or other control devices, to obtain the flow quantities indicated on the Drawings. Balancing shall be done with all controls set for full flow through coils. All automatic throttling valves shall be in the full-open position. All automatic three-way valves shall have the bypass port closed.
- D. Record the following test data for all pumps and pump motors installed at the Project:
 - 1. Pump speed - RPM
 - 2. Total head at shut-off and dead-end discharge - feet of water. (Plot this value on pump curve as a verification of impeller size.)
 - 3. Suction, discharge and total head at final adjusted flow - feet of water.
- E. Balance the water flow through all cooling towers, condensers, coils, in accordance with design requirements.
- F. Flow shall be balanced through all equipment and coils by means of balancing and flow measuring valves provided. In addition, pressure drop shall be measured and curves obtained from the various manufacturers indicating the relationship between flow and pressure drop through the coils and equipment. Readings shall be taken on calibrated test gauges. Submit curves with the final report. Final report shall document all flow and pressure drop measurements.
- G. Balance pumps to their design flow rate, within 100% and 110% of design, so long as pump and motor rating permits. Balance flow through all coils and terminal units to $\pm 10\%$ of design flow rate.
- H. Upon completion of the water balance, reconcile the total heat transfer through all coils by recording the entering and leaving water temperatures and the entering and leaving air dry bulb and wet bulb temperatures.
- I. Upon completion of balancing, adjust all differential bypasses and three-way valve bypasses for the same pressure drop or full bypass as on full flow.

END OF SECTION 23 05 93

SECTION 23 07 00

INSULATION FOR HVAC WORK

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

- A. This Section is coordinate with and complementary to the General Conditions and Supplementary General Conditions of the Work, wherever applicable to Mechanical Work.
- B. Section 01 31 46 - Special Requirements for Mechanical and Electrical Work shall apply.

1.2 DESCRIPTION OF WORK

- A. The work includes furnishing and installing all labor, materials, equipment, accessories and services necessary to provide Piping, Ductwork and Equipment Insulation installation, which is complete in every respect and of the composition and quality as shown on the Drawings and hereinafter specified.

1.3 PIPE INSULATION

- A. The following pipes shall not be insulated. Insulate all other piping:
 - 1. Unions.
 - 2. Automatic air vent drain pipes.
 - 3. Drain pipes embedded in concrete.
 - 4. Condensation drain piping from pneumatic control air piping.
 - 5. Condenser water chemical treatment piping.
 - 6. Refrigerant liquid and outdoor portions of refrigerant hot gas piping except where otherwise noted.

1.4 DUCTWORK INSULATION

- A. Insulate all ductwork except the following portions of ductwork:
 - 1. Ducts provided with sound absorptive lining (except where humidifier is installed and except where located outdoors) may have external insulation thickness decreased provided overall insulation R-value internal plus external complies with R-value specified herein.
 - 2. All exhaust ductwork, except where otherwise noted.
 - 3. Return air ductwork passing through air conditioned space and/or hung ceiling of air conditioned space, except in single story buildings and ducts in ceiling of uppermost floor or in attic space, where all return air ducts must be insulated.
 - 4. Return air ductwork for heating and ventilating systems, where return air ducts pass through heated areas.
 - 5. Supply ducts above hung ceilings where space above hung ceilings is used for return air plenum, except below roof.
 - 6. Exposed supply and return air ducts in air-conditioned spaces if same supply air duct serves that area only.
 - 7. Exposed supply air duct in ventilated spaces, if same duct serves that area only.

1.5 QUALITY ASSURANCE

- A. "Installer": A firm with at least ten 10 years successful installation experience on projects with piping and ductwork insulation similar to that required for this project.
- B. All insulation shall have composite (including insulation jacket or facing and adhesive) fire and smoke hazard ratings as tested by procedure ASTM E-84, NFPA 255 and UL 723 not exceeding:
 - 1. Flame Spread 25
 - 2. Smoke Developed 50
 - 3. Fuel Contributed 50
- C. Accessories such as adhesives, mastics, cements, tapes and cloths for fittings shall have component ratings as listed above. All products shall bear UL labels indicating the above are not exceeded.
- D. Provide certifications or other data as necessary to show compliance with these Specifications and governing regulations. Include proof of compliance for test of products for fire rating, corrosiveness, and compressive strength.
- E. Provide products produced by the manufacturers which are listed in Section 23 05 12, "Approved Manufacturers List"
- F. Insulation Materials: Insulating materials manufacturing facilities must be certified and registered with an approved registrar for conformance with ISO9000 quality standard.

1.6 SUBMITTALS

- A. Refer to Section 01 31 46 - "Special Requirements for Mechanical and Electrical Work" and submit shop drawings and samples.

1.7 GUARANTEE

- A. Refer to Section 01 31 46 - "Special Requirements for Mechanical and Electrical Work".

1.8 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Protect insulation against dirt, water, chemical and mechanical damage. Do not install damaged insulation; remove from project site.
- B. Deliver insulation, coverings, cements, adhesives and coatings to the site in factory-fabricated containers with the manufacturer's stamp, or label, affixed showing fire hazard ratings of the products.
- C. Store insulation in original wrappings and protect from weather and construction traffic.

PART 2 - PRODUCTS

2.1 GLYCOL AND CONDENSER TEMPERATURE PIPING INSULATION

- A. The following piping shall be covered with fiberglass insulation with vapor barrier:

<u>Service</u>	<u>Thickness</u>
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Refrigerant Suction All pipe diameters	1½"
Cold Water Make-Up and Air Conditioning Condensate Drain Piping from Cooling Coil Drain Pans All sizes	1"
Condenser Supply and Return Outside Building	2"
Glycol and condenser Supply Return Inside Building	1½"
Cooling Tower Drain Piping Up to Shut-Off Valve	1"

- B. Insulation on any piping, fitting, flange and valve located in areas exposed to freezing (in unheated areas, at cooling towers and where noted on the Drawings as to provide "Frost Insulation") shall be increased by one inch with the same finish as specified for the particular service when not subject to freezing. Insulation shall always be a minimum of 2½" inches in thickness.
- C. Insulation shall be glass fiber complying with ASTM C547, Type I with a maximum K factor of 0.23 BTU in/hr ft² F at 75 degrees F. mean temperature with factory-applied all service vapor barrier jacket with self seal lap meeting the requirement of ASTM C-1136 Type I.
- D. Insulation shall be heavy density fiberglass sectional pipe insulation as made by Owens-Corning Fiberglass Corp. or Johns-Manville Micro-Lok fiberglass insulation.
- E. Ends of pipe insulation shall be sealed off at all flanges, fittings, valves and at intervals of 21 feet on continuous runs of pipe, with Foster fire-resistant vapor barrier coating Foster 30-65 or Childers CP-34 or equal.
- F. All fittings, valves and flanges for pipe sizes smaller than 4" shall be insulated with molded fiberglass fittings of same thickness as the adjoining pipe insulation, secured with No. 20 gauge galvanized annealed steel wire and covered with Zeston 2000 25/50 PVC as made by Johns Manville, applied per manufacturer's recommendation, except as specified in 2.01 H.
- G. All fittings, valves and flanges for pipe sizes 4" and larger shall be insulated with fabricated mitered segments of pipe insulation of same thickness as the adjoining pipe insulation, secured with No. 20 gauge galvanized annealed steel wire and covered with Zeston 2000 25/50 PVC fitting covers as made by Johns Manville installed per manufacturer's recommendation, except as specified in 2.01 H.
- H. Finish for Exposed Pipe Insulation:
1. The term "exposed" is hereby defined as any place outdoors, as well as any place indoors in Mechanical Rooms, Storage Rooms, Janitor's Closets, etc., where located within 7 feet of floor or access platforms.
 2. All exposed pipe, valve and fittings insulation shall have 0.016-inch-thick corrugated aluminum jacket banded with ½" s.s. bands spaced 12" o.c. Piping, fittings and valves exposed in building, within seven feet of the floor or access platform, shall have 0.016" thick aluminum jacket banded with ½" aluminum bands spaced 12" o.c. or two bands per section. Joints and jacket shall provide complete weatherproof protection either by mechanical contact or by use of Foster 95-44 or Childers CP-76 metal jacketing sealant (gallon cans only; no tubes).

3. All calcium silicate pipe insulation, all insulated condenser water piping exposed to weather and all other insulated pipe exposed to weather shall have 0.016 inch thick aluminum jacket banded with 1/2" s.s. bands spaced 12" o.c. This shall include pipe, fittings and valves.
- I. All below ambient, coated molded fittings and mitered segments shall be vapor sealed with a layer of open weave glass fabric embedded between two 1/16" thick coats of Foster 30-65 or Childers CP-34 vapor barrier coating and lap seal at least 1" for molded type and 2" for mitered type on itself and adjoining insulation.
- J. Direct contact between pipe and hanger should be avoided. Hanger shall pass outside of a metal saddle which shall support a section of high-density insulation equal thickness to adjacent insulation (such as calcium silicate) and of sufficient length to support pipe without crushing insulation. (See table below.) Hangers shall not pierce insulation, and all vapor barriers shall be unbroken and continuous.

Pipe Size	Saddle & Insert Length
1/2"- 2"	10" Long
3"-6"	12" Long
8"-10"	16" Long
12" & Over	22" Long

- K. At pipe supports, insulation shield protection saddles and matching hangers shall be used.
- L. All strainers for chilled water and insulated condenser water piping shall be insulated and boxed in with galvanized sheet metal cover. The insulated metal covers shall be segmented and shall be made removable.
- M. As an alternative to fiberglass insulation, on cold pipes, elastomeric closed-cell insulation may be used.
 1. Insulation material shall be a flexible, closed-cell elastomeric insulation in tubular or sheet form: AP Armaflex, AP Armaflex W, AP Armaflex SS, or AP Armaflex SA. These products meet the requirements as defined in ASTM C 534, "Specification for preformed elastomeric cellular thermal insulation in sheet and tubular form."
 2. Insulation materials shall have a closed-cell structure to prevent moisture from wicking which makes it an efficient insulation.
 3. Insulation material shall be manufactured without the use of CFC's, HFC's or HCFC's. It is also formaldehyde free, low VOC's, fiber free, dust free and resists mold and mildew.
 4. The insulation material shall contain MICOBAN Antimicrobial additive to aid in the prevention of mold and mildew.
 5. Materials shall have a flame spread index of less than 25 and a smoke-developed index of less than 50 when tested in accordance with ASTM E 84, latest revision. In addition, the product, when tested, shall not melt or drip flaming particles, the flame shall not be progressive, and all materials shall pass simulated end-use fire tests.
 6. Materials shall have a maximum thermal conductivity of 0.25 Btu-in./h-ft²- °F at a 75°F mean temperature when tested in accordance with ASTM C 177 or ASTM C 518, latest revisions.
 7. Materials shall have a maximum water vapor transmission of 0.05 perm-inches when tested in accordance with ASTM E 96, Procedure A, latest revision.

8. The material shall be manufactured under an independent third-party supervision testing program covering the properties of fire performance, thermal conductivity and water vapor transmission.
9. Valves, Flanges and Fittings:
 - a. Armacell Fabricated Fittings can be used on all fittings. 2 and 3 Pieces 90s, 45s, Ts, P traps and couplings along with grooved fittings are available.
 - b. All fittings shall be insulated with the same insulation thickness as the adjacent piping. All seam and mitered joints shall be adhered with Armaflex 520, 520 BLV or 520 Black Adhesive. Screwed fittings shall be sleeved and adhered with a minimum 1" overlap onto the adjacent insulation. Armaflex HT 625 Adhesive shall be used with UT Solaflex.
 - c. Valves, flanges, strainers, and Grooved couplings shall be insulated using Armaflex donuts that shall then be covered with sheet or oversized tubular insulation.
10. Adhesives and Finishes
 - a. Adhesive shall be the insulation manufacturer's recommended contact adhesive: Armaflex 520, Armaflex 520 BLV, Armaflex 520 Black, Low VOC Spray Adhesive or Armaflex HT 625 Adhesive.
 - b. The insulation finish shall be the insulation manufacturer's recommended finish: Armaflex WB Finish.
 - c. Accessories such as adhesives, mastics and cements shall have the same properties as listed above and shall not detract from any of the system ratings as specified above.

2.2 PVC INSULATED FITTING COVERS

- A. The Contractor shall use Zeston 2000 25/50 rated PVC covers as made by Johns Manville or approved equal, for concealed piping.
- B. Hot Systems: Fittings shall be insulated by applying the proper factory precut Hi-Lo Temp insulation insert to the pipe fitting. The ends of the Ho-Lo Temp insulation insert shall be tucked snugly into the throat of the fitting and the edges adjacent to the pipe covering tufted and tucked in, fully insulating the pipe fitting. PVC fitting cover is then applied and shall be secured by tack fastening, banding or taping the ends to the adjacent pipe covering.
- C. On fittings where the operating temperature exceeds 250 deg. F, 2 or more layers of the Hi-Lo Temp insulation inserts shall be applied prior to the installation of the PVC fitting cover. The first layer shall be applied with a few wrappings of fiber glass yarn to eliminate voids or hot spots.
- D. Cold Systems: Fittings shall be insulated by applying the proper factory precut Hi-Lo Temp insulation insert to the pipe fitting. The ends of the Hi-Lo Temp insulation insert shall be tucked snugly into the throat of the fitting and the edges adjacent to the pipe covering tufted and tucked in, fully insulating the pipe fitting. All fittings and elbows shall be coated with vapor barrier coating and reinforcing mesh before PVC covers are applied.
- E. A vapor barrier mastic compatible with the PVC shall be applied around the edges of the adjoining pipe insulation and on the fitting cover throat overlap seam. The PVC fitting cover is then applied and shall be secured with pressure sensitive pearl-gray Z-Tape along the circumferential edges. The tape shall extend over the adjacent pipe insulation and have an overlap on itself of at least 2" on the downward side.

- F. 2 or more layers of the Hi-Lo Temp insulation inserts shall be applied with the first layer being secured with a few wrappings of fiberglass yarn.
- G. Refrigerant systems and cold systems located outdoors: Fittings shall be insulated to a full thickness the same as the adjacent pipe insulation, with insulation which has been mitered. An intermediate vapor barrier shall be applied, completely sealing the insulation and on the fitting cover overlap seam. 0.016" aluminum cladding shall be applied and shall be secured with pressure-sensitive pearl gray Z-Tape along the throat seam and the circumferential edges overlapping itself 2" on the downward side with aluminum bands at 12" intervals.
- H. Qualifications for Using Insulation: When the pipe insulation thickness is greater than 1½" or the pipe temperature is greater than 250°F or less than 45°F, additional insulation inserts should be used. Use one Hi-Lo Temp insert for each additional 1" of pipe insulation.
- I. Fitting cover: The temperature of the PVC fitting cover must be kept below 150°F by the use of proper thickness of insulation and by keeping the PVC cover away from contact with, or exposure to, sources of direct or radiant heat.
- J. Where insulated piping is exposed (indoors up to 7 feet above the floor or platform) or any place outdoors, the PVC covers shall be omitted since the use of 0.016" thick aluminum cladding is required on all piping, fittings and valves.

2.3 PIPING EXPOSED TO FREEZING

- A. Insulation on any piping, fitting, flange, and valve located in areas exposed to freezing (in unheated areas, at cooling towers and were noted on the Drawings as to provide "Frost Insulation") shall, in addition to the above covering, be increased by one inch with the same finish as specified for the particular service when not subject to freezing. Insulation shall always be a minimum of 2½" inches in thickness.
- B. Weatherproofing of Piping:
 - 1. Weatherproof all insulated outdoor piping.
 - 2. Where weatherproofing is required, in addition to insulation and finishes specified for frostproofing, cover with Tedlar Film Jackets as made by ALPHA Assoc, Inc. (Woodbridge N.J.).
 - 3. Fittings insulation shall be heavily coat with Childers CP-10/11 or Foster 46-50 weather barrier mastic for hot piping; Childers CP-34 or Foster 30-65 vapor barrier coating for cold piping. Embed into the wet coat a layer of open weave glass cloth and finish with a second coat of same mastic over entire surface.
 - 4. In addition to insulation and finishes specified for frostproof, cover all piping, including fittings and valves, with corrugated aluminum sheet cladding, 0.016 inch thick with lock seams at longitudinal seams, and preformed straps at transverse joints at 12" intervals. Joints and jackets shall provide complete weatherproof protection either by mechanical contact or by use of Foster 95-44 or Childers CP-76 metal jacketing sealant (gallon cans only; no tubes).

2.4 FIRE STOPPING

- A. Packing of openings, where ducts and pipes penetrate fire barriers, shall be done with Rockwool insulation as made by United States Gypsum, Co.

- B. Insulation shall comply with Fed. Spec. HH-1-558, Form A, Class 4, K=0.24, melting point 2000 degrees F.
- C. An acceptable alternative to rockwool insulation shall be 3M Product Caulk CP25 or approved equal.

2.5 DUCTWORK INSULATION

- A. Insulation for Concealed Duct
 - 1. Except where otherwise noted, all concealed rectangular and round ductwork shall be covered with flexible duct insulation with or without vapor barrier complying with ASTM C553, Types I and II and of the thickness and densities indicated below.

<u>Service</u>	<u>R Value</u>	<u>With</u>
Cold and Hot Air Supply Ducts	6	Vapor Barrier
Return Air Ducts (only where required)	6	Vapor Barrier
Hot Supply Ducts	6	---
Outside Air Duct	6	Vapor Barrier
Sound traps	6	Vapor Barrier
Within 5'-0" downstream and upstream of Humidifier in ducts	6	Vapor Barrier

- B. Flexible duct insulation with vapor barrier shall be 1 lb. per cu. ft. density glass fiber with a maximum K factor of 0.29 at 75 deg. F. mean temperature, with reinforced foil-faced, flame resistant kraft vapor barrier (facing to comply with ASTM C1136, Type II).
- C. Insulation with vapor barrier shall be duct wrap insulation FRK-25, type 100 as made by Owens-Corning or Johns Manville Microlite Type 100 with FSK vapor barrier facing or standard 1 lb./cf duct insulation as made by CGG with FSK facing.
- D. Flexible duct insulation without vapor barrier shall be 1 lb. per cu. ft. density glass fiber with a maximum K factor of 0.29 at 75 deg. F. mean temperature and shall be Owens Corning Fiberglass Type 75P, Johns Manville Microlite Type 100 or approved equal.
- E. Adhere insulation to duct with foster fire resistant adhesive 85-60 or Childers CP-127 or approved equal, applied in 4-inch wide transverse strips at 8-inch intervals. The insulation shall be butted with facing overlapping all joints at least 2 inches and sealed with Foster fire-resistant adhesive 85-60 or Childers CP-127 or equal. For insulation with vapor barrier use Foster fire resistant vapor barrier adhesive or approved equal and joints without tabs shall be firmly sealed with aluminum foil tape adhered with same adhesive. Secure insulation with 18-gauge corrosion-resistant wire spaced not more than 18 inches on center. Coat all duct taped seams, punctures and breaks with Foster 30-65 or Childers CP-34 vapor barrier coating.
- F. Additionally, secure insulation to bottom of rectangular ducts over 24" wide with welded pins or stick clips on 18" centers. Cut off excess pins and seal as above.
- G. Insulation for Exposed Rectangular Duct
 - 1. Except where otherwise noted, all exposed rectangular ductwork and plenums shall be covered with rigid duct insulation complying with ASTM C612 Types IA and IB and of the thickness and densities indicated below.

<u>Service</u>	<u>R Value</u>	<u>With</u>
Supply Air Ducts in Mechanical Equipment Rooms	6	Vapor Barrier
Return Air Ducts in Mechanical Equipment Room	6	Vapor Barrier
Cold and Hot Air Supply Ducts Except where otherwise noted	6	Vapor Barrier
Cold and Hot Air Return Air Ducts Except where otherwise noted	6	_____
Outside Air Intake Ducts & plenums	6	Vapor Barrier
Sound Traps	6	Vapor Barrier
Within 5'-0" downstream and upstream of Humidifier in Ducts	6	Vapor Barrier
Outside and Return Mixed Air Duct	6	Vapor Barrier
Hot Supply Duct	6	
Exhaust Air Plenum or Duct Behind Louver up to Automatic damper	6	Vapor Barrier
Exhaust Ducts connected to penthouse louvers or goosenecks up to damper	6	Vapor Barrier
Unused portion of Louvers	6	in 20-gauge Sheetmetal sandwich.
Supply and Return ducts located outdoors	8	

2. Rigid duct insulation with vapor barrier shall be 6 lbs. per cu. ft. density glass fiber with maximum K factor of 0.22 at 75 deg. F mean temperature with fire retardant vapor barrier facing all service jacket complying with ASTM C1136 Type I (white finish).
3. Rigid duct insulation with vapor barrier shall be Fiberglass Type 705 by Owens-Corning or Johns Manville, No. 817 spin-glass w/ASJ or approved equal.
4. Rigid duct insulation without vapor barrier shall be 6 lbs. per. cu. ft. density glass fiber with maximum K factor of 0.22 at 75 deg. F mean temperature with fire retardant facing foil reinforced draft. (all service jacket).

5. Rigid duct insulation without vapor barrier shall be Fiberglass type 705 by Owens-Corning, Johns Manville, No. 817 spin glass w/ASJ or approved equal.
6. Insulation shall be fastened to duct with 12 gauge welded pins and washers, or equivalent as approved. Fasteners shall be spaced 12 to 18 inches on center, a minimum of two rows per side of duct. Secure insulation in place with washers firmly embedded in insulation, or push a self-locking cap over pin after coating with fitting mastic type C by Owens-Corning or approved equal.
7. Seal all joints, breaks and impressions with Foster fire resistant vapor barrier coating Foster 30-65 or Childers CP-34, or equal, and apply 5" wide joint sealing tape to all joints. All surface must be clean and dry before applying tape.
 - a.

H. Insulation for Exposed Round Duct

1. Insulation for exposed round ductwork shall be of material as specified for concealed ductwork and shall be covered with glass cloth or all service jacket smoothly adhered with Foster 85-60/85-20 or Childers CP-82 (5 gallons cans only) adhesive. Seal joints with 5" wide tape.

<u>Service</u>	<u>R Value</u>
Cold and Hot Air Supply Ducts in Mechanical Equipment Rooms	6 with vapor barrier
Air Conditioning Return Air Ducts in Mechanical Equipment Rooms	6 with vapor barrier
Cold and Hot Air Supply Ducts Except where otherwise noted	6 with vapor barrier
Hot Supply Duct	6
Return Air Fan for Air Conditioning Units.	6 with vapor barrier

2. The Contractor shall have the option to use the following material: Insulation for round ducts shall be of thickness noted above and shall be fiberglass pipe and tank insulation having a factory applied ASJ vapor barrier jacket secured with staples and ASJ pressure sensitive tape. Pipe and tank insulation is a 3.00 p.c.f. board cut into strips, fibers oriented perpendicularly to the facing it is adhered to and it must have a UL label.
3. Transition ductwork at sound traps shall be insulated with fibrous glass board with reinforced aluminum vapor barrier, Owens-Corning #705, Johns Manville 817 spin glass, or approved equal. Fasten insulation in place with welded pins and washers or equivalent mechanical fastening method, as approved. Seal all joints with vapor barrier coating to provide a continuous vapor barrier. All edges, corners and joints, are reinforced with 4" wide tape. Tape, of type, and applied in strict conformance with manufacturer's recommendations. Over the insulation apply a flood coat of Foster 30-65 or Childers CP-34 or equal vapor barrier coating. Provide fiberglass fitting tape or glass cloth smoothly adhered with Foster 85-60/85-20 or Childers CP-82 (5-gallon cans only) adhesive.

I. Weatherproofing Finishes for Outdoor Duct Insulation

1. Outdoor duct shall be finished with 0.016 Aluminum Jacketing with factory-applied moisture barrier as manufactured by the Pabco-Childers Metals, smooth finish with PSMR, or approved.
2. Heavy duty 0.016-inch thick aluminum with poly-moisture barrier shall be used. All metal jacketing laps shall be sealed with 1/8" bead of Foster 95-44 or Childers CP-76 metal jacketing sealant.
3. Jacketing shall be applied with minimum 2-inch overlaps facing down from the weather and the jacketing shall be secured with aluminum bands ½ inch by 0.020 inches and aluminum wing seals applied on 12-inch centers, with bands applied directly over butt overlaps or with Pli-Grip Rivets. Where jacketing is cut out or abuts an uninsulated surface, the joint shall be sealed with Foster 95-44, Childers CP-76 or Insul-Coustic Sure-Joint 405 (gallon cans only; no tubes).
4. Fittings, valves and other irregular surfaces shall be protected with two coats of Foster 30-65, Childers CP-34, Marathon Vi-AC Mastic, I-C 551, with Foster Mast-a-Fab, Childers Chil Glas #10 or Vi-AC open weave glass cloth membrane between the coats. The total thickness of the coats shall be .32 mils when dry.
5. Outdoor rectangular ductwork aluminum cladding shall be formed with a high point located along the top longitudinal centerline in order to ensure rain water runoff and so that no water accumulation will occur.

2.6 EQUIPMENT INSULATION

- A. Over the insulation, 2" hexagonal mesh wire shall be tightly stretched in place and secured by wiring to anchors with edges tied together.
- B. Equipment insulation shall be finished with .016" aluminum jacketing banded in place with ½" aluminum bands 12" on center.
- C. Chilled and dual-temperature water pump casings shall be constructed by utilizing a frame of 2" wide 0.05" thick galvanized sheet metal corner angles assembled with pop rivets or welded. This frame shall encompass the lower half of the pump and shall have a split removable cover frame for the top sections of the pump. The entire top of the bottom frame shall be closed with 18-gauge galvanized sheet metal either by spot welding or structural screws. Provide 2" thick 1 lb. density fiberglass blanket lining for top and bottom half of the frame. Frame sidings shall be cut for pipes, flanges, pump shaft and instrumentation/gauges. The innermost layer shall be aluminum in order to protect the insulation from damage.
- D. Chilled water expansion tank, chilled water air separator and chemical treatment tanks other than condenser water tank shall be covered with 2" thick fiberglass U.L. labeled pipe and tank insulation with a vapor barrier. Finish shall be 0.016" aluminum cladding as described above for equipment and piping insulation cladding.
- E. Insulation for single inlet return air fans shall be of material as specified for concealed ductwork and shall be covered with glass cloth or all service jackets smoothly adhered with Foster 85-60/85-20 or Childers CP-82/CP-127 adhesive. Seal joints with 5" wide tape. The Contractor shall have the option to use the following material: Insulation for the fans shall be of the thickness noted above and shall be fiberglass pipe and tank insulation having a factory-applied fire retardant vapor barrier jacket and shall be provided with pre-sized glass cloth smoothly adhered with Foster 85-60/85.20 or Childers CP-82/CP-127 adhesive. Pipe and tank insulation is a 3.00 p.c.f. board cut into strips, and fiber perpendicularly oriented and adhered to jacket. The finish shall be

Insulating Cement or approved equal applied 3" thick in one coat, trowelled to a smooth finish. The same option of pipe and tank insulation with ASJ shall apply.

- F. Sound traps shall be insulated the same as the connecting ductwork.

PART 3 - EXECUTION

3.1 INSPECTION

- A. Contractor shall examine the location where this insulation is to be installed and determine space conditions and notify the Architect in writing of conditions detrimental to proper and timely completion of the work.
- B. Do not proceed with the work until unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install insulation in accordance with manufacturer's written instructions, and with recognized industry practices, to ensure that insulation complies with requirements and serves intended purposes.
- B. Coordinate with other work as necessary to interface installation of insulation with other components of systems.
- C. All insulating materials shall be applied only by experienced workmen, in accordance with the best covering practice. All piping, duct or equipment shall be blown out, cleaned, tested and painted prior to the application of any covering. Adhesives, sealers and mastics shall not be applied, when the ambient temperature is below 40°F, or surfaces that are wet.
- D. Insulation for factory-fabricated air handling units, furnished as part of units.
- E. At all openings in insulation and acoustical duct lining, insulate edges neatly and protect with sheet metal nosing. Use sealant as well.
- F. All items described in general indicate the type of covering required, however, all piping, ductwork or equipment that transmits heat or will form condensation shall be insulated.
- G. Finish for Concealed Pipe Insulation:
 - 1. Factory ASJ (All service jacket) secured in place with Bostich staples 4" o.c. or ASJ with self-sealing lap as made by Johns Manville, Owens-Corning or approved equal. All fittings shall be covered with Zeston PVC covers.
- H. All piping and ductwork insulation shall be continuous through non-fire rated ceiling openings and sleeves passing through non-fire-rated walls or floors. Sleeves shall be packed with mineral wool or thermofiber. Discontinue insulation as it passes through fire-rated wall or floor and use mineral wool or Thermo fiber packing instead. Specific mastics, adhesives and coating shall be applied in strict accordance with Manufacturer's instruction, including recommended coverages.
- I. Where packaged type units are called for in the Specifications, or as scheduled on the Drawings, the insulation shall be as herein specified for the specific system.

- J. All valved and capped outlets left for future work shall be insulated as herein specified for the specific systems with a removable section of insulation over caps.
- K. Where insulation on existing piping, equipment, etc., has been cut, removed or damaged, this Contractor shall reinsulate as herein specified.
- L. All insulation of access doors shall be set in sheet metal double-pan construction.
- M. All ductwork shall be insulated in the field, following complete installation of the ductwork. Installation of insulation on the ductwork in the shop (prior to delivery and installation of the ductwork) is prohibited.
- N. For installation of elastomeric closed-cell insulation:
 - 1. Piping:
 - a. Install pipe insulation by slitting tubular sections and applying onto piping or tubing. Alternately, whenever possible, slide unslit sections over the open ends of piping or tubing. All seams and butt joints shall be adhered and sealed using Armaflex 520, 520 BLV or 520 Black Adhesive. When using AP Armaflex SS, only the butt joints shall be adhered using Armaflex 520, 520 BLV or 520 Black Adhesive. Armaflex HT 625 Adhesive shall be used with UT Solaflex.
 - b. Insulation shall be pushed onto the pipe, never pulled. Stretching of insulation may result in open seams and joints.
 - c. Tape the ends of the copper tubing before slipping the Armaflex insulation over the new pipes to prevent dust from entering the pipe.
 - d. All edges shall be clean cut. Rough or jagged edges of the insulation shall not be permitted. Proper tools such as sharp non-serrated knives must be used.
 - e. On cold piping, insulation shall be adhered directly to the piping at the high end of the run and every 18 feet, using a two-inch strip of Armaflex 520, 520 BLV or 520 Black Adhesive on the ID of the insulation and on the pipe. All exposed end cuts of the insulation shall be coated with Armaflex 520, 520 BLV, or 520 Black Adhesive. All penetrations through the insulation and termination points must be adhered to the substrate to prevent condensation migration.
 - f. Sheet insulation shall be used on all pipes larger than 8" IPS. Insulation shall not be stretched around the pipe. On pipes larger than 12" IPS, adhere insulation directly to the pipe on the lower 1/3 of the pipe. On pipes greater than 24" IPS, complete adhesion is recommended.
 - g. Seams shall be staggered when applying multiple layers of insulation.
 - 2. Hangers:
 - a. Support piping system using high density inserts with sufficient compressive strength. The pipe support insulation shall be elastomeric foam with the same or greater thickness than the pipe insulation. All joints shall be sealed with Armaflex 520, 520 BLV or 520 Black adhesive.
 - b. Standard and split hangers -- Piping supported by ring hangers shall have hangers insulated with the same insulation thickness as the adjacent pipe. All seams and butt joints shall be sealed with Armaflex 520, 520 BLV or 520 Black Adhesive. Armaflex HT 625 Adhesive shall be used with UT Solaflex. Ring hangers may be sleeved using oversized tubular insulation. On cold piping, insulation shall extend up the hanger rod a distance equal to four times the insulation thickness. Insulation tape may be used to a thickness equal to the adjacent insulation thickness.
 - c. Clevis hangers or other pipe support systems -- Saddles shall be installed under all insulated lines at unistrut clamps, clevis hangers, or locations where the insulation

may be compressed due to the weight of the pipe. All piping shall have wooden dowels or blocks of a thickness equal to the insulation inserted and adhered to the insulation between the pipe and the saddle.

It is highly recommended for continuous insulation protection to use hanger sizes equal to the outer diameter of the pipe plus insulation thickness.

- d. Armafix IPH or Armafix NPH can be used to prevent compression of insulation at standard split, clevis hangers or other pipe support systems. To minimize the movement of Armafix, it is recommended that a pair of non-skid pads be adhered to the clamps. In addition, to prevent loosening of the clamps, use of an anti-vibratory fastener, such as a nylon-locking nut, is also recommended.
3. Square and Rectangular Ductwork:
 - a. The top of the ductwork must be sloped to prevent “ponding” of water. The recommendation is at least a 2° angle to the outer side.
 - b. Armaflex Sheet Insulation shall be adhered directly to clean, oil-free surfaces with a full coverage of Armaflex 520, 520 Black or Low VOC Spray Adhesive. Armaflex HT 625 Adhesive shall be used with UT Solaflex. AP Armaflex SA shall be adhered directly to clean, oil-free surfaces.
 - c. The duct insulation shall be constructed from the bottom up, with the top insulation sized to extend over the side insulation. This will form a watershed.
 - d. Butt-edge seams shall be adhered using Armaflex 520, 520 Black, or HT 625 Adhesive by the compression fit method to allow for expansion/contraction. Leave a 1/2”-wide uncoated border at the butt-edge seams on the duct surface and the insulation surface. Overlap the insulation 1/4” at the butt-edges and compress the edges into place. Apply Armaflex 520, 520 Black or HT 625 Adhesive to the butt-edges of the insulation.
 - e. Standing metal duct seams shall be insulated with the same insulation thickness as installed on the duct surface. Seams may be covered using strips of Armaflex Sheet Insulation or half sections of tubular pipe insulation with miter-cut ends. Standing seams shall be adhered using Armaflex 520, 520 Black or HT 625 Adhesive.
 - f. Insulation seams shall be staggered when applying multiple layers of insulation.
 4. Round Ductwork:
 - a. AP Armaflex Sheet and Roll Insulation, UT Solaflex Roll Insulation, or NH Armaflex Sheet and Roll Insulation shall be used on all round ductworks. Insulation shall be wrapped not stretched around the duct. On ductwork larger than 12” in diameter, the insulation shall be adhered to the duct surface on the lower one-third. On ductwork greater than 24” in diameter, the insulation shall be completely adhered to the duct surface. Longitudinal seams shall be located on the lower half of any round ductwork.
 - b. Butt-edge seams shall be adhered using Armaflex 520, 520 Black or HT 625 Adhesive by the compression fit method to allow for expansion/contraction. Leave a 1/2” wide uncoated border at the butt-edge seams on the duct surface and the insulation surface. Overlap the insulation 1/4” at the butt-edges and compress the edges into place. Apply Armaflex 520, 520 Black, or HT 625 Adhesive to the butt-edges of the insulation.
 - c. Insulation seams shall be staggered when applying multiple layers of insulation.
 5. Exposed Outdoor Duct:
 - a. All outdoor exposed ductwork shall be finished using one of the following applications: For all the application methods described below it is very important that the exterior horizontal surfaces shall be sloped to prevent ponding on the top surface of the coated insulation. If the substrate is not sloped make the necessary

adjustments to provide for a slope. DO NOT compromise the Armaflex insulation thickness to achieve the necessary slope.

6. Armaflex WB Finish
 - a. All outdoor ductworks shall be finished with a minimum requirement of two coats of Armaflex WB Finish.
 - 1) Rectangular ductwork
 - a) The surface of the insulation must be clean and dry.
 - b) Apply first coat of Armaflex WB Finish at a rate of 400 square feet per gallon.
 - c) Allow to dry at least four hours.
 - d) Apply second coat at a rate of 400 square feet per gallon.

O. Finish for Exposed Insulation:

1. The term “exposed” is hereby defined as any place outdoors, as well as any place indoors in Mechanical Rooms, Storage Rooms, Janitor’s Closets, etc., where located within 7 feet of floor or access platforms.
2. All exposed pipe, valve and fittings insulation shall have 0.016-inch thick corrugated aluminum jacket banded with ½” s.s. bands spaced 12” o.c. Piping, fittings and valves exposed in the building, within seven feet of the floor or access platform, shall have 0.016" thick aluminum jacket banded with ½” aluminum bands spaced 12" o.c. or two bands per section. Joints and jackets shall provide complete weatherproof protection either by mechanical contact or by use of Foster 95-44 or Childers CP-76 metal jacketing sealant (gallon cans only; no tubes).
3. All calcium silicate pipe insulation, all insulated condenser water piping exposed to weather and all other insulated pipe exposed to weather shall have 0.016-inch-thick aluminum jacket banded with ½” s.s. bands spaced 12" o.c. This shall include pipe, fittings and valves.
4. As an alternative to the use of 0.016” aluminum cladding on outdoor duct insulation, if AP Armaflex insulation is used, the ArmaTuff laminated sheet and roll insulation may be used. ArmaTuff laminated Armaflex sheet and roll insulations may be used for insulating exterior applications such as duct, tanks, vessels and large pipes. Refer to section 3.06 for further installation details. ArmaTuff is a laminate of white polymeric material on Armaflex insulations, which offers durability and resistance to weathering, ultraviolet, acid rain and chemicals. The laminate is 0.013 inches (13 mils) thick. The seams must be installed in compression and sealed with Armaflex 520, or 520 Black contact adhesive. Cover the seams using ArmaTuff 6” Seal Tape.

3.3 PROTECTION

- A. The installer of the insulation shall advise the Contractor of required protection for the insulation work during the remainder of the construction period, to avoid damage and deterioration.

END OF SECTION 23 07 00

SECTION 23 08 00

COMMISSIONING OF HVAC SYSTEM

PART 1 - GENERAL

1.1 DESCRIPTION:

- A. The purpose of this section is to specify the Division 23 responsibilities and participation in the commissioning process.
- B. Work under this contract shall conform to requirements of Division 01, General Requirements, Conditions of the contract, and Supplementary Conditions. This specification covers the commissioning of HVAC mechanical systems which are part of this project.
- C. Commissioning work shall be a team effort to ensure that all HVAC mechanical equipment and systems have been completely and properly installed, function together correctly to meet the design intent, and contract document system performance parameters for fine tuning of control sequences and operational procedures. Commissioning shall coordinate system documentation, equipment start-up, control system calibration, testing and balancing, and verification and performance testing.
- D. The trades represented on the commissioning team shall include, but not be limited to, sheet metal, piping and fitting, controls, test and balance, and electrical. The lead person for each trade who will actually perform or supervise the work is to be designated as the representative to the commissioning team. Responsibility for various steps of the commissioning process shall be divided among the members of the commissioning team, as described in this section.
- E. The Commissioning Authority shall have responsibility for coordinating and directing each step of the commissioning process.
- F. HVAC Mechanical system installation, Start-up and checkout testing, balancing, preparation of O&M manuals, and operator training are the responsibility of the Division 23 Contractors, with coordination, observation, verification, and commissioning the responsibility of Division 1, Section 01 91 13. The 01 91 13 commissioning process does not relieve Division 23 from the obligations to complete all portions of work in a satisfactory and fully operational manner.
- G. Start-up and Checkout procedures/tests shall be those listed or detailed in other sections of the Specifications, to be performed by the Contractors or equipment manufacturer representatives. These procedures/tests shall be completely independent of the procedures and checklists (Verification and Functional Performance) called for in this Section.
- H. The following are common abbreviations used in the Specifications
 1. CA: Commissioning Authority.
 2. A: Architect of Record.
 3. E: Engineer of Record (Mechanical Design Professional).
 4. TAB: Test, Adjust and Balance.
 5. O&M: Operation and Maintenance.
 6. O: Owner
 7. MC: Mechanical Contractor.

8. EC: Electrical Contractor.
9. DDC: Direct Digital Controls
10. AC: Automatic Controls System Contractor
11. CM: Construction Manager

1.2 RELATED SECTIONS:

- A. Commissioning - General Requirements Section 01 91 13
- B. Verification Test Check Lists -HVAC Commissioning Section 23 08 00-1

1.3 CITED STANDARDS:

- A. ASHRAE Guideline 4-1993

1.4 SCOPE OF WORK:

- A. Commissioning work of Division 23 shall include, but not be limited to:
 1. Providing documentation of the Start-up and Checkout procedures and tests of the equipment.
 2. Providing testing, adjusting, and balancing of systems to be commissioned.
 3. Cooperation with the Commissioning Authority.
 4. Providing qualified personnel for participation in commissioning tests, including seasonal testing required after the initial testing.
 5. Providing equipment, materials, and labor as necessary to correct construction and/or equipment deficiencies found during the commissioning process.
 6. Providing operation and maintenance manuals, and as-built drawings for the equipment/system to be commissioned to the Commissioning Authority for verification.
 7. Providing training and demonstrations for the systems specified in this Division.
- B. The work included in the commissioning process involves a complete and thorough evaluation of the operation and performance of the following components, systems, and sub-systems:
 1. Pumps
 2. Air Handling Units
 3. VFD
 4. Humidifier
 5. Fans
 6. Cooling Tower
 7. Piping System
 8. Ductwork System
 9. TAB
 10. Controls
- C. Timely and accurate documentation is essential for the commissioning process to be effective. Documentation required as part of the commissioning process shall include but not be limited to:
 1. Progress and status reports, including deficiencies noted.
 2. Minutes from all commissioning meetings.
 3. Start-up and Checkout procedures and tests.
 4. Training agenda and materials.
 5. As-built records.
 6. Commissioning report.

7. Operation and maintenance (O & M) manuals.
- D. Detailed Verification and Functional Performance testing shall be performed on all installed equipment and systems to be commissioned to ensure that operation and performance conform to Contract Documents and Design Intent. All tests shall be witnessed by the Commissioning Authority and shall be detailed in Sections 23 08 00-1 and 23 08 00-2.
- E. Comprehensive training of O&M personnel shall be performed by the Mechanical Contractor, and where appropriate by other sub-contractors, and vendors prior to turnover of building to the owner. The training shall include classroom instruction, along with hands-on instruction on the installed equipment and systems.

1.5 ROLES AND RESPONSIBILITIES

All parties involved in the construction process shall be involved in the commissioning process. Following is a description of the responsibilities of each party:

- A. Owner
 1. Assign maintenance personnel and schedule them to participate in meetings, training sessions, and inspections as follows:
 - a. Construction Phase coordination meetings.
 - b. Initial Owner training sessions at the initial placement of major equipment and subsequent training sessions.
 - c. Maintenance orientation and inspection.
 2. Attend meetings with the TAB contractor as scheduled by the Commissioning Authority. Participate with the Commissioning Authority, the MC, the Mechanical Contractor, the Design Professional, and the TAB Contractor to implement the TAB checklist, part of Section 23 08 00-1. The purpose is to verify that the TAB Contractor understands the TAB requirements. The TAB Contractor shall outline TAB procedures and get concurrence from the Design Professional and Commissioning Authority.
 3. Participate in the final review at the acceptance meeting.
- B. Commissioning Authority (CA)
 1. Develop the commissioning requirements and all related testing, and quality control sections.
 2. Include a list of all contractors for commissioning events.
 3. Execute the mechanical commissioning program, through organization of meetings, tests, demonstrations, training events and performance verifications. Organizational responsibilities include the preparation of agendas, attendance lists, arrangements for facilities, and timely notification to participants for each commissioning event. The Commissioning Authority shall act as chairman at all commissioning events and ensure the execution of all agenda items. The Commissioning Authority shall prepare minutes of every commissioning event and send copies to all attendees and the Owner within 5 workdays of the event.
 4. Review the design documents for their effect on the commissioning process and the final performance of the HVAC system. This includes ensuring that appropriate commissioning guidelines have been followed, and that there are adequate devices included in the design to ensure the ability to properly test, adjust, and balance the systems, and to document the performance of each piece of equipment and each system. Any items required but not shown shall be brought to the attention of the Contractor prior to the submittal of shop drawings.

5. Schedule the first of the Construction Phase commissioning coordination meetings, at some convenient location and at a time suitable to the Contractor and the CM. Subsequent meetings shall be scheduled as required. These meetings shall be for the purpose of reviewing the mechanical orientation and inspections, O&M submittals, training sessions, test, adjust and balance (TAB) work.
6. Schedule the initial Owner training session so that it will be held immediately before the mechanical system orientation and inspection. This session shall be attended by the Owners O&M personnel, the mechanical Contractor and equipment suppliers as necessary, the Design Professional, the CM and the Commissioning Authority. The Design Professional shall conduct this session giving an overview of the system, the system design goals, and the reasoning behind the selection of the equipment. Subsequent training sessions need not be attended by the Design Professional. The format shall follow the outline in the O & M manuals and shall include hands-on training.
7. Supervise and conduct periodic inspections of work in progress to ensure that systems and equipment to be commissioned are installed according to approved shop drawings.
8. Supervise the Mechanical system orientation and inspection following the initial training session. The Mechanical system orientation and inspection shall be conducted by the mechanical Contractor. The emphasis of this Mechanical system orientation and inspection shall be an observation of the equipment location with respect to accessibility. Prepare minutes of this meeting, with a separate summary of deficiency findings by the Owner and Commissioning Authority. Distribute to attendees and the Owner.
9. Adequate accessibility for maintenance and component replacement or repair is the CM's responsibility and shall be checked by the Commissioning Authority.
10. Submit detailed Verification test procedures and data sheets.
11. Submit detailed Functional Performance Test procedures and data sheets.
12. Witness the implementation of the Verification and Functional Performance Tests as indicated in the specified commissioning checklists for the equipment and system to be commissioned. Ensure the results are documented (including a summary of deficiencies), and incorporated in the O&M manuals.
13. Supervise the installation of calibrated test instrumentation to monitor and record data as necessary.
14. Supervise and witness verification tests.
15. Submit Verification test checklists report implementation to the CM for review and acceptance.
16. After the Verification Checklist test/acceptance, the Commissioning Authority shall confirm to CM that the mechanical systems are ready for Functional Performance Testing.
17. Supervise and witness Functional Performance Tests.
18. Submit Functional Performance Test checklists report implementation to the CM, for review and acceptance.
19. Supervise and witness the re-test if deficiencies are found, or corrected, and additional testing is requested.
20. Receive and review the Operation and Maintenance (O&M) manuals as submitted by the contractor, ensuring that they follow the specified outline and format. Insert systems description as provided by the Design Professional.
21. Prior to initiating the TAB work, the Commissioning Authority shall meet with the Owner, mechanical Contractor, Design Professional and TAB Contractor in preparation for implementing the TAB Plan Checklist (start-up and checkout), part of Section 23 08 00. The purpose is to verify that the TAB Contractor understands the TAB requirements. The TAB Contractor shall outline TAB procedures and get concurrence from the Design Professional and Commissioning Authority.

The TAB report, per the Specifications, shall be submitted by the TAB contractor along with the filled-in checklist "Functional Performance Test-TAB Plans" Spot check verification of the TAB report shall be according to "Functional Performance Test B TAB".

22. Upon receipt of notification from the CM that the mechanical systems have been completed and are operational, the Commissioning Authority shall proceed to verify the TAB report and operation of the control systems in accordance with the Commissioning Specification.
23. Review as-built drawings for equipment and systems to be commissioned for accuracy. Request revisions to achieve accuracy.
24. Ensure that the O&M manuals and all as-built records have been updated to include all modifications reported to CA made during the construction phase.
25. Repeat the supervision of Functional Performance Tests to accommodate seasonal tests and/or correct any performance deficiencies. Revise and re-submit the related report implementation to the CM for review and acceptance.
26. Prepare the final commissioning report.
27. Assemble the final project documentation which shall include the commissioning report, and all as-built records. Submit this documentation to the CM for review and acceptance.

C. Architect (A)

1. Provide support to all parties providing a service as a part of the commissioning process. This shall include providing adequate space for equipment installation and maintenance.
2. Include Section 01 91 13 regarding commissioning in Division 1-General Requirements alerting all parties to the need to participate.

D. Mechanical Design Professional (E)

1. Prepare contract documents, for the mechanical system.
2. The Design Professional shall specify and verify adequate maintenance accessibility for each piece of equipment in shop drawings and the actual installation.
3. The Design Professional retains responsibility for the system evaluation, adequacy of the system to meet design intent, capacity of the system, quality control check or any of the other elements of the system design.
4. Attend the initial Owner training sessions. Conduct the mechanical training session pertaining to the overview of the system design, the system design goals and the reasoning behind the selection of equipment.
5. Participate with the Commissioning Authority, the Owner, the Mechanical Contractor, the Design Professional, and the TAB contractor to implement the TAB checklist, part of Section 23 08 00. The purpose is to verify that the TAB contractor understands the TAB requirements. The TAB contractor shall outline TAB procedures and get concurrence from the Design Professional and Commissioning Authority.
6. Review Verification and Functional performance testing reports for deficiencies in meeting the finalized Design Intent.
7. Review as-built records as required by contract documents and turn them over to the Commissioning Authority for inclusion in final project documentation.
8. Review and comment on the final commissioning report.

E. Construction Manager (CM)

1. Ensure that cost for commissioning requirements is included in the contract price.
2. Ensure that commissioning requirements are included in the mechanical, electrical, and controls contracts, as well as in other sub-contractors, to ensure full cooperation of all parties in the mechanical commissioning program.

3. Ensure acceptable representation, with the means and authority to prepare and coordinate the execution of the mechanical commissioning program as described in the contract documents.
4. Participate in O&M personnel orientation and inspection at the final construction stage.
5. Attend the O&M training sessions. These training sessions are to be attended by the Owner, Commissioning Authority, CM, Contractors, and equipment suppliers as necessary. The Design Professionals shall attend only the initial training sessions. The format shall follow the outline in the O&M manuals. This mechanical system orientation and inspection should include hands-on training.
6. Participate with the Commissioning Authority, the Owner, the Mechanical Contractor, the Design Professional, and the TAB contractor to implement the TAB checklist, part of Section 23 08 00. The purpose is to verify that the TAB contractor understands the TAB requirements. The TAB contractor shall outline TAB procedures and get concurrence from the Design Professional and Commissioning Authority.
7. Follow up with AC to receive from him a statement that control systems have been calibrated. Distribute that statement to CA.
8. Follow up with TAB to receive from him a statement that TAB work has been completed and submit the final TAB reports to CA for review.
9. Participate in any deficiency resolution (See item 3.03).

F. Mechanical Contractor (MC)

1. Include the cost to complete commissioning requirements for mechanical systems in the contract price.
2. Include requirements for submittal data, O&M data, and training in each purchase order or sub-contract written.
3. Ensure cooperation and participation of specialty sub-contractors such as sheet metal, piping, refrigeration, and TAB.
4. Ensure participation of major equipment manufacturers in appropriate training and related videotaping and testing activities.
5. Attend the Construction Phase coordination meeting scheduled by the Commissioning Authority.
6. Participate with the Commissioning Authority, the Owner, the CM, the Design Professional, and the TAB contractor to implement the TAB checklist, part of Section 23 08 00. The purpose is to verify that the TAB contractor understands the TAB requirements. The TAB contractor shall outline TAB procedures and get concurrence from the Design Professional and Commissioning Authority.
7. Prepare preliminary schedules for mechanical system orientation, inspections, O&M manual submission, training sessions, pipe system testing, flushing and cleaning, duct testing, equipment Start-up and Checkout, TAB Plan Meeting, Verification and Functional Performance tests, and task completion schedules for same for use by the Commissioning Authority. Update schedules as appropriate throughout the construction period. Notify the Commissioning Authority a minimum of two weeks in advance of any scheduled event.
8. Provide the CA Start-up and Checkout procedures and checklists documenting their successful completion.
9. Assist the commissioning Authority in Verification and Functional Performance tests, as indicated in the specified checklists.
10. Attend an initial training session.
11. Conduct mechanical system orientation and inspection at the equipment placement completion stage.
12. Update drawings to the record condition to date, and review with the Commissioning Authority.

13. Gather O&M data on all equipment and assemble it in binders as required by the Commissioning Specification. Submit to the Commissioning Authority prior to the completion of construction.
 14. Participate in and schedule vendors and Contractors to participate in the training sessions as set up by the Commissioning Authority.
 15. Provide written notification to the CM and Commissioning Authority that the HVAC and controls work have been completed in accordance with the contract documents and that the equipment, systems, and sub-systems are operating as required.
 16. Provide a complete set of as-built records to the Commissioning Authority.
- G. Test, Adjust, and Balance Contractor (TAB Contractor)
1. Include the cost for commissioning requirements in the contract price.
 2. Attend the initial commissioning coordination meeting scheduled by the Commissioning Authority.
 3. Be part of the implementation of the Verification and Functional Performance tests, as indicated in the specified Commissioning Checklists.
 4. Participate with the Commissioning Authority, the Owner, the CM, the Mechanical Contractor, and the Design Professional to implement the TAB Plan Checklist, part of Section 23 08 00. The purpose is to verify that the TAB contractor understands the TAB requirements. The TAB contractor shall outline TAB procedures and get concurrence from the Design Professional and Commissioning Authority.
 5. At the completion of the TAB work, and submittal of final TAB report, notify the mechanical Contractor and CM.
 6. Participate in training sessions as scheduled by the Commissioning Authority.
- H. Automatic Controls System Contractors. (AC)
1. Include the cost for commissioning requirements in the contract price.
 2. Attend commissioning coordination meetings scheduled by the Commissioning Authority.
 3. Be part of the implementation of the Verification and Functional Performance tests, as indicated in the specified Commissioning Checklists.
 4. Review design for controllability with respect to selected manufacturers' equipment.
 - a. Verify that proper hardware exists for the functional performance required by the specification and sequence of operation.
 - b. Verify that proper safeties and interlocks are included per the design.
 - c. Verify proper selection of sensor ranges.
 - d. Clarify all questions of operation.
 5. Provide the following submittals to the Commissioning Authority.
 - a. Sequences of Operation Submittals. The Controls Contractor=s submittals of control drawings shall include complete detailed sequences of operation for each piece of equipment, regardless of the completeness and clarity of the sequences in the specifications. They shall include:
 - 1) An overview narrative system of the system generally describing its purpose, components, and function.
 - 2) All interactions and interlocks with other systems.
 - 3) Detailed delineation of control between any packaged controls and the Automatic Temperature Control (ATC) listing which points the ATC monitors only and which points it controls and which points are adjustable.
 - 4) Written sequences of control for packaged control equipment. (Equipment manufacturer's stock sequences may be included but will generally require additional narrative).
 - 5) Start-up sequences

- 6) Warm-up mode sequences
 - 7) Normal operating mode sequences
 - 8) Unoccupied mode sequences
 - 9) Shutdown sequences
 - 10) Capacity control sequences and equipment staging
 - 11) Temperature and pressure control: setbacks, setups, resets, etc.
 - 12) Detailed sequences for all control strategies, e.g. economizer control, optimum start/stop, staging, optimization, demand limiting, etc.
 - 13) Effects of power or equipment failure with all standby component functions.
 - 14) Sequences for all alarms and emergency shutdowns
 - 15) Seasonal operational differences and recommendations
 - 16) Initial and recommended values for all adjustable settings, setpoints, and parameters that are typically set or adjusted by operating staff, and any other control settings or fixed values, delays, etc. that will be useful during testing and operating the equipment.
 - 17) Daily weekly, and monthly schedules of start, run, and end times.
 - 18) To facilitate referencing all sequences shall be written in small statements, each with a number for reference. For a given system, numbers will not repeat for different sequence sections.
- b. Control Drawings Submittal
- 1) The control drawings shall have a key to all abbreviations.
 - 2) The control drawings shall contain graphic schematic depictions of the systems and each component, superimposed on diagrams of the physical layout.
 - 3) The schematic will include the system and component layout of any equipment that the control system monitors, enables or controls, even if the equipment is primarily controlled by packaged or integral controls.
 - 4) Provide a full points list, of all control points, including analog inputs, analog outputs, digital inputs, and digital outputs. Include the values of all parameters for each system point. Provide a separate list for each stand-alone control unit. The list shall have the following as a minimum included for each point:
 - a) Controlled system
 - b) Point abbreviation
 - c) Point description
 - d) Display unit
 - e) Control point or setpoint (Yes/No)
 - f) Monitoring point (Yes/No)
 - g) Intermediate point (Yes/No)
 - h) Calculated point (Yes/No)

Key:

Point Description: DB temp, airflow, etc.

Control or Setpoint: Point that controls equipment and can have its setpoint changed (OSA, SAT, etc.)

Intermediate Point: Point whose value is used to make a calculation which then controls equipment (space temperatures that are averaged to a virtual point to control reset)

Monitoring Point: Point that does not control or contribute to the control equipment, but is used for operation, maintenance, or performance verification.

Calculated Point: AVirtual@ point generated from calculations of other point values.

The Controls Contractor shall keep mechanical, electrical, TAB contractors, A, E, CA, and CM informed of all changes to this list during programming and setup

- c. Hardware and software submittals including the logic diagram showing the logic flow of the system.
- d. Control panel construction shop drawings.
- e. A complete control language program listing including all software routines employed in operating the control system. Also provide a program write-up, organized in the same manner as the control software. This narrative shall describe the logic flow of the software and the functions of each routine and sub-routine. It should also explain individual math or logic operations that are not clear from reading the software listing.
- f. Hardware Operation and Maintenance manuals.
- g. Application software and project applications code manuals.
6. An updated, as-built version of the control drawings and sequence of operations shall be provided for inclusion in the final controls O&M Manual submittals.
7. Verify proper installation and performance of controls/ATC hardware and software provided by others.
8. Integrate installation and programming schedules with construction and commissioning schedules.
9. Provide thorough training to operating personnel on hardware operations and programming, and the application program for the system.
10. Provide control system technician for use during system verification and functional performance testing.
11. Provide system modifications as required.
12. Provide support and coordination with TAB contractor on all interfaces between their scopes of work. Provide all devices, such as portable operator terminals, for TAB use in completing TAB procedures. This support and coordination shall be in the following manner:
 - a. Meet with the TAB contractor prior to beginning TAB and review the TAB plan to determine the capabilities of the control system toward completing TAB. Provide the TAB any needed unique instruments for setting terminal unit boxes and instruct TAB in their use (handheld control system interface for use around the building during TAB, etc.)
 - b. Provide qualified technicians to operate the controls to assist the TAB contractor in performing TAB or provide sufficient training for TAB to operate the system without assistance.
13. The controls contractor shall prepare a written plan indicating in a step-by-step manner, the procedures that will be followed for Start-up and Checkout and adjust the control system prior to commissioning testing. At a minimum, the plan shall include for each type of equipment controlled by the automatic controls:
 - a. System name
 - b. List of devices
 - c. Step-by-step procedures for testing each controller after installation, including:
 - 1) Process of verifying proper hardware and wiring installation.
 - 2) Process of downloading programs to local controllers and verifying that they are addressed correctly.
 - 3) Process of performing operational checks of each controlled component.
 - 4) Plan and process for calibrating valve and damper actuators and all sensors.

- 5) A description of the expected field adjustments for transmitters, controllers, and control actuators should control responses fall outside of expected values.
 - d. A copy of the log and field checkout sheets that will document the process. This log must include a place for initial and final read values during calibration of each point and clearly indicate when a sensor or controller has passed and is operating within the contract parameters.
 - e. A description of the instrumentation required for testing.
 - f. Indicate what tests on what systems should be completed prior to TAB using the control system for TAB work. Coordinate with the MC, A.E, and TAB contractor for this determination.
 14. The controls contractor shall have all required Start-up and Checkout checklists, calibrations, and tests of the system completed and approved by the E. The E shall determine if these submittals meet his/her requirements and requirements of the Contract Documents. Once the E accepts these submittals, they shall be forwarded to CA who will forward them to the A for record prior to TAB.
 15. Assist and cooperate with CA, MC, in the following manner:
 - a. Using a licensed technician who is familiar with this building's systems, execute the Verification and Functional testing of the control systems. Provide two-way radios during the testing.
 16. List and clearly identify on the as-built duct and piping drawings the locations of all sensors utilized in the start-up and checkout and commissioning processes.
 - I. Equipment Suppliers and Miscellaneous Contractors
 1. Include the cost for commissioning requirements in the contract price.
 2. Provide submittals, and appropriate O&M manual section(s).
 3. Attend the initial commissioning coordination meeting scheduled by the Commissioning Authority.
 4. Participate in training sessions as scheduled by the Commissioning Authority.
 5. Demonstrate performance of equipment as applicable.
- 1.6 DOCUMENTATION:
- A. The Commissioning Authority shall oversee and maintain the development of commissioning documentation. The commissioning documentation shall be kept in three-ring binders and organized by system and sub-system when practical. All pages shall be numbered, and a table of contents page(s) shall be provided. The commissioning documentation shall include, but not be limited to, the following:
 1. A detailed description of the design intent for the project, listing operating parameters, control sequences, occupancy conditions, etc.
 2. A complete description of how the HVAC system is intended to operate.
 3. Approved TAB report.
 4. All accepted shop drawings of mechanical equipment to be commissioned. Shop drawings shall be full-size sheets folded as required to fit in binders.
 5. All Start-up and Checkout procedures and tests signed.
 6. All verification and functional performance test checklists/results, signed by indicated personnel organized by system and sub-system.
 7. Three copies of the operation and maintenance (O&M) manuals specified in other sections of these specifications shall be included with the commissioning documentation. The manuals shall be incorporated in the commissioning documentation prior to the commencement of O&M training required in this and other sections of the specification. Preparation of O&M manuals shall be as specified in section 3.07 of these specifications.

PART 2 - PRODUCTS

2.1 TEST TOOL EQUIPMENT:

- A. The appropriate Contractor(s) shall furnish all special tools and equipment required during the commissioning process. A list of all tools and equipment to be used during commissioning shall be submitted to the Commissioning Authority for approval. The Owner shall furnish the necessary utilities for the commissioning process.

2.2 TEST EQUIPMENT B PROPRIETARY:

- A. Proprietary test equipment and software required by any equipment manufacturer for programming and/or start-up, whether specified or not, shall be provided by the manufacturer of the equipment. The manufacturer shall provide the test equipment, demonstrate its use, and assist in the commissioning process as needed. Proprietary test equipment (and software) shall become the property of the Owner upon completion of the commissioning process.

PART 3 - EXECUTION

3.1 GENERAL:

- A. The first meeting of the commissioning team members shall be held at a time and place designated by the CM. The purpose shall be to familiarize all parties with the commissioning process, and to ensure that the responsibilities of each party are clearly understood.
- B. The Contractor shall complete all phases of work so the systems can be started, tested, balanced, and acceptance procedures are undertaken. This includes the complete installation of all equipment, materials, piping, ductwork, controls, etc., per the contract documents and related directives, clarifications, change orders, and Design Intent.
- C. A Commissioning Plan shall be developed by the Commissioning Authority. The CM shall assist the Commissioning Authority in preparing the Commissioning Plan by providing all necessary information pertaining to the schedule of actual equipment installation, and their tests.
- D. Acceptance procedures are normally intended to begin prior to completion of a system and/or sub-systems, and shall be coordinated with the Division 23 contractor. The start of acceptance procedures before system completion does not relieve the contractor from completing those systems as per the schedule.

3.2 PARTICIPATION IN ACCEPTANCE PROCEDURES:

- A. The Contractor shall provide skilled technicians to start up and debug all systems within Division 23. These same technicians shall be made available to assist the Commissioning Authority in completing the commissioning program. Work schedules, time required for testing, etc., shall be requested by the Commissioning Authority and coordinated by the CM and Contractor. The contractor shall ensure that the qualified technician(s) are available and present during the agreed-upon schedules and of sufficient duration to complete the necessary tests, adjustments, and/or problem resolutions.

- B. System testing problems and discrepancies may require additional technician time, Commissioning Authority time, reconstruction of systems, and/or replacement of system components. The additional technician time shall be made available for subsequent commissioning periods until the required system performance is obtained.
- C. The Commissioning Authority reserves the right to question the appropriateness and qualifications of the technicians relative to each item of equipment, system, and/or sub-system. Qualifications of technicians shall include expert knowledge relative to the specific equipment involved and a willingness to work with the Commissioning Authority. The contractor shall provide adequate documentation and tools for Start-up and Checkout tests and commissioning tests for the equipment, system, and/or sub-system to be commissioned.

3.3 DEFICIENCY RESOLUTION:

- A. In some systems, mis adjustments, misapplied equipment, and/or deficient performance under varying loads will result in additional work being required to commission the systems. This work shall be completed under the direction of the Owner and CM, with input from the Contractor, equipment supplier, design professional, and Commissioning Authority. Whereas these members shall have input and the opportunity to discuss, debate, and work out problems, the Owner shall have final jurisdiction over any additional work done to achieve performance.
- B. Corrective work shall be completed in a timely fashion to permit the completion of the commissioning process. Experimentation to demonstrate system performance may be permitted. If the Commissioning Authority deems the experimentation work to be ineffective or untimely as it relates to the commissioning process, the Commissioning Authority shall notify the Owner and the CM, indicating the nature of the problem, expected steps to be taken, and suggested deadline(s) for completion of activities. If the deadline(s) pass without resolution of the problem, the Owner reserves the right to obtain supplementary services and/or equipment to resolve the problem. Costs incurred to solve the problems in an expeditious manner shall be the contractor's responsibility.

3.4 ADDITIONAL COMMISSIONING:

- A. Additional commissioning activities may be required after system adjustments, replacements, etc., are completed. The contractor(s) suppliers, and Commissioning Authority shall include a reasonable reserve to complete this work as part of their contractual obligations.

3.5 SEASONAL COMMISSIONING:

- A. Seasonal commissioning pertains to testing under full load conditions during peak heating and peak cooling seasons, as well as part load conditions in the spring and fall. Initial commissioning shall be done as soon as contract work is completed, regardless of season. Subsequent commissioning may be undertaken at any time thereafter to ascertain adequate performance during the different seasons.
- B. Heating equipment shall be tested during winter design extremes. Cooling equipment shall be tested during summer design extremes with a fully occupied building. Each contractor and supplier shall be responsible for participating in the initial and the alternate peak season tests of the systems as required to demonstrate performance.

3.6 ACCEPTANCE PROCEDURES:

- A. Equipment or system shall be deemed accepted after its Verification Test and Functional Performance Test have been accepted by the Commissioning Authority.
- B. Verification Tests
 - 1. Verification tests are primarily static in nature to ascertain and prepare the equipment or system for operational modes under Functional Performance Testing. These Verification tests shall begin only after the Start-up and checkout tests have been successfully completed.
 - 2. Tests shall be performed for the items indicated on the checklists with participants as shown. Participants shall include in their proposals all costs to do the work involved in these tests.
 - 3. The Commissioning Authority shall coordinate and witness the Verification Tests, see Section 23 08 00-1. A TAB Plan Checklist is included.
- C. Functional Performance Tests
 - 1. Functional performance tests are primarily dynamic in nature and shall be performed under operation and various modes to verify all the sequences of operation and interlocks. These tests shall begin only after the Verification tests have been successfully completed.
 - 2. Tests shall be performed for the items indicated on the checklists, with participants as shown. Participants shall include in their proposals all costs to do the work involved in these tests.
 - 3. The Commissioning Authority shall coordinate and witness the Functional Performance Tests.
- D. Instrumentation
 - 1. The test, adjust and balance contractor shall provide all instrumentation required for the commissioning tests. Instruments shall have been calibrated within the six-month period prior to these tests. The calibration shall be traceable to National Institute of Standards and Technology standards.
- E. Tests For Deficiencies
 - 1. Any identified deficiencies need to be evaluated by the Design Professional and CM to determine if they are part of the contractor's or sub-contractors' contractual obligations. Construction deficiencies shall be corrected by the responsible contractor(s), and the specific test repeated.
 - 2. If it is determined that the HVAC system is constructed in accordance with the contract documents, and the performance deficiencies are not part of the contract documents, the Owner must decide whether any required modifications needed to bring the performance of the HVAC system up to the finalized design intent shall be implemented, or if the test shall be accepted as submitted. If corrective work is performed, the owner shall determine if a portion or all required tests should be repeated, and a revised report submitted.

3.7 OPERATING AND MAINTENANCE MANUAL:

- A. Shall be in accordance with ASHRAE Guideline 4-1993 (Preparation of Operating and Maintenance Documentation for Building Systems).
- B. The operating and maintenance manual shall consist of a sturdy binder with 8-1/2" x 11" sheets containing the following major sections.

1. System Descriptions:
 - a. Each major system shall be described, type-written, in general terms, including major components, interconnections, theory of operation, theory of controls, unusual features, and major safety precautions. This information should correlate with the information provided in the manufacturer's instructions book. This section shall include, but not be limited to, the following data:
 - 1) Detailed description of each system and each of its components showing piping, valves, controls, and other components, with diagrams and illustrations where applicable.
 - 2) Wiring and control diagrams with data to explain detailed operation and control of each component.
 - 3) Control sequences describing start-up, all modes of operation, and shutdown.
 - 4) Corrected shop drawings.
 - 5) Approved product data including all performance curves and rating data.
 - 6) Copies of approved certifications and laboratory test reports (where applicable).
 - 7) Copies of warranties.
 - b. Updated as-built version of the control drawings and sequences of operation, detailed in article 1.05 H. shall be reduced in size and folded to usefully fit into the Manual, and submitted.
2. Operating Instructions:
 - a. Condensed, typewritten, suitable for posting, instructions shall be provided for each major piece of equipment. Where more than one (1) common unit is installed, one instruction is adequate. The instructions shall provide procedures for:
 - 1) Starting up the equipment/system.
 - 2) Shutting down the equipment/system.
 - 3) Operating the equipment in emergency or unusual conditions.
 - 4) Safety precautions.
 - 5) Troubleshooting suggestions.
 - 6) Other pertinent data applicable to the operation of particular systems or requirements.
 - b. The instructions shall be suitable for posting adjacent to the equipment concerned.

The Contractor shall provide instructions for:

 - 1) Equipment and systems listed under 1.04 Scope of Work.
3. Ongoing and Preventive Maintenance:
 - a. Condensed, typewritten procedures for recommended ongoing and preventive maintenance actions shall be provided for each category of equipment and systems listed under 1.04 Scope of Work. This information shall include, but not be limited to the following:
 - 1) Maintenance and overhaul instructions.
 - 2) Lubricating schedule including type, grade, temperature, and frequency range.
 - 3) Parts list, including source of supply and recommended spare parts.
 - 4) Name, address, and 24-hour telephone number of each subcontractor who installed equipment and systems, and local representative for each type of system.
 - 5) Other pertinent data applicable to the maintenance of particular systems or equipment.
 - b. These recommended preventive maintenance actions shall be categorized by the following recommended frequencies:

- 1) Weekly
- 2) Monthly
- 3) Quarterly
- 4) Semi-Annual
- 5) Annual
- 6) Other

C. Postal Operating Instructions and Diagrams:

1. Operating Instructions:

- a. Copies of operating instructions provided in the operating manual shall be posted in the near vicinity of each piece of applicable equipment. The instructions shall be mounted neatly in frames under Plexiglas, where they can be easily read by operating personnel. Instructions mounted outdoors shall be suitably protected from weather.

2. Posted Systems Diagrams:

- a. Simplified one (1) line diagrams of the systems listed shall be developed of conveniently adequate size and posted neatly under Plexiglas in the main or most appropriate equipment room for easy reference by operating and maintenance personnel. These drawings shall be done in a professional manner that is acceptable to the DDC. The diagrams shall show each component including all valves installed in the system, with name and identifying number. If space does not permit valves installed in the system, with names and identifying numbers on the diagrams, valve charts shall be provided. Explanatory notes, where needed, shall be provided. This shall apply to equipment and systems listed under Article 1.04 Scope of Work.
- b. These diagrams shall be suitable for reduction in size and use in the operating manual system descriptions previously covered.

3.8 AS-BUILT DRAWINGS:

- A. The Commissioning Authority shall review the as-built contract documents pertaining to the equipment/system to be commissioned to verify incorporation of both design changes and as-built construction details. Discrepancies noted shall be corrected by the appropriate party.

3.9 OPERATING AND MAINTENANCE TRAINING AND VIDEOTAPING:

- A. The Mechanical Contractor, TAB Contractor, Automatic Controls, and appropriate sub-contractors, shall provide comprehensive operating and maintenance instructions on building systems prior to delivery. The instructions shall include classroom instruction delivered by competent instructors based upon the contents of the operating manual. Emphasis shall be placed upon overall systems diagrams and descriptions, and why systems were designed as they were. The classroom instruction shall also include detailed equipment instruction by qualified manufacturer representatives for all equipment listed in Article 1.04 Scope of Work for which operating instructions are provided. The manufacturer representative training shall emphasize operating instructions, and preventing maintenance as described in the operating manual. Videotaping of these instructions shall be by CA. At a minimum, the training sessions shall cover the following items:

1. Types of installed systems
2. Theory of operation
 - a. Design intent
 - b. Occupied vs. unoccupied or partial occupancy
 - c. Seasonal modes of operation

- d. Emergency conditions and procedures
 - e. Comfort conditions
 - f. Indoor air quality
 - g. Energy efficiency
 - h. Other issues important to facility operation.
3. System operations.
 4. Use of control system
 - a. Sequence of operation
 - b. Problem indicators
 - c. Diagnostics
 - d. Corrective actions
 5. Service, maintenance, diagnostics, and repair.
 6. Use of reports and logs.
 7. Troubleshooting, investigation of malfunctions, and determining reasons for the problem.
- B. Each classroom training period shall be followed by an inspection, explanation, and demonstration of the system concerned by the instructors. All equipment shall be started up and shut down.
- C. The contractor shall be responsible for organizing, arranging, and delivering this instruction in an efficient and effective manner on a schedule agreeable to the owner.
- D. The contractor shall provide, at or before substantial completion, a proposed agenda and schedule of the above training for approval by the Commissioning Authority and the Owner.

END OF SECTION 23 08 00

SECTION 23 09 00

AUTOMATIC TEMPERATURE CONTROLS - ELECTRIC

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

- A. This Section is coordinated with and complementary to the General Conditions and Supplementary General Conditions of the Work, wherever applicable to Mechanical Work.
- B. Section 01 31 46 - Special Requirements for Mechanical and Electrical work shall apply.

1.2 DESCRIPTION OF WORK

- A. The work includes the providing of all labor, materials, equipment, accessories, services and tests necessary to complete and place into satisfactory operation a complete system of automatic temperature controls as shown on the drawings and hereinafter specified.
- B. The control system shall be of the electric-electronic fully modulating type unless otherwise indicated, all as hereinafter specified. Control equipment shall be as manufactured by Distech Controls. All controls shall be the product of one manufacturer. The temperature control manufacturer shall be responsible for the quality and satisfactory operation of material provided but not actually manufactured by him.
- C. The system shall be compatible with BACNET. The system shall have a graphic system which is compatible with the system currently installed, which is a Distech Control system, installed and maintained by ADVANTEX Solutions; contact Giovanni Natale from ADVANTEX Solutions (T: 718-278-2290, C: 917-682-2521, E-mail: gnatale@advantexsolutions.com).
- D. The system shall have a new graphic.
- E. The control system shall include all necessary sensors, thermostats, damper motors, transmitters, transducers, relays, switches, etc., and all necessary equipment for a complete control system, regardless of whether or not specifically mentioned, including electric relays and contactors required for control interlocking.
- F. The control system shall include motor control wiring including all control and interlock wiring from switches, freezestats, firestats and relays, to motor controllers, variable frequency drives, contactors, etc. and all other motor control wiring.
- G. Fan air flow measuring devices shall be by factory mounted. The air flow measuring device manufacturer's representative shall inspect the installation when complete and shall provide certification, in writing, that the installation complies with their requirements.
- H. Provide nameplates on all devices, whether or not mounted on the face of local control panels. In occupied areas, nameplates shall be concealed beneath covers of room type instruments, to describe functions.

- I. Automatic dampers, smoke dampers and combination fire smoke dampers shall be provided under this section. Provision shall be made under the electrical contract for the opening and closing of the fire/smoke dampers and smoke dampers, as required for fire emergency. Provision shall be made under this section for opening and closing dampers and for normal air handler operation. Combination fire/smoke dampers and smoke dampers shall be wired under the electrical contract and controlled via the fire alarm system. Under this section, the CONTRACTOR shall coordinate with the fire alarm sub-contractor. Provide shop drawings, locating dampers on floor plans and on riser diagrams and indicating type of control for each damper, i.e., open/close under fire alarm, open/close with shutdown of specific AHU's under fire alarm, and used for smoke purge control. These shop drawings will be for use by the CONTRACTOR as part of the coordination.
- J. Terms ATC subcontractor, BAS subcontractor and temperature control Contractor refer to the CONTRACTOR providing work under this section of the specification. The BAS subcontractor or automation system Contractor referred to in this and other sections shall be one and the same Contractor as the ATC subcontractor.
- K. All sensors, transmitters, thermostats, automatic control valves, wells, automatic dampers, combination fire smoke dampers and smoke dampers, to be mounted in pipes or ducts shall be mounted in such pipe or ducts by the CONTRACTOR providing the piping or ducts. This subcontractor, the ATC subcontractor, shall supply these devices to the CONTRACTOR performing the mounting in a timely manner so as not to inhibit or delay his work. The final installation of these devices, i.e. connection, shall be the responsibility of this section.
- L. Wiring between the fire alarm system and the automatic temperature control system shall be provided by the CONTRACTOR providing the fire alarm system. The subcontractor shall provide terminal points for the CONTRACTOR to wire to in local temperature control panels and in smoke damper panels. The subcontractor shall provide the Sub-Contractor with a wiring diagram and the location of all the interface terminal points.
- M. All temperature sensors, humidity sensors, actuators and DDC controllers and all associated wiring including power wiring, damper (including fire and smoke) wiring and wiring to control duct terminal units, i.e., automatic dampers, reheat coil, VAV and CAV boxes, shall be provided under this section. This shall include extending power wiring from junction boxes left under the electrical work and making power wiring connections. See electrical drawings for location of junction boxes. Where junction boxes are not shown on the electrical drawings, provide 120 volt power wiring from the nearest power panel under this section.
- N. Provide control wiring required to other equipment provided under this contract.
- O. All automatic controls required for AHUs for all projects shall comply with this section.
- P. The BAS shall include the as-built narrative sequence of operation for all systems so that the operator can access the sequence of operation for any system while viewing the graphic for that system.
- Q. As-built sequence of operation shall be provided in BAS software. When viewing a control schematic on the BAS, the operator shall have the option of having the system display the sequence of operation.

- R. Provide a display controller or panel-mounted controller with display screen with touch control or keypad, as specified herein, at each AHU and pumping/heat exchanger system and other systems provided with control under this contract. The touch/display screen shall allow hospital maintenance staff to monitor systems temperatures, pressures, and status and to modify setpoints.

1.3 QUALITY ASSURANCE

- A. Only firms regularly engaged in the manufacture and installation of this equipment with the characteristics and capacity similar required and whose products have been installed by them and are in satisfactory use in similar service for not less than 10 years will be acceptable.
- B. All control equipment used in this project shall have been successfully proven in actual field installations for a period of two (2) years prior to the date of submittal of said equipment to the Architect for approval.
- C. The control system shall be installed completely in all respects by competent mechanics, regularly employed by the manufacturer of the control system.

1.4 SUBMITTALS

- A. Refer to Section 01 31 46 - Special Requirements for Mechanical and Electrical Work and submit shop drawings.
- B. Complete shop drawings shall be submitted to the Architect for approval before any field installation is started. Such drawings shall give a complete description of all control elements and shall show completed schematic piping and wiring diagrams, including functional descriptions. Valve and damper schedules shall be included.
- C. Floor plans indicating all room thermostat locations not shown on the Drawings, and samples of each type, shall be prepared and submitted to the Architect for approval before installation. Samples of unitary controls shall also be submitted for approval, and a typical assembly shall be field erected, before installation. All room controls shall be mounted five feet above the finished floor.

1.5 RELATED WORK UNDER ELECTRICAL WORK

- A. All power wiring for pumps, fans, unit heaters, clocks, air compressors, aftercooler, etc. See Special Requirements for Mechanical and Electrical Work.
- B. The entire system of Automatic Temperature Controls and the Building Automation System shall be powered from the building's power system. Components and devices to be powered include, but are not limited to, all ATC panels, BAS computers and remote stations, valve actuators, damper actuators, central and unitary equipment controls and terminal unit controls including VAV boxes. The source of power for all such devices shall be derived from either junction boxes left by the Electrical Contractor as indicated on the electrical drawings, or, if not indicated on the electrical drawings, the HVAC Contractor under his contract shall provide power wiring taken directly from the building's Power Distribution Panel(s).

1.6 COORDINATION

- A. Refer to Section 01 31 46 - Special Requirements for Mechanical and Electrical Work.

1.7 GUARANTEE

- A. Refer to Section 01 31 46 - Special Requirements for Mechanical and Electrical Work.
- B. The control system herein specified shall be free from defects in workmanship and material under normal use and service. If, within one year from the date of acceptance by the Architect, any equipment herein described is proved to be defective in workmanship or material, it shall be adjusted, repaired or replaced, free of charge, during the guarantee period.

PART 2 - PRODUCTS

2.1 VALVE AND DAMPER OPERATORS

- A. All operators shall be of totally enclosed type in dustproof housings of pressed steel or approved cast metal. All motors shall be of a permanently lubricated type with an oil-immersed gear train or internal servo relief valve. An open-type gear train will not be acceptable. All operators shall be of the spring return type, to provide failsafe operation and overtravel protection. Each automatic damper shall be provided with a separate damper operator. Operators to be located outdoors shall be NEMA 3R rated.

2.2 ELECTRIC WIRING

- A. All electric wiring, materials and installation shall be in accordance with the latest revision of the National Electric Code, and applicable Local Code, and shall carry the UL label where applicable. All wiring shall be installed in rigid galvanized steel conduit, 1/2" minimum, and shall be a minimum of #14 AWG. All specials, such as junction boxes and connectors, shall be of type designed for use with conduit.

2.3 AUTOMATIC DAMPERS, AND SMOKE DAMPERS

- A. Dampers shall have 14 gauge galvanized frames of not less than 3" in width and blades of 16 gauge, or double 22 gauge, galvanized steel, and shall be adequately braced to form a rigid assembly, where required in galvanized ductwork. Dampers shall have blades not more than 8" wide. The linkage and hardware shall be zinc plated steel. Damper blades and rods shall be installed in horizontal position.
- B. In copper, aluminum and stainless steel ductwork, damper material shall match the ductwork, with blades of 48 oz. copper, 16 gauge aluminum, or 16 gauge stainless steel.
- C. All dampers shall be of the proportioning or opposed blade type and shall be motor operated. Dampers shall have continuous elastomer or stainless steel stops to avoid leakage. Bearings shall be oilite nonferrous sleeve type. All dampers shall be provided with continuous 3/16" x 2" closed cell neoprene gasketing around perimeter of the frame and at interlocking blade edges, to form an airtight seal.
- D. All dampers shall be constructed to provide a maximum leakage of 3%, with an approach velocity of 1500 fpm flow, when closed against 4 inches of water. Submit leakage and flow characteristic data for all dampers.

- E. All outside air dampers shall automatically return to closed position in the event of loss of electricity or air.
- F. Automatic dampers shall be furnished by the control manufacturer and shall be set in place by the HVAC Contractor under the supervision of the control manufacturer, unless otherwise indicated.

2.4 INSERTION AND IMMERSION THERMOSTATS

- A. All thermostats shall have adjustable throttling ranges and shall be capable of positioning valve or damper operators in intermediate positions. The control elements of the thermostats shall be centrally mounted inside the supply duct or casing to measure the air temperature. The sensing shall be transmitted to the central mechanism located on the local control panel by means of capillary tubing or electronic transmission. Thermostats shall be capable of controlling without hunting and shall respond to a change of plus or minus 3EF. The control point shall be adjustable 15E above and below intended setting, with a minimum scale of at least 50EF. Sensing elements shall be of proper design and material for its specific application and shall have sufficient length to cover a minimum of two-thirds of the coil or duct.

2.5 AUTOMATIC CONTROL VALVES

- A. All automatic control valves shall be furnished by the temperature control manufacturer and shall be installed by the HVAC Contractor under the control manufacturer's supervision.

2.6 THERMOMETERS

- A. Furnish and install dial thermometers with 1% of range accuracy, on each local panel with appropriate temperature ranges, adjacent to each air insertion and water immersion controller. Thermometers shall have a 3 1/2" dial, remote bulb, of liquid filled or electronic transmission type, uniform scale, and same type sensing bulbs as thermostats. In addition, provide thermometers on local panels for the following:
 1. O.A. temperature.
 2. Return air temperature
 3. H.W. supply and return temperature
 4. Ch. W. supply and return temperature
 5. Air handling unit discharge
 6. Each zone discharges air temperature

2.7 VALVES

- A. All valves shall be equipped with throttling plugs and removable composition discs. All valves shall be sized by the control manufacturer and guaranteed to be of sufficient size to meet the heating and cooling requirements. All water valves shall be sized for pressure drop and flow rates indicated on the drawings. All valves shall be single-seated.

2.8 ROOM THERMOSTATS

- A. All proportioning thermostats shall have an adjustable throttling range. All thermostats shall be provided with an adjustable range of 55 deg F – 85 deg F., key-operated, non-indicating, locked cover type. Finish and final locations shall be approved by the Architect.

2.9 FIRE PROTECTION DUCTSTATS

- A. A manual reset fire protection duct stat shall be provided in the air inlet to each return air fan, and exhaust fan within 10 feet of the fan motor, to stop the return fan, exhaust fan, and its respective supply fan, whenever the temperature exceeds 145°F.

2.10 LOCAL PANELS

- A. Furnish and install adjacent to each water system and each H & V unit and AC unit as herein specified, locked enclosed local control panel of 14 gauge steel with welded angle iron brackets, wall or floor type, in which shall be mounted the associated temperature controls, relays, thermostats, etc., and on which shall be flush mounted the associated switches, gauges, thermometers, etc., as previously and hereinafter described. The basic background color of the panel shall be as approved by the Architect. Provide a canopy light on top of the local control panel with a light switch.
- B. Panels shall be prewired to terminal strips.
- C. Details of panel shall be submitted for approval prior to fabrication. Locations of local panel are to be convenient for adjustment and service and all such locations are to be approved prior to installation. Provide engraved nameplates beneath panel mounted control device and gauge, clearly describing the function of said device and the range of operation. Provide a laminated color coded schematic control diagram on panel face. Provide a key for local panel.
- D. Instrumentation within the panel shall be identified. All electrical components within the panel shall be factory pre-wired to a numbered terminal strip. All wiring within the panel shall be in accordance with NEMA and UL standards and shall meet local codes.

PART 3 - EXECUTION

3.1 INSPECTION

- A. Examine location where controls and equipment are to be installed and determine space conditions and notify architect in writing of conditions detrimental to proper and timely completion of the work.
- B. Do not proceed with the work until unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install in accordance with the manufacturer's written instructions, and with recognized industry practices, to ensure that equipment complies with requirements and serves intended purposes.
- B. Coordinate with other work as necessary to interface installation of equipment with other components of systems.

3.3 FIELD QUALITY CONTROL

- A. Upon completion of the installation of the automatic temperature control system and after motors have been energized with a normal power source, test the system to demonstrate compliance with

requirements. When possible, field correct malfunctioning controls then retest to demonstrate compliance. Replace controls that cannot be satisfactorily corrected. Refer to Section - Test and Balancing

3.4 SERVICE

- A. After completion of the control system installation, the control manufacturer shall regulate and adjust all thermostats, control valves, damper motors, etc., and place them in complete operating condition, subject to the approval of the Architect. Complete instructions shall be given to the operating personnel. There shall be one day of instruction given for the Winter cycle and one day of instruction for the Summer cycle operation.

3.5 CONTROL SEQUENCE

- A. Control sequence shall be as specified and/or as indicated on the drawings. Pressures and temperatures indicated are approximate and shall be adjusted on the job for maximum performance. After final adjustment, and before acceptance, the control diagrams required shall be revised, or supplemented, to show coordinated settings for all controls, including pneumatic-electric switches on and off pressures, sensitivity (branch pressure change per unit change in controlled variable), throttling range, tabulated settings for instruments in sequence, branch pressures at which instrument set point and controlled variable coincide, automatic reset becomes inactive. Capacity controls for refrigeration equipment and heating equipment shall be coordinated with components furnished with the machines and the necessary controllers, relays, etc.
- B. A separate tabulation shall be provided of control settings of all automatic controls including components furnished with the machines. Tabulation shall also include upper and lower limits for all safety and operating controls on the machines. All of the above adjustments will be required at the completion of the job.

3.6 AC-2ET (EXISTING DX SPLIT UNIT)

- A. Damper Control – normal operation
 - 1. When AC-2ET is in normal operation, Control Damper MD-2 shall be open and Control Dampers MD-1 on supply shall be closed.
- B. Start-up and Shutdown
 - 1. When the AC-2ET is enabled, and after the delay time has elapsed, and MD-2 is proven open and MD-1 is proven closed as indicated by damper end switches, the supply fans shall start.
 - 2. When the supply fan is shut down, the automatic control dampers shall remain in the normal operation position.
- C. Fire Alarm Shut Down: Under a fire or smoke alarm condition the FACP shall shut down the supply fans through the dry contacts provided by the electrical contractor. Upon closure of these contacts control relay shall be activated, shutting down the supply fan, closing smoke dampers, and shutting down the general exhaust fans. Current sensor switches provided for each fan shall be double pole with one set of contact for status indication at the FACP and a second set for status indication at the BAS system.

3.7 AC-2E CELLAR MER (NEW UNIT)

- A. Damper Control – normal operation
1. When AC-2E is in normal operation, Control Damper MD-1 shall be open, and Control Dampers MD-2 shall be closed.
- B. Start-up and Shutdown
1. When the supply fan is started, and MD-1 is proven open and MD-3 and MD-4 are proven closed as indicated by damper end switches, and when the supply smoke damper and return smoke damper are fully open, as indicated by the damper end switches, the supply fan shall start. When the supply fan is shut down, the automatic control dampers shall remain in the normal operation position.
- C. Temperature Control using the DX coil for cooling and glycol coil for reheat
1. (Cooling MODE) When cooling is required as indicated by the average space temperature and Outdoor Air Temperature is above 55°F (adjustable), the control valve CV-SC-1 (economizer mode) shall be OPEN, the control valve CV-SC-3 (condenser) shall be OPEN, and CV-SC-4 (cooling tower) shall be open and the control valves CV-SC-2 (glycol reheat) shall be closed . The supply fans shall start at 30% vfd signal. The BMS shall set the DX air temperature and shall be reset from 58°F (adjustable) up to 62°F (adjustable) to maintain the average space temperature at setpoint 70°F ±1°F (adjustable) providing RH is within range 50% ±3% RH.
 2. (Dehumidification MODE) When the average space RH is above 53% ±0% (adjustable), the BMS shall set the DX air temperature and shall be reset from 48°F (adjustable) up to 58°F (adjustable) to maintain the average space RH at setpoint 50% RH (adjustable) and the glycol/reheat coil valve shall modulate open to maintain the average space temperature at setpoint, 70° F (adjustable). As the glycol reheat control valve CV-SC-2 is modulated open, the cooling tower control valve CV-SC-4 shall be modulated closed in sequence with CV-SC-2. CV-SC-4 valve closing shall be limited to 5%(adjustable).
 3. When the average space RH is 50% RH or less, the unit control system shall return to average space temperature control (COOLING). The BMS shall set the DX air temperature and shall be reset from 58°F (adjustable) up to 62°F (adjustable) to maintain the average space temperature at setpoint 70°F ±1°F (adjustable) providing RH is within range 50% ±3% RH.
 4. If, while supplying 30% vfd signal and cooling, the average space temperature rises above setpoint by 1°F, increase the vfd signal to 60% to maintain the average space temperature setpoint.
 5. If, while under dehumidification control and supplying 30% vfd signal, the average space relative humidity cannot be maintained at setpoint (50% RH, adjustable), increase the vfd signal to 60% to maintain the average space relative humidity setpoint.
- D. Humidity Control (Steam Humidifier)
1. When the average space RH is below 47% ±0% (adjustable), and the average space temperature is within the control range (69°F and 71°F, adjustable), the humidifier shall modulate open using a PI controller.
 2. When the average space RH is above 50% ±0%, and the average space temperature is within the control range (69°F and 71°F) the humidifier shall modulate closed using a PI controller.
 3. If, while humidifying, the humidifier discharge relative humidity exceeds the high limit setpoints, 85% RH (adjustable), the humidifier control shall be overridden to maintain the discharge relative humidity at or below its high limit setpoint.

4. The humidifier shall not function unless air flow is proven by the air flow switch in the humidifier discharge air stream.

E. Economizer Control

1. When the OA temperature is below 55°F (adjustable), the system shall enable the economizer mode and the 30 minutes (adjustable) timer shall start. After the 30 minutes timer has elapsed, In economizer mode, control valve CV-SC-1 (economizer) is open and CV-SC-2 (glycol reheat) and CV-SC-3 (condenser) are closed. The AC compressors are shut off. The control valves CV-SC-1 (economizer mode) and CV-SC-4 (cooling tower) shall be in control to maintain the glycol coil discharge air temperature as needed to maintain the average space temperature setpoint.
2. When the average space temperature is above 70°F ±0°F (adjustable), the control valves CV-SC-4 shall control open to decrease the glycol coil air discharge temperature.
3. When the average space temperature is below SC°F ±0°F (adjustable), the control valve CV-SC-4 shall control close to increase the glycol coil air discharge temperature.
4. When the control valve CV-SC-4 is fully open and the average space temperature cannot be maintained, and it is above 71°F the system shall enable the DX cooling mode and Economizer Control shall be disabled.
5. When the average space temperature is below 70°F ±0°F (adjustable), the ECONOMIZER CONTROL mode shall be enabled and DX COOLING mode shall be disabled.
6. When the control valve CV-SC-4 is below 80% and the average space temperature drops below 69°F (adjustable), the glycol water circulating pumps shall shut off and shall cycle on and off as required to maintain the average space temperature low limit 69°F (adjustable).

F. Condenser Glycol Control

1. Three fluid cooler type cooling towers will be used to provide condenser glycol to the existing AC-4E, existing AC-5E air handling units and new AC-2E.
2. Cooling Tower fan speed shall be controlled to maintain the condenser glycol supply temperature.
3. The fluid coolers shall have spray pumps and cooling tower fans.
4. Each fluid cooler shall be controlled to maintain the condenser glycol supply temperature of 80°F (adjustable).
5. Should the pump fail to operate, the lag pump shall operate, and an alarm condition indicate on the BMS.
6. When in Economizer Mode, the fluid coolers shall be controlled in sequence to maintain the glycol supply temperature of 55°F (adjustable).
7. When Cooling Tower Fan speed is 30%, and the condenser glycol supply temperature drops 2 deg (adjustable) below the setpoint, one cooling tower shall be turned off and the isolation valve shall be closed. If the condenser glycol supply temperature drops by another 2 deg, another cooling tower shall be turned off and the isolation valve shall be closed. One cooling tower shall remain with the isolation valve open.
8. When Cooling Tower Fan speed is 100%, and the condenser glycol supply temperature rises 1 deg (adjustable) above the setpoint, one cooling tower shall be turned on and the isolation valve shall be open. If the condenser glycol supply temperature rises by another 1 deg, another cooling tower shall be turned on and the isolation valve shall be closed.

- G. Fire Alarm Shut Down: Under a fire or smoke alarm condition the FACP shall shut down the supply and return fans through the dry contacts provided by the electrical contractor. Current sensor switches provided for each fan shall be double pole with one set of contact for status indication at the FACP and a second set for status indication at the BAS system.

3.8 GLYCOL LOOP PRESSURE CONTROL

A. Glycol level control

The pressure sensor installed on the glycol loop shall indicate the glycol pressure in the loop. When the pressure is below 20 PSI (adjustable), an alarm shall be sent to the BMS and the operator shall verify the glycol level in the loop and reset the alarm.

3.9 CONTROL SYSTEM TESTING, ADJUSTING, CALIBRATION

- A. Work and/or systems installed under this Division shall be fully functioning prior to Demonstration, Acceptance Periods and Contract Close Out. THE CONTRACTOR shall start, test, adjust, and calibrate all work and/or systems under this contract, as described below.
- B. Verify proper electrical voltages and amperages and verify that all circuits are free from grounds or faults.
- C. Verify integrity/safety of all electrical connections.
- D. Verify proper interface with fire alarm system.
- E. Test, calibrate, and set all digital and analog sensing, and actuating devices. Calibrate each instrumentation device by making a comparison between the Operator Interface display and the reading at the device, using an instrument traceable to the National Bureau of Standards, which shall be at least twice as accurate as the device to be calibrated (e.g., if field device is +1- 0.5% accurate, test equipment shall be +1- 0.25% accurate over same range). Record the measured value and displayed value for each device in the Control System Commissioning Report.
- F. Check and set zero and span adjustments for all actuating devices. Manually activate damper and valve operators to verify free travel and fail condition. Check split range positioners to verify proper operation. Record the results for each device in the Control System Commissioning Report.
- G. Check each digital control point by making a comparison between the control command at the DPU and the status of the controlled device. Check each digital input point by making a comparison of the state of the sensing device and the Operator Interface display. Record the results for each device in the Control System Commissioning Report.
- H. Verify proper sequences by using the approved checklists to record results and submit with Control System Commissioning report. Verify proper sequence and operation of all specified functions.
- I. Perform testing with CONTRACTOR to setup the setpoints for chilled water system, all hot water, dual temperature system. Prior to start work, submit test plan to the Owner's representative for review and approval.
- J. Tune all control loops to obtain the fastest stable response without hunting, offset or overshoot. Record tuning parameters and response test results for each control loop in the control System commissioning report. Except from a startup, maximum allowable variance from set point for controlled variables shall be as follows:
 - 1. Air temperature: plus or minus 0.5°F
 - 2. Water temperature: plus or minus 2°F

3. Relative humidity plus or minus 2%

3.10 CONTROL SYSTEM DEMONSTRATION

- A. Demonstrate the operation of the Control Systems hardware, software, and all related components and systems to the satisfaction of the Commissioning Agent. Schedule the demonstration with Owner s representative 2 weeks in advance. Demonstration shall not be scheduled until all hardware and software submittals, and the Commissioning Test Report is approved. If the Work fails to be demonstrated to conform to the Contract specifications, so as to require scheduling of additional site visits by the Commissioning Agent for re-demonstration, CONTRACTOR shall reimburse Owner for all direct and indirect costs of subsequent Commissioning Agent site visits.
- B. The CONTRACTOR shall supply all personnel and equipment for the demonstration, including but not limited to, instruments, ladders, etc. CONTRACTOR supplied personnel must be competent with and knowledgeable of all project-specific hardware, software, and the HVAC systems. All training documentation and submittals shall be at the job site.
- C. The system shall be demonstrated following the same procedures used in the Commissioning Tests by using approved Commissioning Checklists. Demonstration shall include, but not necessarily be limited to the following:
- D. Demonstrate that all required software is installed on workstations. Demonstrate that all graphic screens, alarms, trends and reports are installed as submitted and approved.
- E. Demonstrate that all points specified and shown can be interrogated and/or commanded (as applicable) from all workstations, as specified.
- F. Demonstrate that remote communication abilities are in accordance with these Specifications.
- G. Demonstrate correct calibration of input/output devices using the same methods specified for the commissioning tests. A maximum of 10 percent of 110 points shall be selected at random by the Commissioning Agent for demonstration. Upon failure of any device to meet the specified end-to-end accuracy, an additional 10 percent of 110 points shall be selected at random by the Commissioning agent for demonstration. This process shall be repeated until 100 percent of randomly selected 110 points have been demonstrated to meet specified end-to-end accuracy.
- H. Demonstrate that all DDC and other software programs exist at respective field panels. The Direct Digital Control (DDC) programming and point database shall be as submitted and approved.
- I. Demonstrate that all DDC and other software programs accomplish the specified sequences of operation.
- J. Demonstrate that the panels automatically recover from power failures, as specified.
- K. Demonstrate that all alarms are received at the appropriate workstations and printers.
- L. Demonstrate that the stand-alone operation of panels meets the requirements of these Specifications.
- M. Identify access to equipment selected by Commissioning Agent. Demonstrate that access is sufficient to perform required maintenance.

- N. Control System Demonstration shall be completed and approved prior to Substantial Completion.

3.11 ON SITE CONTROL SYSTEM OPERATOR TRAINING

- A. Provide services of controls CONTRACTOR's qualified technical personnel for six (6) days, to instruct Owner's personnel in general operation and maintenance of the control systems. Training sessions shall be witnessed by the Commissioning Agent. Instruction shall be classroom setting at the project site. Requests for training shall be for contiguous or non-contiguous 8-hour days, unless otherwise mutually agreed upon by CONTRACTOR, Commissioning Agent, and Owner. The Owner's representative shall notify CONTRACTOR 1 week in advance of each day of requested training.
- B. Provide four sets of approved Operations and Maintenance Manuals to be used for training.
- C. The CONTRACTOR's designated training personnel shall meet and/or correspond with the Commissioning Agent and Owner's representative for the purpose of discussing and fine-tuning the training agenda prior to the first training session. Training agenda shall generally be as follows:
1. Day 1:
 - a. Brief walk-through of the building, including identification of all controlled equipment and systems and condensed demonstration of Digital System Controller (DSC) capabilities.
 - b. Brief overview of the various parts of the O & M manual, including hardware and software programming and operating publications, catalog data, controls installation drawings, and DDC programming documentation.
 - c. Demonstration of workstation menu penetration and broad overview of the various workstation features.
 - d. Demonstration of workstation boot-up, login/logout procedures, printer operation, password setup, and exception reporting.
 - e. Demonstration of workstation graphic screens
 - f. Demonstration of workstation reports
 - g. Demonstration of alarm feature
 - h. Demonstration of trend feature
 - i. Demonstration of workstation diagnostics features, program upload / download capabilities and software backup concepts. Procedures to follow after power outage.
 2. Day 2:
 - a. DSC programming
 - b. Review sequences of operation and how it is accomplished by DSC programming.
 - c. Fail modes and procedures to take in the event of a power failure.
 - d. Standalone modes and procedures to take in the event of various communication failures.
 - e. Demonstration of set-point optimization and fine-tuning concepts.
 - f. Demonstration of DSC features, diagnostics, program upload / download.
 - g. Demonstration of I/O hardware testing, calibration, and replacement.
 - h. Demonstration of all remaining miscellaneous workstation features.
 - i. Graphic workstation screens.
 - j. Review of Owner selected topics.
 - k. Question and answer period.

3.12 ATC/BAS ACCEPTANCE PERIOD

- A. After approval of the ATC/BAS Demonstration and prior to Contract Close Out, the BAS system shall enter an Acceptance Period of four weeks. The Acceptance Period shall not be scheduled until all HVAC systems are in operation and have been accepted, all required cleaning and lubrication has been completed (i.e., filters changed, piping flushed, strainers cleaned, etc.), and the TAB report has been submitted and approved. Schedule the beginning of the Acceptance Period with the Owner's Representative 2 weeks in advance. During the Acceptance Period, the system shall operate properly without malfunction, without alarm caused by control action or device failure, and with smooth and stable control of systems and equipment in conformance with these specifications. At the end of the four-week period, the Commissioning Authority shall provide written notification of the pass/fail status of the Acceptance Period including documentation of problems requiring CONTRACTOR attention. Should problems occur during the initial Acceptance Period, the CONTRACTOR shall correct problems and provide notification to the Owner's representative that all problems have been corrected. The Acceptance Period shall be restarted at a mutually scheduled time for an additional one-week period. This process shall be repeated until Commissioning Authority issues notice that the ATC/BAS has passed the Acceptance Period without exception.
- B. During the Acceptance Period, the Owner's Operations staff shall maintain a hard copy log of all alarms generated by the BAS. For each alarm received, CONTRACTOR shall diagnose the cause of the alarm, and shall list on the log for each alarm, the diagnosed cause of the alarm, and the corrective action taken. If in the CONTRACTOR's opinion, the cause of the alarm is not the responsibility of the CONTRACTOR, the CONTRACTOR shall immediately notify the Owner's representative.
- C. During the Acceptance Period, the CONTRACTOR shall maintain all controller network and workstation hardware and software in a state that will allow remote access by Commissioning Authority to Trend Logs as specified below.

3.13 TREND LOGS

- A. Prepare controller and workstation software to display graphical format trend logs during the Acceptance Period. Trend logs shall demonstrate compliance with contract documents. Trend logs shall be set up to meet the following requirements.
- B. Trend logs shall include all analog and digital input values, analog and digital output values, and set points that are on a reset schedule.
- C. Lines shall be labeled and shall be distinguishable from each other by using either different line types, or different line colors.
- D. Indicate engineering units of the y-axis values, e.g., degrees F., inches w.g., Btu/lb, percent wide open, etc.
- E. The y-axis scale shall be chosen so that all trended values are in a readable range. Do not mix trended values on one graph if their unit ranges are incompatible.
- F. Trend outside air temperature, humidity, and enthalpy during each period in which any other points are trended.

- G. All points trended for one HVAC subsystem (e.g. air handling unit, chilled water system, etc.) shall be trended during the same trend period.
- H. Each graph shall be clearly labeled with HVAC subsystem title, date, and times.
- I. A complete set of trend logs shall consist of all required points, trended for the time period listed for each point category. Point values shall be recorded based on the change-of-value (COV) differentials listed. If the ATC/BAS does not have the capability to trend based on COV, then point values shall be trended based on the time intervals listed:

Point Category	COV	Time Interval	Time Period
Duct Pressure	0.02 in. w.g.	1 minute	4 hours
Temperature	0.2 degrees F	10 minutes	24 hours
Humidity	1 percent RH	10 minutes	24 hours
Fan Volume Control Output	1 percent	1 minute	4 hours
Valve and Damper Outputs	1 percent	10 minutes	24 hours
CO ₂	50 ppm	10 minutes	24 hours

- J. Provide a specific trend log report for zone temperature and humidity for use by the museum curators.

3.14 SOFTWARE OPTIMIZATION ASSISTANCE

- A. The CONTRACTOR shall provide the services of a control’s technician for a maximum of 40 man-hours at the project site to be at the disposal of the Commissioning Authority. The purpose of this requirement is to make changes, enhancements, and additions to controller and/or workstation software that have been identified by the Commissioning Authority during the construction and commissioning phases of the project and that are beyond the specified Contract requirements. This service shall be provided at no additional cost to the Owner. Requests for assistance shall be for contiguous or non-contiguous 8-hour days, unless otherwise mutually agreed upon by CONTRACTOR, Commissioning Authority, and Owner. The Owner’s representative shall notify CONTRACTOR 2 days in advance of each day of requested assistance.
- B. The controls technician provided shall be thoroughly trained in the programming and operation of the controller and workstation software. If the controls technician provided cannot perform every software task requested by the Commissioning Authority in a timely fashion, CONTRACTOR shall provide additional qualified personnel at the project site as requested by the Commissioning Authority, to meet the specified time requirement.
- C. If any part of this requirement is scheduled during the Acceptance Period, such changes made because of this requirement shall not prevent approval of the Acceptance Period. However, during the Opposite Season Acceptance Period such changes shall be demonstrated to perform as documented by the Commissioning Authority.

3.15 ATC/BAS OPPOSITE SEASON ACCEPTANCE PERIOD

- A. During the warranty period, but not later than 6 months from completion of the Acceptance Period, BAS shall enter an Opposite Season Acceptance Period of two weeks. Opposite Season Acceptance Period shall not be scheduled until seasonal conditions have changed to the opposite of those that occurred during the Acceptance Period. Schedule the beginning of the Acceptance

Period with the Owner's representative 2 weeks in advance. All requirements specified for the Acceptance Period shall also apply to the Opposite Season Acceptance Period.

B.

END OF SECTION 23 09 00

SECTION 23 09 01

BUILDING AUTOMATION SYSTEM

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

- A. This Section is coordinated with and complementary to the General Conditions and Supplementary General Conditions of the Work, wherever applicable to Mechanical Work.
- B. Section 01 31 46 - Special Requirements for Mechanical and Electrical Work shall apply.

1.2 DESCRIPTION OF WORK

- A. The work includes the providing of all labor, materials, equipment, accessories, services, and tests necessary to complete and make ready for operation by the Owner, a building automatic system as shown on the drawings and hereinafter specified.
- B. The Building Automatic System shall be provided by the same manufacturer as the automatic temperature controls, Section 23 09 00. The basis of design is Distech Controls.
- C. The Automatic System Subcontractor shall furnish and install all equipment, accessories, wiring, and instrument piping required for a complete and functioning system.
- D. All materials and equipment used shall be standard components, regularly manufactured for this and/or other systems, and not custom designed especially for this project. All systems and components shall have been thoroughly tested and proven in actual use.
- E. The automation system shall be of a fully modular architecture permitting expansion by adding computer memory, application software, operator peripherals and field hardware.
- F. If the expansion of the automation system requires greater computer processing power, it shall be possible to transfer all existing software and databases, both vendor-supplied and user-defined, to a new more powerful computer. This shall be accomplished by using removable, compatible disk cartridges.
- G. Systems that require the existing user-defined database to be re-entered through the operator's terminal shall not be acceptable.
- H. Although fire alarm and security points will not be installed or monitored, initially the system shall be installed completely ready to receive or accept these points at a later date without additional central hardware or software.
- I. The system as specified shall monitor, control, and calculate all of the points and functions as listed in the Building Automation Schedule.
- J. The system as installed shall have sufficient computer memory and application software for 100% point expansion above those points as listed in the Building Automation Schedule.

1.3 QUALITY ASSURANCE

- A. Only firms regularly engaged in the manufacture and installation of this equipment with characteristics and capacities required, whose products have been in satisfactory use in similar service for not less than 10 years shall be acceptable.
- B. The entire building automation system shall be installed by skilled electricians and mechanics, all of whom are properly trained and qualified for this work. All wiring shall be installed in accordance with the Project Electrical Specifications.
- C. Supervision and checkout of the system shall be by factory-trained engineers and technicians directly employed by the automation Contractor.
- D. Provide systems produced and installed by the manufacturers, which are listed in Section "Approved Manufacturer's List".
- E. Provide equipment whose performance, under specified conditions, is certified by the manufacturer.

1.4 SUBMITTALS

- A. Refer to Section 01 31 46 - Special Requirements for Mechanical and Electrical work and submit shop drawings.

1.5 COORDINATE

- A. Refer to Section 01 31 46 - Special Requirements for Mechanical and Electrical Work.

1.6 GUARANTEE

- A. Refer to Section 01 31 46 - Special Requirements for Mechanical and Electrical Work.
- B. The system including all hardware and software components shall be guaranteed for a period of one year following the date of final acceptance. Any manufacturing defects arising during this warranty period shall be corrected without cost to the Owner.
- C. All applicable software as detailed in this Specification shall be updated by the Automation Subcontractor free of charge during the warranty period. This will ensure that all system software will be the most up-to-date software available from the Automation Subcontractor.

PART 2 - PRODUCTS

2.1 TRANSMISSION NETWORK

- A. Distributed Communication Processor:
 - 1. The system shall use an intelligent Distributed Communication Processor. This processor shall be microprocessor-based and shall interface with Central Processing Unit and Remote-Control Units.
- B. Multi-Drop Trunk(s):

1. The automation system shall include a multi-drop digital transmission network that provides the communication link between the Distributed Communication Processor and all Remote-Control Units and remote operator consoles.
2. The transmission shall be asynchronous and utilize a polled-response method. The system shall utilize a cyclic redundancy check or dual transmission with parity check to ensure signal reliability.
3. The network riser shall be fiber-optic.
4. The transmission speed shall be a minimum of 9600 baud and operate in a half-duplex mode.
5. The system shall support multiple multidrop trunks. Each multi-drop trunk shall support a minimum of 32 Remote Control Units.
6. Each multi-drop trunk shall have an allowable line length of at least 20,000 feet without signal degradation. All multidrop trunks shall be interfaced to the system via standard interfaces. With the addition of modems, the multidrop trunk shall interface to unconditioned voiceband 3002 telephone lines for remote building tie-in to the automation system.
7. Lightning protection shall be provided at all points of entry of casing into the building.

2.2 BUILDING CONTROL SYSTEM

- A. The building control system specified herein shall be a direct digital control system which can, without additional equipment or software, perform all of the automatic temperature control and energy management functions as required in this Specification. Direct Digital Control shall be defined as a control technique through which the process variable is continuously monitored by a RCU panel which accomplishes loop control by calculating a control solution for output to a control device, independent of the host computer.
- The system, as specified, shall independently control the building's HVAC equipment to maintain a comfortable environment in an energy efficient manner. The building operator shall communicate with the system and shall have the capability to alter the control sequence of operation within the building.
- B. System Architecture: The building control system shall consist of a network of independent, stand-alone control units, RCU. Each stand-alone control unit shall be capable of performing all specified control functions in a completely independent manner. Additionally, control units shall be capable of being networked for single point programming and for the sharing of point information and control instructions between panels without the use of the host computer. All operator communication with the system shall be via operator terminals. It shall be possible for each control unit to have a dedicated local display or for a collection of control units to share a single operator terminal.
- C. Remote Control Unit (RCU):
- Each remote control unit shall be capable of full operation either as a completely independent unit or as a part of the building-wide control system. All RCU shall contain the necessary equipment for direct interface to the sensors and actuators connected to it.
- Control strategies shall be resident at each RCU. Each RCU shall be capable of communication with each other RCU and for all RCU in the system from any one operator terminal. Each control unit shall provide the ability to support its own portable operator terminal.

2.3 FIELD HARDWARE

A. Remote Control Units (RCUs):

1. Physical Characteristics (except for terminal unit RCUs)
 - a. All metal construction conforming to NEMA-12 requirements.
 - b. Full-front piano hinged door with nameplates identifying the RCU.
 - c. The same key lock on each RCU shall be provided with a key to the hospital master key system.
 - d. All RCU shall be free standing attached to building structure or rooftop air handling unit structure. Vibration isolation shall be provided as required to protect the electronic equipment.
2. Electrical Characteristics
 - a. A pilot light indicating power on
 - b. Operating on 120 volt, 60 HZ power
 - c. A manual by-pass switch to permit immediate isolation of the RCU for servicing, except for smaller controllers such as fan VAV boxes.
 - d. A 120 volt AC service outlet.
 - e. Circuit protection including surge transient protection for the data collection hardware.
 - f. Factory prewired.
3. RCU shall be capable of operating in ambient temperatures between 32°F to 120°F and ambient humidity conditions of 10% RH to 95% RH (non-condensing).
4. Final locations of RCU's shall be subject to the Owner's representative approval. RCU shall not be located directly underneath valves or other areas where they may be subject to water damage. RCU shall be located in a space between 4 and 7 feet above finished floor, with a minimum 3-foot clearance in front.
5. Each RCU shall perform continuous diagnostics, and any malfunction shall be annunciated at the operator's console as well as visually indicated at the RCU.
6. Failure of any RCU on the system shall not affect the proper operation of the host and other RCU's.
7. The system shall be capable of phased startup. That is any RCU shall be capable of properly communicating with the host while remaining RCU's are being installed.
8. Surge transient protection shall be provided in each RCU for the purpose of suppressing induced voltage transients.
9. Each RCU including cabinet, power supply, function cards and termination modules shall be approved by U.L.
10. The remote-control unit shall be listed by Underwriters Laboratories (UL) against fire and shock hazard as a signal system appliance unit.

B. Sensors/Input Signals:

1. Each remote-control unit shall be capable of direct interface to a variety of industry standard sensors and input devices. it shall be possible for each remote-control unit to monitor the following types of inputs:
 - a. Analog Inputs:
 - 4-20 mA
 - 0-10 vDC
 - thermistors
 - 3-15 psi
 - b. Digital Inputs:

- dry contact closure
- pulse accumulator

C. Actuators/Output Signals:

1. The remote-control unit shall directly control pneumatic and electronic actuators and control devices. Each control unit shall be capable of providing the following control outputs:
 - a. Digital Outputs (Contact Closure):
 - motor starts, sizes 1 to 4
 - b. Analog Outputs:
 - 3-15 PSI
 - 4-20 mA
 - 0-16 vDC

D. Sensors:

1. All analog sensors shall utilize industry standard 4-20 milliamp signals to facilitate Owner expansion.
2. All analog signals shall be converted for digital transmission at the RCU.

E. Electric KWH and KW metering:

1. Under this section provide the necessary transponders pulse initiators, sensors, interface devices, totalizers, and current and potential transformers necessary to determine electrical demand for the building.
2. Sensor installation shall also be capable of monitoring power failure.
3. Calculation of KWH from the measured KW shall be performed through software at the host computer.
4. Refer to the electrical drawings for the number of service feeders, etc.
5. Provide separate meters for power to the chiller plant.

F. Current Sensors

Provide current sensors for fan and pump motors to indicate status at the BAS and at the fire alarm control panel.

2.4 OPERATOR INTERFACE

A. The building control system shall permit full operator communication including: obtaining information about the performance of his system; allowing the operator to change the system operation; and diagnosing system malfunctions. Operator communication shall be through the use of any one of the following operator terminals:

1. Hand-held terminal/Portable Operator Terminal (POT)
2. Printer
3. Central console PC
4. Portable PC

B. It shall be possible to have one operator's terminal at each remote control unit, or to have a single operator's device which can be connected to any panel in the network. The building control system shall permit complete operation of any remote control unit within the network from any operator terminal within the system.

- C. The network shall be addressable as a whole and shall not require referencing a particular control unit for the commanding or monitoring of points on the network.

2.5 CENTRAL CONSOLE HARDWARE

- A. NOT USED

2.6 SELF-DIAGNOSTICS AND ALARM REPORTING

- A. Each remote-control unit shall contain self-diagnostics that continuously monitor the proper operation of the unit. A malfunction of the unit will be reported and will inform the operator of the nature of the malfunction, and the control unit affected. It shall be possible to annunciate malfunctions as well as other control unit alarms at a selected central operator's terminal.
- B. The system shall also allow on-line diagnosis via internet or modem from a remote location (vendor's headquarters or local branch office or another remote site).

2.7 ENERGY CONSUMPTION MEASUREMENT

- A. NOT USED.

2.8 WEB SERVER OPERATOR INTERFACE

- A. Furnish a web server to allow daily operations functions to be accomplished from any network connected web browser.
- B. Operators shall be able to utilize any commercially available browser such as Microsoft Internet Explorer or Netscape Navigator. No additional software shall have to be installed on the client PC for normal operation of the system.
- C. All communications between the web browser and web server shall be encrypted using 128-bit SSL encryption.
- D. Web server shall be able to be located on the Owner's Intranet or on the Internet.
- E. Web server shall have the ability to automatically obtain an IP (Internet Protocol) address using DHCP. The use of static IP addressing shall also be supported.
- F. Web server will have adequate capacity to store and serve 4000 user-defined graphics.
- G. Any unlimited number of users shall be able to access the web server. A minimum of 30 users shall be able to utilize this device at the same time.
- H. BACnet. The web server shall support the BACnet Interoperable Building Blocks (BIBBS) for Read (Initiate) and Write (Executable) services. These are the Data Sharing BIBBS as follows:

DS-RP-A, B
DS-RPM-A
DS-WP-A

DS-WPM-A

- I. The web browser client shall support Sun Microsystems Java 2 (JRE 1.4.0 or higher) plug-in.
- J. Functionality
 1. Operators shall be required to enter in a valid username and password to access the system. The view of the system provided for the user will be customized based on user identity.
 2. Operator security. Each operator shall be able to be assigned a unique username and password. Users shall be assigned to view, view and edit or administrative capability.
 3. The web server shall display the same graphics that have been created for the Operators Workstation. Graphics shall be able to contain both static information such as floor plans, equipment schematics, etc. as well as dynamic information including space temperatures, setpoints, equipment status, etc.
 4. All dynamic values shall be automatically refreshed every 10 seconds. The refresh of dynamic data shall not require a refresh of the static information on the graphic.
 5. Operators with proper security shall be able to override setpoints and equipment operation.
 6. System schedules shall be easily selected for display. Operators with valid security shall be allowed to make changes to schedules including modifications to start and stop times and creating exception days. These changes shall be made graphically within the web browser.
 7. A log of system alarms and events shall be able to be viewed from the web browser. Operators with proper security shall be able to acknowledge alarms.
 8. System trends shall be able to be selected and viewed. Trends shall be shown graphically with the proper axis scaling automatically selected.
 9. Operators with proper access shall be able to configure the web server using their web browser.
- K. Web Server
 1. Web server shall be installed on the hospital server in the building IT server room.
 2. All user-entered information (web pages, security, etc.) shall be stored in non-volatile memory. System operational information and clock functions shall be backed up by battery or other device for a minimum of seventy-two (72) hours.
- L. Color Graphics

The Web Browser GUI shall make extensive use of color in the graphic panel to communicate information related to setpoints and indoor environmental comfort. Animated graphic interface files (GIFs), active setpoint graphic controls and valid web content (like local weather forecast) shall be used to enhance usability:

 1. Display Size: The GUI workstation software shall graphically display in 1024 by 768 pixels 24-bit True Color.
 2. General Graphic: General area maps shall show locations of controlled buildings in relation to local landmarks.
 3. Color Floor Plans: Floor plan graphics shall show heating and cooling zones throughout the buildings in a range of colors, which provide a visual display of temperature relative to their respective setpoints (see section below). The colors shall be updated dynamically as a zone's actual comfort condition changes. Locations of space sensors shall also be shown for each zone. The intent of the specification is to enable the operator to readily assess problems at a glance. The floor plan graphic shall also include the measured temperature, RH and CO₂ (RH and CO₂ as applicable) in each zone.

4. Mechanical Components: Mechanical system graphics shall show the type of mechanical system components serving any zone through the use of a pictorial representation of components. Selected I/O points being controlled or monitored for each piece of equipment shall be displayed with the appropriate engineering units. Animation shall be used for rotation or moving mechanical components to enhance usability.
5. Minimum System Color Graphics: Color graphics shall be selected and displayed via a web browser for the following:
 - a. Each piece of equipment monitored or controlled including each terminal unit.
 - b. Each floor and zone controlled.

M. Zone Setpoint Adjustments

1. Color floor plans displayed via a web browser shall utilize a contiguous band of colors, each corresponding to actual zone temperatures relative to the desired heating and cooling setpoints. The ideal temperature shall be shown as a green color band. Temperatures slightly warmer than ideal shall be shown in yellow, and even warmer temperature band shall be shown in orange. Temperatures slightly cooler than ideal shall be light blue, and even cooler temperatures shall be shown as dark blue. All alarm colors shall be in red.
2. Active Zone Graphic Setpoint Controls: Utilizing a mouse, it shall be possible to select occupied or unoccupied setpoints (corresponding to the floor plan colors) and drag the color slide bar(s) to increase or decrease heating and cooling setpoints. In addition to the slide bars, an operator may type the numeric value of the heating and cooling setpoints. The floor plan graphic shall then change colors on a zone-by-zone basis to reflect the actual temperature in each zone relative to the changed heating or cooling setpoint.

N. Hierarchical Schedules

1. Utilizing the Navigation Tree displayed in the web browser GUI, an operator (with password access) shall be able to define a Normal, Holiday or Override schedule for an individual piece of equipment or room or choose to apply a hierarchical schedule to the entire system, site, or floor area. For example, Independence Day >Holidays for every level in the system would be created by clicking at the top of the geographic hierarchy defined in the Navigation Tree. No further operator intervention would be required and every control module in the system with would be automatically downloaded with the >Independence Day= Holiday.

All schedules that affect the system/area/equipment highlighted in the Navigation Tree shall be shown in a summary schedule table and graph.

2. BACNET Schedules: Schedules shall comply with the BACNET standard, (Schedule Object, Calendar Object, Weekly Schedule property and Exception Schedule property) and shall allow events to be scheduled based on:
 - a. Types of schedules shall be Normal, Holiday or Override
 - b. A specific date,
 - c. A range of dates,
 - d. Any combination of Month of Year (1-12, any), Week of Month (1-5, last, any), Day of Week (M-Sun, Any)
 - e. Wildcard (example, allow combinations like second Tuesday of every month).
3. Schedule Categories: The system shall allow operators to define and edit scheduling categories (different types of Athings@ to be scheduled; for example, lighting, HVAC occupancy, etc.). The categories shall include name, description, icon (to display in the hierarchy tree when icon option is selected) and type of value to be scheduled.
4. Schedule Groups: In addition to hierarchical scheduling, operators shall be able to define functional Schedule Groups, comprised of an arbitrary group of areas/rooms/equipment

scattered throughout the facility and site. For example, the operator shall be able to define an >individual tenant= group B who may occupy different areas within a building or buildings. Schedules applied to the >tenant group= shall automatically be downloaded to control modules affecting spaces occupied by the >tenant group=

5. **Intelligent Scheduling:** The control system shall be intelligent enough to automatically turn on any supporting equipment needed to control the environment in an occupied space. If the operator schedules an individual room in a VAV system for occupancy, for example, the control logic shall automatically turn on the VAV air handling unit, chiller, boiler, and/or any other equipment required to maintain the specified comfort and environmental conditions within the room.
6. **Partial Day Exceptions:** Schedule events shall be able to accommodate a time range specified by the operator (ex: board meeting from 6 pm to 9 pm overrides Normal schedule for conference room).
7. **Schedule Summary Graph:** The schedule summary graph shall clearly show Normal versus Holiday versus Override Schedules, and the net operating schedule that results from all contributing schedules. Note: In case of priority conflict between schedules at the different geographic hierarchy, the schedule for the more detailed geographic level shall apply.
8. **Schedule Distribution:** For reliability and performance, instead of maintaining a single schedule in a field device that writes over the network to notify other devices when a scheduled event occurs, field devices will only keep their part of the schedule locally. The BAS server software shall determine which nodes a hierarchical schedule applies to and will create/modify the necessary schedule objects in each field device as necessary.

O. **Events & Alarms**

Events and alarms associated with a specific system, area, or equipment selected in the Navigation Tree, shall be displayed in the Action Pane by selecting an >Events= view. Events, alarms, and reporting actions shall have the following capabilities:

1. **Events View:** Each event shall display an Event Category (using a different icon for each event category), date/time of occurrence, current status, event report, and a URL link to the associated graphic for the selected system, area or equipment. The URL link shall indicate the system location, address, and other pertinent information. An operator shall easily be able to sort events, edit event templates and categories, and acknowledge or force a return to normal in the Events View as specified in this section.
2. **Event Categories:** The operator shall be able to create, edit or delete event categories such as HVAC, Maintenance, Fire, or Generator. An icon shall be associated with each Event category, enabling the operator to easily sort through multiple events displayed using a built-in filter.
3. **BACNET Event Templates:** BACNET Event template shall define different types of alarms and their associated properties. As a minimum, properties shall include a reference name, verbose description, severity of event, acknowledgment requirements, high/low limit and out of range information.
4. **Event Areas:** Event Areas enable an operator to assign specific Event Categories to specific Event Reporting Actions. For example, it shall be possible for a operator to assign all HVAC Maintenance events on the 1st floor of a building to email the technician responsible for maintenance. The Navigation Tree shall be used to set-up Event Areas in the Graphic Pane.
5. **Event Time/Date Stamp:** All events shall be generated at the DDC control module level and comprise the Time/Date Stamp using the standalone control module time and date.

- 6. Event Configuration: Operators shall be able to define the type of events generated per BACNET object. A network view of the Navigation Tree shall expose all BACNET objects and their respective Event Configuration. Configuration shall include assignment of event, alarm, type of Acknowledgment and notification for return to normal or fault status.
- 7. Event Summary Counter: The view of events in the Graphic Pane shall provide a numeric counter, indicating how many events are active (in alarm), require acknowledgment, and total number of events in the BAS Server database.
- 8. Persistent Data. The system shall allow for external systems to access the event instance data. Event data shall be stored and queried in the database in a relational manner. At a minimum, the fields to be stored in the database are:

X	Event Source	X	BACNET	Event
X	Event Generation Time			
X	Acknowledge Required Flag			
X	Delivery Priority			
X	BACNET Event Type			
X	Event Message Text			
		X	Classification of Event	
		X	Event Acknowledgment	
		X	Return to Normal Time	
		X	Operator Comments	
		X	Who Acknowledged the	

- 9. Event Auto-Deletion: Events that are acknowledged and closed, shall be auto-deleted from the database and archived to a text file after an operator defined period.
- 10. Event Reporting Actions: Event Reporting Actions specified shall be automatically launched (under certain conditions) after an event is received by the BAS server software. Operators shall be able to fully define these Reporting Actions using the Navigation Tree and Graphic Pane in the web browser GUI. Reporting Actions shall be as follows:
 - a. Print: Alarm/Event information shall be printed to the BAS server's PC or a networked printer.
 - b. Email: Email shall be sent via any POP3-compatible e-mail server (most Internet Service Providers use POP3). Email messages may be copied to several email accounts.
 - Note: Email reporting action shall also be used to support alphanumeric paging services, where email servers support pagers.

- c. File Write: The ASCII File write reporting action shall enable the operator to append operator defined alarm information to any alarm through a text file. The alarm information that is written to the file shall be completely definable by the operator. The operator may enter text or attach other data point information (such as AHU discharge temperature and fan condition upon a high room temperature alarm).
 - d. Write Property: The write property reporting action updates a property value in a hardware module.
 - e. SNMP: The Simple Network Management Protocol (SNMP) reporting action sends an SNMP trap to a network in response to receiving an event.
 - f. Run External Program: The Run External Program reporting action launches specified program in response to an event.
11. Event Simulator: The web browser GUI user shall provide an Event Simulator to test assigned Reporting Actions. The operator shall have the option of using current time or scheduling a specific time to generate the Event. Utilizing the Navigation Tree and drop-down menus in the Graphic Pane, the operator shall be able to select the Event Type, Status, Notification, Priority, Message, and whether acknowledgment is required.
 12. External Injection of Events. The BAS server software shall provide a CORBA interface for external injection of events, allowing the system to receive/report events generated from external source other than the BAS system.

P. Trends

Trends shall conform to the BACNET Trend Log Object specification. The system shall be able to trend and display graphically any analog, digital or calculated points. A trend log=s properties shall be editable using the Navigation Tree and Graphic Pane.

1. Viewing Trends: The operator shall have the ability to view trends by using the Navigation Tree and selecting a Trends button in the Graphic Pane. The system shall allow y- and x-axis maximum ranges to be specified and shall be able to simultaneously graphically display multiple trends per graph.
2. Local Trends: Trend data shall be collected locally by Multi-Equipment/Single Equipment general-purpose controllers, and periodically uploaded to the BAS server if historical trending is enabled for the BACNET object. Trend data, including run time hours and start time date shall be retained in non-volatile module memory.
3. Resolution. Sample intervals shall be as small as one (0.1) second. Each trended point will have the ability to be trended at a different trend interval. When multiple points are selected for display that have different trend intervals, the system will automatically scale the axis.
4. Dynamic Update. Trends shall be able to dynamically update at operator-defined intervals.
5. Zoom. It shall be possible to zoom-in on a particular section of a trend for more detailed examination.
6. Numeric Value Display. It shall be possible to pick any sample on a trend and have the numerical value displayed.
7. Provide memory capacity for a minimum of 365 days of historical trending, events and logging.

Q. Security Access

Security access from the web browser GUI to BAS server shall require a Login Name and Password. Access to different areas of the BAS system shall be defined in terms of Roles, Privileges and geographic area of responsibility as specified:

1. Roles: Roles shall reflect the actual roles of different types of operators. Each role shall comprise a set of easily understood English language privileges. Roles shall be defined in terms of View, Edit and Function Privileges. Systems that use cryptic Boolean numbers to define system access are not acceptable.
 - a. View Privileges shall comprise: Navigation, Network, and Configuration Trees, Operators, Roles and Privileges, Alarm/Event Template and Reporting Action.
 - b. Edit Privileges shall comprise: Setpoint, Tuning and Logic, Manual Override, and Point Assignment Parameters.
 - c. Function Privileges shall comprise: Alarm/Event Acknowledgment, Control Module Memory Download, Upload, Schedules, Schedule Groups, Manual Commands, Print, and Alarm/Event Maintenance.

2.9 FACILITY MONITORING AND CONTROL FUNCTIONS

A. Report and Logs

1. An operator shall be able to manually request reports and logs from the console keyboard. The operator shall have the capability to direct any log or report to either a report printer or CRT display.
2. It shall be possible for the automation system to automatically initiate logs and reports. These logs and reports shall be initiated on time, date, or day basis, or any combination of time, date or day.
3. Each report shall be in English language with information logically grouped in a format that facilitates easy interpretation. Reports and logs shall be attainable on a per point basis or user-defined group of points. Groups of points shall be logically combined without regard to the hardware physical locations. Example:
 - Current value of a discharge temperature in a particular air handler.
 - Current value of all discharge temperatures in a specific building.
 - Current value of all discharge temperatures in a multi-building complex.
4. As a minimum, the following report categories shall be provided (pre-programmed by the Automation System Contractor):
 - Summaries - Access Reports
 - Historical Trends - Data Base Management Reports
 - Profile Reports - System Diagnostic Report
 - Totalization Logs - Energy Management
5. Summaries
 - All Point
A summary shall be provided detailing the current values of any and all points associated with the automation system.
 - Building or System or Custom Group
A summary shall be provided detailing the current values of any and all points within a building or system as detailed by the Owner.
 - Motor Status
A summary shall be provided detailing the current status of any and all motors connected to the system. This summary shall also have the capability of detailing the current values of points associated with any of the system motors.

- Alarm
A summary shall be provided to detail the status of any and all the points currently in alarm.
 - Alarm Limit
A summary shall be provided to detail the operator assigned high and/or low alarm limit for any and all alarmable points on the system.
 - CPA Set Point
A summary shall be provided detailing the set point for any and all CPA points supported by the system.
 - Message
A summary shall be provided detailing the contents of any and all messages within the system.
6. Historical Trend Log
A log shall be provided for each defined trend group which shall include as a minimum; username(s) assigned to that group, time increment in real-time, and associated values per time increment.
7. Access Reports
- Access Level Assignments
A report shall be provided detailing operator access level assignments. This report shall include as a minimum, operator's name, password, access level assignment and on-duty initials.
 - System Entry
A report shall be provided detailing which operator signed on or off the building automation system. The report shall include operator's name, password, time and date, console number and elapsed time of operator access.
8. System Diagnostic Report
A report shall be provided detailing any system hardware software errors. This report shall include as a minimum those errors occurring within the central processing unit including disk subsystem.

B. Alarm Processing

The automation system shall have the following alarm processing features, all of which shall be owner defined through the input keyboard.

1. Alarm Reporting

Each alarm as determined by the system shall cause the following information to be logged:

- Current time, date and initials of on-duty operator.
- User name assigned to point.
- Point descriptor.
- Current value or status.

- Appropriate engineering units.
- Alarm designator -nature of alarm - high or low.
- Operator instructive message.

The operator message shall be an owner-defined message with a text capability of at least 256 characters per message. These messages shall be generated to the operator while the system is online and fully operational.

The operator shall have the ability to direct the alarm report and message to any output device on the system.

Any point which goes into alarm and has a graphic display associated with that point shall automatically display that graphic for operator review.

An operator shall be able to define any alarm as being critical or non-critical.

All critical alarms shall be displayed in a separate area of the operator's terminal display.

In the event of multiple alarms, all alarms shall be buffered according to priority until displayed or printed.

All operator acknowledgment of critical alarms shall be logged including time, date, operator's initials, and username of point being acknowledged. Alarms shall be acknowledged on a per point basis in the order they reported on the operator's terminal.

Return to normal of points previously in alarm shall be logged including time, date, operator's initials and username of point.

2. Analog Limits

Each analog point shall have associated high and low limits. If the measured or calculated value drops below the low limit or exceeds the high limit that point shall be considered in alarm and report as previously defined in alarm reporting.

Each high and low limit shall have an associated user defined limit differential to prevent nuisance alarms caused from floating about the alarm limit.

Any analog point shall be disable from alarm reporting if it is associated with a previously defined master point which is turned off.

3. Binary Alarms

For each binary contact alarm designated on the system, the operator shall be able to define which contact state is the alarm state.

Each binary point detected as being in alarm shall report as previously defined in alarm reporting.

Any binary point shall be disabled from alarm reporting if it is associated with a previously defined master point which is turned off. The operator shall be able to define an adjustable time delay which disables alarm checking during starting and stopping of equipment.

C. Analog/Binary Totalization

The automation system software shall support both analog and binary totalization.

The operator shall be able to:

- enable to disable individual points from totalizing.

- assign upper limits for each point enabled for totalization.
- reset a totalized value.
- display the current value of an individual point, group of points of all system points.

1. Reporting

Any point's current value exceeding its assigned upper limit shall report as a totalized alarm point.

2. Analog Points

It shall be possible to totalize analog values with appropriate engineering units such as kilowatt hours, gallons, pounds, liters, etc.

3. Binary Points

It shall be possible to totalize the accumulated -

- Run time in hours or minutes
- Contact status in hours or minutes

(Example: magnetic contact switch indicates a door open for 45 minutes).

D. History Trending

1. The system software shall provide the ability to historically trend operator selectable points.
2. The operator shall be able to assign any system point, analog or binary, real or calculated to a trend group. Trend groups shall consist of a single point or multiple point groups with a capacity of at least 50 points.
3. Operator assignments shall be through the operator's terminal in simple English language. Points assigned to a trend group shall be the point's English username.
4. Trended values shall be historically retained on the system disk for future inquiry.
5. Operator shall be able to request trended values to be retrieved from disk and printed out at operator defined time intervals.
6. Operator shall be able to define time intervals to one minute resolution.

2.10 ENERGY MANAGEMENT CONTROL FUNCTIONS

A. NOT USED.

PART 3 - EXECUTION

3.1 INSPECTION

- A. Examine the location where this equipment is to be installed and determine space conditions and notify the Architect in writing of conditions detrimental to proper and timely completion of the work.
- B. Do not proceed with work until unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install equipment where shown, in accordance with the manufacturer's written instructions and with recognized industry practices, to ensure that equipment complies with requirements and serves intended purposes.
- B. Coordinate with other work as necessary to interface installation of equipment with other components.

3.3 SYSTEM TURN-OVER AND SERVICE

- A. System Start-up and Acceptance
 - 1. Upon completion of the installation, the Automation System Sub-Contractor shall startup the system and perform all necessary testing and debugging operations. An acceptance test in the presence of the Owner's representative, the Architect, and the Engineer shall be performed. When the system performance is deemed satisfactory in whole or in part by these observers, the system parts will be accepted for beneficial use and placed under warranty.
- B. Owner's Instruction
 - 1. The Automatic System Subcontractor shall provide two copies of an operator's manual describing all operating and routine maintenance service procedures to be used with the system. The Automatic Subcontractor shall instruct the Owner's designated representatives in these procedures during the start-up and test period. The duration of the instruction period shall be no less than eighty hours. These instructions are to be conducted during normal working hours. The instructions shall consist of both hands-on and classroom training at the job site.

END OF SECTION 23 09 01

SECTION 23 20 00

PIPING FOR HVAC

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

- A. This Section is coordinated with and complementary to the General Conditions and Supplementary General Conditions of the Work, wherever applicable to Mechanical Work.
- B. Section 01 31 46 - Special Requirements for Mechanical and Electrical Work shall apply.

1.2 DESCRIPTION OF WORK

- A. The Work includes providing of all labor, materials, equipment, accessories, services and tests necessary to complete and make ready for operation by the Owner, all piping as shown on the Drawings and hereinafter specified.

1.3 QUALITY ASSURANCE

- A. "Manufacturers"-Firms regularly engaged in manufacture of pipe whose products have been in satisfactory use in similar service for not less than ten (10) years.
- B. Provide pipe whose performance, under specified conditions, is certified by the manufacturer.
- C. Piping systems and installation of piping shall comply with ANSI/ASME B31.9, Building Service Piping (B31.1, Power Piping).
Refrigerant piping systems shall comply with ANSI/ASME (B31.5, Refrigeration Piping).
- D. All piping and fittings shall be made in the USA and shall be labeled as such. Piping shall also be labeled with ASTM number for easy identification/verification at the site.

1.4 SUBMITTALS

- A. Refer to Section 01 31 46, "Special Requirements for Mechanical and Electrical Work", and submit shop drawings.

1.5 COORDINATION

- A. Refer to Section 01 31 46, "Special Requirements for Mechanical and Electrical Work".
- B. Furnish fabrication detail drawings for all pipe hangers and supports for piping 2½" inches nominal size and larger.
- C. Furnish hanger and support location drawings for piping 2½" inches nominal size and larger.
- D. Perform calculations necessary for the design and selection of hangers, supports, anchors, guides, restraints, snubbers, and supplementary supporting steel for piping 2½" inches nominal size and larger.

- E. Perform weight distribution, expansion and movement calculations for all piping.
- F. Shop Drawings and Data: Contractor shall prepare the following drawings:
 - 1. Fabrication Detail Shop Drawings: These drawings shall show each pipe hanger or support for piping 2½" inches nominal size and larger and shall include location of hanger with reference to nearest building columns or beams, arrangements and detail of hanger, detail of concrete anchor or detail of welded or bolted attachment to structural steel, bill of materials for all components with ASTM specification numbers and direction and magnitude of movement and thrusts and weight at hanger point. Provide the load at each concrete anchor.
 - 2. Piping Erection Detail and Layout Drawings: Provide scaled detailed piping arrangement drawings showing all piping systems and connected components. Indicate piping in double line detail for all piping 2" and larger. Show piping with insulation thicknesses. Indicate all valves and valve handles, automatic actuators, strainers and access space, reducers, instruments, anchors/guides and supports, seismic components (if applicable) and all equipment to which piping is connected.
 - 3. Hanger and Support Location Shop Drawings: Contractor shall mark all pipe hanger and support locations for piping 2½" inches nominal size and larger on Piping Erection Detail and Layout drawings. The contractor shall also show all structural grids and support points on these drawings.

1.6 WARRANTY

- A. Refer to Section 01 31 46, "Special Requirements for Mechanical and Electrical Work".

PART 2 - PRODUCTS

2.1 PIPE

- A. All pipes shall be new, free from scale or rust, of the material and weight specified under the various services. Each length of pipe shall be properly marked at the mill for proper identification with the name or symbol of the manufacturer.
- B. All steel piping, except where otherwise rated, shall be standard or extra strong weight, in conformance with the ASTM A-53 Grade B seamless, for piping 2" and larger, as manufactured by National Tube Division, Republic Steel Corp., or approved equal. Piping shall be ASTM A-53 Type F continuous but weld, for piping less than 2".
- C. High-temperature hot water supply and return piping shall be ASTM A-106 Grade B.
- D. All brass piping shall be standard or extra heavyweight 85% red brass semi-annealed seamless-drawn, in conformance with the ASTM B-43, as manufactured by Anaconda, American Brass Co., Chase Brass and Copper Co., or Revere Copper and Brass, Inc.
- E. All copper tubing shall be of weight as required for service specified, with conformance with ASTM B-88 for Types "L" and "K" tubing, as manufactured by Chase, Anaconda, Revere, or approved equal. Tubing and fittings shall be thoroughly cleaned with a sand cloth and treated with an approved noncorrosive flux before the solder is applied.

- F. All galvanized steel piping shall be standard or extra strong weight, as specified, in conformance with the ASTM A-53 Grade B. The pipe shall be hot-dipped zinc-coated with Prime Western smelter and not wiped.
- G. Generally, unless otherwise specified, joints in steel piping of sizes 2 inches and under shall be screwed, and all sized 2½" inches and over shall be welded or flanged. Brass pipe shall be screwed 2 inches and smaller and flanged 2½" inches and over. Copper tubing shall be silver-soldered or 95-5 solders as herein specified.
- H. Screwed Piping
 - 1. All connections to apparatus with screwed piping shall be made with 250-pound brass seat unions.
 - 2. All screwed nipples shall be Schedule 80 nipples.
- I. Threaded joints in glycol-filled systems shall be made by Radiator Specialty Co. Submit a sample and obtain approval.
- J. Welding Piping
 - 1. All fittings for welded piping shall be as manufactured by Tube Turn, Grinnell, Bonney Forge or equal as approved by the Architect. The fittings shall be of the same weight and material as the piping to which they are attached.
 - 2. For piping 2½" and larger, full size branch connection shall be made with manufactured welding tees, branch connections for less than full size, shall be made with welding tees or with Weldolet forged branch outlet fittings. Fishmouthing, shaped nipples, and stubbing not permitted.
- K. Welding outlet fittings shall be Weldolets as manufactured by Bonney Forge, Inc., or approved equal 2 or 3 and smaller branches shall be made with thredolets as made by Bonney Forge or approved equal.
- L. Weld ells shall have a center line radius not less than the diameter of the pipes.
- M. All flanges shall be welding neck flanges ANSI B16.5 ASTM 181 Grade I. All systems, except where otherwise noted - 150 lbs. Class, forged steel.
- N. Instrumentation connections : ½" and smaller on all systems shall be provided by welding threaded 2000# forged steel half couplings to the pipe.
- O. All pipe to be welded shall be cut off clean and beveled. All welding shot shall be removed.
- P. Composition of welding electrodes shall be in accordance with manufacturer's recommendations.
- Q. Backing rings shall be used for all welded piping for high-temperature hot water. High-temperature hot water piping to be butt welded in sizes 2" and larger, socket welded in sizes 1½" and smaller. Rings shall be carbon steel with knock-off spacer pins, for Schedule 40 and/or Schedule 80 pipe dimensions, as manufactured by Tube Turn, Inc. or Robven Backing Ring Co. Smaller branches on high-temperature hot water shall be made by using "Weldolets" or approved equal fittings. Ells for high-temperature hot water system shall be long radius. All flanges shall be welding neck flanges ASA B16,5 ASTM 181 Grade L,300 lbs. Class, forged steel.

- R. Pipe welding shall comply with the provisions of the latest revision of the applicable code, whether ASME Boiler and Pressure Vessel Code, ANSI Code for Pressure Piping B31, or such state or local requirements as may supersede codes mentioned above.
- S. Before any pipe welding is performed, submit a copy of the welding procedure specifications together with proof of its qualification as outlined and required by the most recent issue of the code having jurisdiction. Submittal shall comply with ANSI/ASME B31.1/B31.9.
- T. Before any operator shall perform any pipe welding, also submit the operator's qualification record in conformance with provisions of the code having jurisdiction, showing that the operator was tested and certified under the Procedure Specification as before mentioned. Submittal shall comply with ANSI/ASME B31.1/B31.9.
- U. Assume responsibility for the quality of welding done and repair or replace any work not in accordance with these specifications.
- V. In addition, all pipe welding procedures and procedures for qualification of pipe welding operators shall comply with the requirements of the American Welding Society.
- W. Cut weld test plugs at locations selected at random by the Architect. The test plugs shall be tested by the testing agency approved for this project. Failure of the test plugs to meet the standards of the specified codes and agencies shall result in the complete removal and replacement of the joint and retesting of the operator who performed the welding. The removal and replacement of the joints shall be at no additional cost to the Owner.
- X. Pipe Schedule: Pipe for the various services shall be as follows:

Service	Material	Schedule
Cold Water	Copper	Type K
Cold Water	Copper	Type "TP"
Hot Water (Heating) and reheat	Steel	40
Condenser Water/Glycol	Steel	40
Refrigerant	Copper Tubing	ACR Type

- Y. The Contractor shall have the option to use Type K copper for hot water and chilled water piping up to and including 2", and brazed Type L copper for glycol water piping up to and including 2".
 Below ground fuel oil in NYS & NYC - cathodically protected or fiberglass reinforced plastic suitable for fuel oil use. Galvanized pipe not acceptable.
 Nassau and Suffolk Counties - double walled pipe only. Check this.

2.2 FITTINGS

- A. Fittings shall be specified under the "Fitting Schedule" for various services.
- B. Welding fittings shall be of the same material and schedule as the pipe to which they are welded. Welding elbows shall be long radius pattern unless clearance conditions necessitate the use of standard radius pattern. Welding fittings shall be as made by Tube-Turn.
- C. Fittings shall be of material conforming to the following schedule:

Steel Welding Fittings	ASTM A-106
Forged Steel Fittings	ASTM A-234
Malleable Iron Fittings	ASTM A-197
Ductile Iron Fittings	ASTM A-395 & A-536
Cast-Iron Fittings	ASTM A-126
Brass Fittings	ASTM B-62
Wrought Copper Fittings	ASTM B-75 & B-152
Bronze Cast Fittings	ASTM B-584
Solder Fittings	ASTM B-88
Stainless Steel	ASTM A-403, Grade WP, Class S or W

- D. All fittings used at expansion loops or bends shall be extra heavy.
- E. Cast-iron, malleable-iron and bronze fittings shall be of Crane manufacturer or approved equal.
- F. Flanges shall be raised face, of the same weight as the fittings in each service category. All flanges shall be drilled to "US Standard" hex nuts and washers. Bolting shall conform to ASTM 193 Grade B-7, threads Class 7 fit. Nuts shall be semi-finished hexagonal, ANSI B18.2 ASTM A194 Grade 2H.
1. Flange Adapters for grooved end pipe shall be ASTM A-395 and A-536 ductile iron, with synthetic rubber gasket. (Grade to suit the intended service.) Flange Adapters shall be CL 150, Victaulic Style 741.
- G. Unions - Unions 2 inches and smaller shall be screwed. Unions 2½" inches and larger shall be flanged. Screwed unions on steel pipe, unless otherwise specified, shall be of malleable iron with bronze ground seats suitable for 300 pounds W.S.P. Screwed unions on copper or brass pipe shall be brass, ground joint suitable for 300 pounds W.S.P. Flanged unions shall be malleable iron for steel pipe, and brass for copper or brass pipe, gasket type suitable for 150 pounds W.S.P. If grooved mechanical pipe couplings are used, additional unions are not required. Couplings shall serve as unions. Unions shall be manufactured by Crane or approved equal.
- H. Union shall not be used on high-temperature hot water piping. Bolts for high-temperature hot water piping shall be alloy steel studs threaded full length and fitted with two hexagon nuts per stud for all flanged joints.
- I. Gaskets used on high-temperature hot water systems shall be Flexitallic Style CG spiral-wound type with compression stop and shall be certified for use in HTHW systems. Gasket pressure and temperature ratings shall exceed the operating conditions of the HTHW system in which they are being installed.
- J. Brass pipe threads shall be cut with special brass threading dies, and the joints shall be made up with lubricant. Strap wrenches, or equivalent, shall be used in making up brass pipe. Wrenches that gouge or scar the pipe will not be used.
- K. Solder for each solder-type fitting shall be of 95% tin and 5% antimony or silver solder, as specified herein. Refrigerant piping joints shall be made with silver solder.
- L. Unless otherwise specified, all flanged joints shall be fitted with Manville or equal ring gaskets designed for the intended service.

M. Fitting Schedule: Fittings for the various services shall be as follows:

Service	Size	Material	Weight	Type
Low Pressure Steam	2" & below 2½" & above	C.I. Steel	125# Sch. 40	Screwed Welding
Low Pressure Condensate	ALL ALL 2" & below 2½" & above	Yoloy Bronze C.I. Steel	Standard 125# 125# Sch. 40	Screwed Screwed Welding
Overflow and Drain	ALL	Galv. M.I. Wrought Copper	150# 125#	Screwed Solder
Cold Water	ALL	Bronze Wrought Copper	125# 125#	Brazed Solder
Compressed Air	ALL	Wrought Copper	125#	95-5 Solder
Overflow and Drain	ALL	Wrought Copper	125#	Solder
Cold Water	ALL	Bronze Wrought Copper	125# 125#	Brazed Solder
Condenser Water	2" & Below 2½" & Above	CI Steel	125# Sch. 40	Screwed Welding
Glycol (Heating)	ALL	Steel or Wrought Copper	Sch. 40 125#	Welding Solder
Refrigerant	ALL	Wrought Copper	300#	15% Silver Solder

2.3 PIPE HANGERS AND SUPPORTS

A. Provide necessary structural members, hangers and supports of approved design to keep piping in proper alignment and prevent transmission of injurious thrusts and vibrations. In all cases where hangers, brackets, etc., are supported from metal decking and/or concrete construction, care shall be taken not to weaken decking and/or concrete or penetrate waterproofing. All hangers and supports shall be capable of screw adjustment after piping is erected. Hangers supporting piping expanding into loops, bends and offsets shall be secured to the building structure in such a manner that horizontal adjustment perpendicular to the run of piping supported may be made to accommodate displacement due to expansion. All such hangers shall be finally adjusted, both in the vertical and horizontal direction, when the supported piping is hot, or chilled, as required. Hangers in direct contact with copper or brass pipe shall be solid copper.

B. Pipe hangers shall be the clevis and pipe roll types, except where otherwise noted.

PIPE HANGER SCHEDULE				
Pipe	Type of Hanger	Make and Model		
		Grinnell Fig. No.	B-Line Fig. No.	Carpenter & Paterson Fig. No.
2" & smaller (steel)	Clevis Hanger	260	B3100	100
2" & smaller (copper)	Adjustable Wrought Iron	CT-65	B3104CT	100 CT
2½" to 4" (steel)	Adjustable Steel Yoke Pipe Roll	181	B3110	140

PIPE HANGER SCHEDULE				
Pipe	Type of Hanger	Make and Model		
		Grinnell Fig. No.	B-Line Fig. No.	Carpenter & Paterson Fig. No.
2½" to 4" (copper)	Adjustable Swivel Ring	CT-69	B3170CT	
5" & above	Two Rod Roller Hanger	171	B3114	142

- C. Beam clamps - Hangers supported from floor steel shall be approved I beam clamps. I beam clamps for hangers shall be wrought steel. B-Line Fig. B3055 (C&P Fig. m 268) or equal.
- D. Where piping is run near the floor and not hung from the ceiling construction but is supported from the floor, such supports shall be of pipe standards with base flange and adjustable top yoke similar to B-Line Fig. B3091 (C&P Fig. 247) or equal.
- E. All vertical piping shall be anchored by means of heavy steel clamps securely bolted or welded to the piping, and with end extension bearing on the building.
- F. All vertical piping shall be guided at each floor by use of clamps fastened to building structure. Provide 360° protective saddle at guides. Saddles shall be fastened to pipe or insulation.
- G. Vertical runs of pipe not over 15 feet long shall be supported by hangers placed not over one foot from the elbows on the connecting horizontal runs.
- H. Vertical runs of pipe over 15 feet long but not over 60 feet long and not over 6 inches in size, or not over 30 feet long and not over 12 inches in size, shall be supported on heavy steel clamps. Clamps shall be bolted tightly around the pipes and shall reset securely on the building structure without blocking. Clamps shall be welded to the pipes or placed below couplings. Clamps shall be B-Line Fig. B3373 or equal.
- I. For all chilled water, dual temperature water, makeup water and insulated refrigerant piping, provide "Insulshield" as made by Insulcoustic Corp. or pipe covering protection shield B-Line Fig. B3151 (C&P Fig. 265P) with steel shield min. 9 inches long, with vapor barrier jacket. For steam, condensate, hot fuel oil and hot-water heating piping 2 inches and smaller, same as above. For steam, condensate and hot-water heating and high temperature hot water piping 2½ inches and larger, provide steel pipe covering protection saddles B-Line Fig. B3160 (C&P Fig. 353 series).
- J. Piping in trenches shall reset or hang from angle iron cross supports provided by the Contractor with two coatings of red primer and final coat for black asphaltum paint.
- K. Hanger rods shall be of the following diameters:

Pipe Size	Rod Diameter	Max. Spacing
1¼ inch & below	¾ inch	6'-0"
1½" and 2 inch	¾ inch	10'-0" (copper 8'-0")
2½ inch 3 inch	½ inch	10'-0" (copper 8'-0")

Pipe Size	Rod Diameter	Max. Spacing
4 inch 5 inch	5/8 inch	12'-0"
6 inch	3/4 inch	12'-0"
8 inch & above	7/8 inch	12'-0"

- L. Hanger rods shall be attached to preset concrete inserts with steel reinforcing rod through the insert and both ends hooked over the reinforcing mesh. For pipes 4 inches and larger, rods shall extend through concrete slab above where they shall be attached to steel bearing plates 6" x 6" x 1/4".
- M. All trapeze pipe supports shall be constructed of angle iron or C-channel. Uni-strut type supports are prohibited for use on HVAC piping, except insulated refrigerant piping may be supported using strut type supports as long as AP Armaflex insulation is used and the strut clamp is a Series 72 Klo-Shure by Hydra-Zorb which is intentionally oversized to match the O.D. of the insulation and includes a plastic clamp collar insert. All angle iron supports located outdoors (trapeze supports or vertical components) shall be of galvanized or stainless steel, including all related support rods and hardware.
- N. Piping shall not be hung from other piping, ducts, conduits or from equipment of other trades and no vertical expansion shields will be permitted. Hanger rods shall not pierce ducts.
- O. All water piping connected to rotating equipment within all mechanical spaces shall be isolated from the building structure by means of vibration hangers inserted in the hanger rods. The vibration hangers shall consist of a steel spring in combination with a double deflection neoprene element within a rectangular steel housing. Combined static deflection shall be 1.375" minimum. Hangers shall have capability of supporting the piping at a fixed elevation during installation and shall incorporate an adjusting device to transfer the load to the spring. Deflection shall be indicated by means of scale. Vibration hangers shall be type PCDNHS made by Mason Industries. Provide flexible pipe connectors at all pump suction and discharge piping.
- P. All steam and condensate piping within all mechanical spaces shall be isolated from the building structure by means of vibration hangers inserted in the hanger rods. The vibration hangers shall consist of a steel spring in combination with a double deflection neoprene element within a rectangular steel housing. Minimum static deflection shall be 1.375". Vibration hangers shall be Vibratol type HESL with options 2 and 4 as made by B-Line Systems, Inc. (Type PCDNHS as made by Mason Industries.)
- Q. Where additional steel is required for the support of hangers, furnish and install same subject to the approval of the Architect. Piping and ductwork shall not be supported from concrete slab construction at ceiling.
- R. All piping running on walls shall be supported by means of hanger suspended from heavy angle iron wall brackets. No wall hooks will be permitted.
- S. Lateral bracing of horizontal pipe shall be provided where required to prevent side sway or vibration. The lateral bracing shall be of a type approved by the Architect and shall be installed where directed by the Architect.
- T. All heavy piping is defined as follows:
 1. individual pipes having a nom. dia. greater than 12 inches.

2. groups of pipes consisting of more than three 8 inches, or more than two 10-inch nom. 1 dia. pipes,
 3. Any combination of closely spaced pipes weighing more than the equivalent of above or 15 lb. per lin. ft., shall be supported at all cross points with overhead floor beams by fastening to the flange of such beams with steel clamps or other suitable means.
- U. Where such heavy piping runs parallel with the floor beams properly designed auxiliary steel must be provided. The spacing of such auxiliary steel supports shall in no case be greater than the spacing of the floor beams running perpendicular to the corrugations of the permanent slab steel forms.
- V. Assume the responsibility for the proper transfer of the loads of the piping systems to the structure. No additional cost to the Owner should be expected for any corrective work during construction.

2.4 ANCHORS

- A. All anchors shall be separate and independent of all hangers, guides, and supports. Anchors shall be of heavy blacksmith construction suitable in every way for the work approved by the Architect. Anchors shall be welded to the pipe and fastened to the structure with bolts.
- B. Anchors shall be fabricated and assembled in such a form as to secure the piping in a fixed position. They shall permit the line to take up its expansion and contraction freely in opposite directions away from the anchored points; and shall be so arranged as to be structurally suitable for particular location, and line loading. Submit calculations and details for approval.

PART 3 - EXECUTION

3.1 INSPECTION

- A. The contractor shall examine location where the piping is to be installed and determine space conditions and notify the Architect in writing of conditions detrimental to proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Coordinate with other work as necessary to interface installation of piping with other components of systems.
- B. Provide and erect in a workmanlike manner, according to the best practices of the trade, all piping shown on the Drawings or required to complete the installation intended by these Specifications.
- C. The Drawings indicate schematically the size and location of piping. Piping shall be set up and down and offset to meet field conditions and to provide adequate maintenance room and headroom in the Mechanical Rooms.
- D. Study the General Construction Specifications and Plans, of the exact dimension of finished work and of the height of finished ceilings in all rooms where radiation, units, equipment or pipes are

to be placed and arrange the work in accordance with the Schedule of Interior Finishes, as indicated on the Architectural Drawings.

- E. All piping shall be run perpendicular and/or parallel to floors, interior walls, etc. Piping and valves shall be grouped neatly and shall be run so as to avoid reducing headroom or passage clearance. Provide min. 7'-6" headroom under passageway in Mechanical Equipment Room. All valves, controls and accessories concealed in furred spaces and requiring access for operation and maintenance shall be arranged to assure the use of a minimum number of access doors.
- F. All pipelines made with screwed fittings must be provided with sufficient number of flanges or unions to enable the removal of piping without breakage of fittings.
- G. All piping shall be erected as to insure a perfect and noiseless circulation throughout the system. No bullhead tees will be permitted.
- H. All valves and specialties shall be placed so as to permit easy operation and access.
- I. Provide proper provision for expansion and contraction in all portions of pipe work, to prevent undue strains on piping or apparatus connected therewith. Provide signed and sealed pipe expansion calculations by an independent, licensed NYS Professional Engineer to substantiate all such provisions for said expansion and contraction. These calculations shall be based on the piping shop drawings. Provide double swings at riser transfers and other offsets wherever possible, to take up expansion. Arrange riser branches to take up motion of riser.
- J. Approved bolted, gasketed, flanges (screwed or welded) shall be installed at all apparatus and appurtenances, and wherever else required to permit easy connection and disconnection. Screwed unions shall be used on piping 2" or less.
- K. All piping connections to coils and equipment shall be made with offsets provided with screwed or welded bolted flanges arranged so that the equipment can be serviced or removed without dismantling the piping.
- L. If, after plant is in operation, any coils or other apparatus are stratified or air bound (by vacuum or pressure), they shall be repiped with new approved and necessary fittings, air vents, or vacuum breakers at no extra cost. If connections are concealed in furring, floors, or ceilings, the Contractor shall bear all expenses of tearing up and refinishing construction and finish, leaving same in as good condition as before it was disturbed.
- M. Fittings shall be of the eccentric reducing type, where changes of size occur in horizontal piping to provide for proper drainage or venting. Steel pipe bends shall be made of the very best grade open hearth, low carbon steel, leaving a smooth uniform exterior and interior surface. Pipe bends shall be made with seamless steel pipe, having a minimum radius of not less than five (5) pipe diameters.
- N. Tubing shall be erected neatly in a workmanlike manner. Bends in soft copper tubing benders to prevent deformation of the tubing in the bends. Approved seat-to-pipe threaded adapters shall be provided for junctions with valves and other equipment having threaded connections.
- O. Vertical sections of main risers shall be constructed of pipe lengths welded together. No couplings shall be used.

- P. The ends of all pipe and nipples shall be thoroughly reamed to the full inside diameter of the pipe and all burrs formed in the cutting of the pipes shall be removed.
- Q. Piping shall be installed in accordance with the latest edition of the ASME Code for Pressure Piping.
- R. All piping shall be concealed above furred ceilings in rooms where such ceilings are provided (except where specifically indicated otherwise on the drawings, or in walls or partitions, except as otherwise indicated).
- S. Piping, fittings or valves of dissimilar materials shall be connected with dielectric connectors as made by Ebco Company or approved equal.
- T. Piping at all equipment and valves shall be supported to prevent strains or distortions in the connected equipment and valves. Piping shall be sufficiently supported to allow for removal of equipment, valves and accessories with a minimum of dismantling and without causing excessive stress or damage to the remaining piping, valves or equipment, without requiring additional supports after these items are removed.
- U. Pipe nipples - Any piece of pipe 3" in length and less shall be considered a nipple. All nipples with unthreaded portion 1½" and less shall be extra heavy. Only shoulder nipples shall be used. No close nipples will be permitted.
- V. Screw threads shall be cut clean and true; screw joints made tight without caulking. No caulking will be permitted. A non-hardening lubricant shall be used. No bushings shall be used. Reductions, otherwise causing objectionable water or air pockets, to be made with eccentric reducers or eccentric fittings.
- W. Pitch steam and condensate lines downward one inch per 40 feet in direction of flow to ensure adequate flow and prevent noise and water hammer. Steam and return run outs to risers and to elements shall pitch ½" inch per foot. At low points of steam lines provide traps adequately sized to collect condensate. Mains shall be dripped at least every 100 feet of run. All supply mains shall be dripped and trapped on any vertical lift, except where otherwise noted. Provide capped dirt pockets at all traps, riser heels, and wherever dirt and scale may accumulate to meet job conditions, mains shall set up (with drip connections to return line) to maintain headroom, clear other pipes, etc. Steam mains are to be installed as high as possible. System is to be arranged to secure venting of air to the return line at all low points in steam mains, without permitting ingress of air. In any case, where return or drip piping, to meet job conditions, may have to set down under stoops, doors, etc., and again rise after passing these, the sets shall be made up with 45-degree fittings and with Y-laterals at each end, with brass plugs to permit easy cleaning of trapped portions of pipe. At any points where return mains have to rise again, after being depressed, provide also approved overhead "airlines" (not smaller than ¾" in size) with adjusting valves, and connect with two high sides. Any turns in water-sealed lines shall be made with crosses, with brass plugs in unused outlets to facilitate cleaning. All apparatus subject to high temperature differentials and high steam demand loads such as heating coils, domestic hot water heaters and steam-water converters, shall have a vacuum breaker.
- X. Pitch water piping upward one inch per 100 feet in the direction of flow to ensure adequate flow without air binding, and to prevent noise and water hammer. Pitch drain piping 5/8 inch per foot in the direction of flow. Branch connections to mains are to be made in such a manner as to prevent air trapping and permit free passage of air. To meet job conditions, mains shall set up to

maintain headroom, and clear other trades. Provide oversized float-operated automatic air vent (with valve). Avoid 90-degree lift set-ups in supply lines by using 45-degree ells. Where 90-degree lifts exceed 1½" install automatic air vent in supply lines. All lifts in return lines shall be installed with automatic air vents. Pipe outlet of all automatic air vents to an open sight drain if the vent is concealed, or to within two feet of the floor within machine rooms. All water piping shall pitch back to low points for drainage. Low points shall be provided with capped ¾ inch hose cocks.

- Y. Provide drain valves at the heel of all interior main water risers. Provide capped drain valves at the heel of all perimeter water risers.
- Z. Provide isolation valves where tying new piping into the existing system. Refer to the valves specifications for the proper valve type for the service. Refer to the Drawings for the pipe/valve size. In addition to the isolation valves at the tie-in points, also provide a balancing valve on the supply side for chilled water, chilled glycol/brine, condenser water and heating/reheat hot water system tie-ins.
- AA. Miscellaneous drains, vents, reliefs, and overflows from tanks, equipment, piping, relief valves, pumps, etc., shall be run to the nearest open-sight drain or roof drain. Provide capped drain valves whenever required for complete drainage of piping, including the system side of all pumps.
- BB. Provide domestic water connections from valved outlets to any equipment requiring the same.
- CC. All drain piping from condensate drain pans shall be properly trapped in accordance with the static pressures involved. Provide cleanout at first change in direction or before the trap. Condensate drain piping sizes shall be not less than 1½" except that fan coil unit drains may be 1".
- DD. The contractor shall utilize a Smog-Hog (or similar) type local exhaust system vented to the outdoors, when welding steel pipe and/or soldering pipe inside the building.

3.3 FIELD QUALITY CONTROL

- A. Upon completion of installation of piping (partial or complete) test piping to demonstrate compliance with requirements. Where possible in the field, correct malfunctioning piping, then retest to demonstrate compliance. Replace piping which cannot be satisfactorily corrected. Refer to Section 23 05 93 - Testing and Balancing.

END OF SECTION 23 20 00

SECTION 23 21 23

PUMPS FOR HVAC

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

- A. This Section is coordinate with and complementary to the General Conditions and Supplementary General Conditions of the Work, wherever applicable to Mechanical Work.
- B. Section 01 31 46 - Special Requirements for Mechanical and Electrical Work shall apply.

1.2 DESCRIPTION OF WORK

- A. The Work includes providing of all labor, materials, equipment, accessories, services and tests necessary to complete and make ready for operation by the Owner, all pumps as shown and scheduled on the Drawings and hereinafter specified.

1.3 QUALITY ASSURANCE

- A. Manufacturing firms regularly engaged in manufacture of this equipment with characteristics and capacities required, whose products have been in satisfactory use in similar service for not less than ten (10) years.
- B. Provide product produced by the manufacturers, which are listed in Section 23 05 12 "Approved Manufacturer's List".
- C. Provide equipment whose performance, under specified conditions, is certified by the manufacturer.

1.4 SUBMITTALS

- A. Refer to Section 01 31 46 - Special Requirements for Mechanical and Electrical Work, and submit shop drawings.

1.5 COORDINATION

- A. Refer to Section 01 31 46 - Special Requirements for Mechanical and Electrical Work.

1.6 GUARANTEE

- A. Refer to Section 01 31 46 - Special Requirements for Mechanical and Electrical Work.

PART 2 - PRODUCTS

2.1 IN-LINE PUMPS

- A. Furnish and install in-line pumps where shown on the plans and as specified.

- B. The pumps shall be of the horizontal, oil-lubricated type, specifically designed and guaranteed for quiet operation. Suitable for 125# working pressure.
- C. The pumps shall have a ground and polished steel shaft with a hardened integral thrust collar. The shaft shall be supported by two horizontal sleeve bearings designed to circulate oil. The pumps are to be equipped with a watertight seal to prevent leakage. The motor shall be non-overloading at any point on pump curve. Impellers shall be of bronze construction.
- D. The motor shall be of the open, drip-proof, sleeve-bearing, quiet-operating, rubber-mounted construction.
- E. Motor efficiencies must meet or exceed that specified in Section 01 31 46.
- F. All pumps in VFD application must have flexible couplings and inverter-duty motors.

PART 3 - EXECUTION

3.1 INSPECTION

- A. Contractor shall examine location where pumps are to be installed and determine space conditions and notify Architect in writing of conditions detrimental to proper and timely completion of the work.
- B. Do not proceed with the work until unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install equipment where shown, in accordance with manufacturer's written instructions, and with recognized industry practices, to ensure that equipment comply with requirements and serve intended purposes.
- B. Add concrete under structural members of pump base and grout around the base as required by manufacturer's written instruction.
- C. Coordinate with other work as necessary to interfere with installation of equipment with other components of systems.
- D. Install all pumps with a minimum of five (5) pipe diameters of straight pipe upstream of pump suction connections or provide a suction diffuser. If the suction diffuser is provided, it must contain an integral strainer and the Y-strainer required on the suction piping to the pump shall be omitted.
- E. For any pump which, through balancing, the Contractor is not capable of achieving the design flow and pressure, impeller trimming, a new impeller and/or a new motor shall be provided at no additional cost. If a new motor is provided of larger horsepower, then any required electrical work shall also be included at no additional cost. If necessary, larger motor starters, VFDs or disconnects shall be provided along with any larger conduits, wire sizes or fuses.

3.3 FIELD QUALITY CONTROL

- A. Upon completion of the installation of equipment and after the motor has been energized with normal power source, test equipment to demonstrate compliance with the requirement. When possible, field correct malfunctioning units, then retest to demonstrate compliance. Replace units that cannot be satisfactorily corrected. Refer to Section 23 05 93 - Test and Balancing.
- B. All pump casings shall be hydrostatically tested at 1 ½ times design working pressure. The pump manufacturer shall be responsible for his service department aligning in the field prior to start-up of all flexibly coupled units. Alignment shall be with dial indicator with accuracy of plus or minus .002 inches. The pump manufacturer must submit a written report certifying that the alignment work had been performed by his personnel and that the pumps are ready for operation.

END OF SECTION 23 21 23

SECTION 23 25 00

WATER TREATMENT AND CLEANING

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

- A. This Section is coordinate with and complementary to the General Conditions and Supplementary General Conditions of the Work, wherever applicable to Mechanical Work.
- B. Section 01 31 46 - Special Requirements for Mechanical and Electrical Work shall apply.

1.2 DESCRIPTION OF WORK

- A. The work includes the providing of all labor, materials, equipment, accessories, services and tests necessary to complete and make ready for operation by the Owner, all water treatment and cleaning as shown on the drawings and hereinafter specified.
- B. The Contractor shall engage the services of a water treatment contractor who shall provide a complete water treatment service. The service shall include furnishing and application of all chemicals, at least one visit a month to collect samples for chemical analysis at the water treatment company's laboratory, and all necessary inspection, adjustment, and maintenance of the chemical treating devices. Complete chemical control of the treatment shall be included. Reports shall be furnished to Architect after each visit.
- C. Water treatment shall be applied concurrently with the operation of each circulating water system for a period of one year. An initial dose of treatment chemical shall also be applied immediately after each system is initially filled with water if operation is to be delayed after filling.
- D. In addition to the chemicals indicated, slimicides and algacides shall be provided as necessary. Chromate and phosphate will not be acceptable. All chemicals shall be approved by local and state agencies having jurisdiction for discharge to the sewer system.
- E. The firm's water treatment laboratory shall be equipped to analyze water in accordance with the statement methods of the American Public Health Association.
- F. Water treatment contractor shall provide chemical feeding devices during the period of this contract. At the termination of the contract, the treatment equipment shall belong to the Owner.
- G. Provide a water treatment program for the following systems:
 - 1. Water/Glycol closed system.

1.3 QUALITY ASSURANCE

- A. Firms regularly engaged in manufacture of this material with characteristics and capacities required, whose products have been in satisfactory use in similar service for not less than 10 years.
- B. Provide products produced by the manufacturers, which are listed in Section 23 05 12, "Approved Manufacturer's List".

- C. Provide equipment whose performance, under specified conditions, is certified by the manufacturer.

1.4 SUBMITTALS

- A. Refer to Section 01 31 46 - Special Requirements for Mechanical and Electrical Work and submit shop drawings.
- B. Submit documentation of acceptability of chemicals for discharge to the sewer system.

1.5 COORDINATION

- A. Refer to Section 01 31 46 - Special Requirements for Mechanical and Electrical Work.

1.6 GUARANTEE

- A. Refer to Section 01 31 46 - Special Requirements for Mechanical and Electrical Work.

PART 2 - PRODUCTS

2.1 CHEMICAL TREATMENT - CONDENSER WATER SYSTEM

- A. Circulating Condenser water system - provide complete chemical treatment program including corrosion inhibitor and pH control designed to meet the following requirements.

Phosphonate	6-8 ppm
Molybdate	8-10 ppm
pH	7.5 - 8.5
Cycles	10 Max. based upon raw water
Biocide	Non phenol, non-oxidizing biocide for algae and slime Algicide and H.T.H. control fed to develop a minimum of 24 ppm in the circulating water for a period of 4 hours.

2.2 CHEMICAL TREATMENT CLOSED CHILLED AND HOT WATER SYSTEMS

- A. Provide a Nitrite based material to maintain the following conditions in each closed water system.

	<u>Hot Water</u> (180EF. max.)	<u>Chilled Water</u>	<u>Hot Water</u> (250EF. max)
pH	7.5 - 9.0	7.5 - 9.0	7.5 - 9.0
Nitrite as NO ₂	1500 - 2000	300 - 400 ppm	300 - 400 ppm

2.3 CHEMICAL TREATMENT - CLEANING - DEGREASING

- A. Provide a supervised program of cleaning and degreasing chemicals used in the specified systems prior to start-up. Sufficient chemicals shall be added to each system to establish a concentration of 120 ppm degreasing chemicals containing 20% diocytulfocuccinate and a concentration of 240 ppm of cleaning chemical containing 15% polyacrilate and 25% diphosphonate in the water. Systems shall then be circulated for a minimum of 8 hours, dumped, flushed, and refilled, with

the correct corrosion inhibitors added for operation. Strainers are to be hand cleaned after flushing.

2.4 CHEMICAL FEED AND CONTROL - CONDENSER WATER SYSTEMS

- A. Chemical feed shall be accomplished from the low point of the system. Each chemical shall be fed from a mechanical pump which is suitable for the maximum building pressure where it is installed. Each pump shall be on an automatic controller, based on chemical demand.
- B. The water treatment chemical(s) shall be downstream of all sampling and corrosion coupon sample ports. The high-pressure chemical feed line(s) into the building system shall be as short as possible and shall feed directly into a condenser water line. The positioning of these feed lines shall be such that the chemicals do not contact each other before they enter the building system. Appropriate check valves and control valves shall be installed to preclude back-feeding of one chemical into another and to allow easy disassembly of the mechanisms.
- C. Control system shall be as manufactured by Heating Economy Services Co., Inc., Uniloc Corporation, or approved equal, for controlling Total Dissolved Solids (TDS), pH, and chemical treatment in the cooling water system. Control panel shall be a single NEMA 12 steel enclosure, primed and painted, and shall have the following basic features, fully pre-wired:
 - 1. Internal wiring harnessed, color coded, clearly identified and brought to master terminal board.
 - 2. Grounded AC receptacles for chemical treatment pumps and utility use.
 - 3. Manual Off/Auto selector switches and indicating lamps for bleed-off control, chemical feed and acid feed with legend plates.
 - 4. A counter and timer pulsed from a water meter with electric contactor in the make-up water supply line to operate the chemical treatment pumps.
 - 5. A selector switch to allow control of chemical feed from metered make-up or pH controller.
 - 6. Conductivity controller with indicating meter.
 - 7. The TDS shall be monitored and controlled by a voltage regulated, linear conductivity controller. The conductivity controller shall be fully transistorized with plug-in printed circuit boards. The controller shall be linear over its full measuring range of 100 to 6,000 micro-ohms and shall have a built-in 20 amp heavy duty relay. Power and bleed-off status shall be displayed by indicating lights on the front panel. The controller shall be insensitive to phase angle shifts and be capable of operating with input line voltage of 95 to 130 volts, AC, without affecting accuracy.
- D. The pH controller shall be an integral part of the control panel and it too shall be front panel mounted. It shall have these features.
 - 1. Input Range0-∇4 pH
 - 2. Input Impedance.....Greater than 10¹³ ohms.
 - 3. Output0-10 volts.
 - 4. StabilityLess than 0.001 pH/week
 - 5. Line Voltage Effect0.001% change.
 - 6. Limit of ErrorOutput - 1% of full scale.
 - 7. Limit of Error.....Meter - 2% of full scale.
 - 8. Response Time1 sec. for 90% of change for typical electrode system regardless of length of transmitter cable. 12 amps 25°C.
 - 9. Input Bias Cable.....Less than 10.
 - 10. Avg. Temperature Coeff.0.001 pH per °C.

- 11. Humidity EffectsNegligible at 99% relative humidity.
- 12. Ambient Temperature40 Deg. F. to 140 Deg. F.
- 13. Temperature CompensationAutomatic
- 14. Alarm per ControlSingle pole, single throw, high or low mode-field selectable.
- 15. Contact Rating120 VAC 5 amps res.
- 16. Power Requirements90 - 132 VAC/60 Hz/12 watts.

The pH controller shall be voltage regulated and fully transistorized with adjustable High/Low contacts and indicating lamps. The controller shall be linear over its full measuring range of 0-14 pH. A manual Off-Auto selector switch indicating lamp and feed limit timer shall be provided for acid pump control. pH shall be recorded on a strip recorder.

When the pH of the system falls below the pH setpoint, the controller shall be interlocked with bleed-off valve open, the inhibitor feed pump on, the acid feed pump off and the low pH alarm on, until the situation is corrected.

The pH probe shall have a remote pre-amplifier coupled with it to insure that the length of the transmitter cable does not affect the response time or the accuracy of the system.

- E. The chemical feed shall be controllable by either a reset timer actuated by a make-up water meter with electric contactor, or from the pH controller. The chemical feed control module shall have a pump status indicating lamp, a Manual/Off/Auto switch and a 20-amp pump relay.
- F. Provide sufficient sample stream piping assemblies. Each shall be pre-piped and consist of one (1) conductivity probe with dual carbon elements pitted in a PVC holder, mounted in a FloTee, one (1) pH flo-cell with measuring and reference electrodes, three (2) chemical injection tees, one (1) check valve, one (1) flow switch, one (1) sample cock and inlet and outlet shut-valves.
- G. Provide four (4) chemical feed pumps, positive displacement type, with ball type check valve and feed rate adjustable while pump is running. Each chemical feed pump shall have the necessary pressure rating and discharge capacity to meet system requirements. The acid pump shall contain the necessary materials of construction to resist corrosion from pumping Sulfuric Acid. Two (2) pumps shall be used for alternate feed of biocide via 7 days 24 hour controller, Heating Economy Service Co., Model L-10-A. Provide pump motor starters and all wiring and motor controls for pump operation.
- H. The controller, sample stream piping assembly and chemical feed pumps shall be prepiped, prewired, and assembled on a steel wall frame. Provide required inlet and outlet connections. 110/1/60 power to the control panel shall be provided under Division 16.
- I. Water Meter: Water meter shall be installed on make-up water line to tower. Water meter shall have electric contact head, 500 gallon size. Wiring from the control panel to the water meter shall be provided under this Section.

2.5 CONDENSER WATER SYSTEM COUPON RACK

- A. For all systems which circulate open circuit condenser water, furnish and install a coupon rack to monitor chemical treatment. Coupon to be prefabricated corrosion coupon by-pass assembly, as manufactured by Hesco or approved equal. The prefabricated assembly shall include as a minimum:
 - 1. Inlet and outlet shut-off valve.
 - 2. Strainer.
 - 3. Corrosion probe connection fittings.

4. Two (2) corrosion coupons with holders.
 5. Two corrosion coupon tees.
 6. Flow control valve.
- B. Placement of corrosion coupon rack shall be at, or as near as possible, to the low point of the system. It shall be placed immediately upstream of the chemical feed injection point and shall receive the "chemically oldest" water of the system. The inlet shall be from the bottom of the corrosion coupon rack. The Owner shall have the right to increase the number of coupon ports and the number of corrosion coupon racks.
- C. Corrosion coupons will be analyzed by the manufacturer of the coupons and test reports provided at recommended intervals for two years after system is turned over to the Owner.

2.6 CHEMICAL TREATMENT CONDENSER WATER SYSTEM

- A. System shall comply with all EPA requirements and applicable NYC Building Code and other agency requirements.
- B. The corrosion inhibitor system shall be suitable for the intended system and shall result in a corrosion rate no greater than 0.0002 inches per year as demonstrated on ASTM D-2688 in-situ steel corrosion coupons and 0.0002 inches per year on in-situ copper corrosion coupons. These readings shall be verified by the destructive corrosion rate evaluated on pipe samples taken from the pipe system which were specifically installed for this purpose.
- C. These chemicals shall be introduced into the system as close as is convenient to the low point of the system by means of automated pumps and controllers. The feed lines shall be kept as short as possible and shall feed into a constantly flowing line, downstream of the corrosion coupon rack. The metering pumps and timers shall be such that they allow a 7-day time cycle with a minimum time clock interval of 15 minutes.
- D. The parameters which are to be defined by the water treatment company shall consist of pH range, corrosion inhibitor range dispersant(s) levels of biocide maximum chloride level, alkalinity level, the Maximum Recommended Cycles of Concentration and Legionella Pneumophilia Screening Test for this system.
A Legionella Pneumophilia Screening Test shall be made at a minimum of four times per year during the operation of the cooling tower system. This test shall be performed by a laboratory using the Center for Disease Control approved Legionella Screening Test. The laboratory report shall state the Legionella Pneumophilia bacteria count per millimeter and the result for previous tests. Reports shall be forwarded to Engineer and Owner.
- E. Provide all necessary wiring to an adequate source of electric power provided under the Electrical Contract and all required interwiring.
Daily records of all water treatment activities shall be maintained by building operations personnel representing the Owner. These records shall consist of all communications and test records from the water treatment company, all chemical additions, all fill and drain cycles, cleanings, additions to the piping system and any other pertinent data, starting at the first filling of the system.

2.7 CONDENSER WATER SYSTEM CHEMICAL FEED CONTROL PANEL

- A. Condenser Water - A central automatic water control system shall be provided to maintain the specified parameters within the limits dictated by make-up water quality and environmental conditions (biological growth). The control panel shall have the following features in addition to those indicated above:
1. TDS - The dissolved solids control portion of the system is based on conductivity and shall have the following features and accessories:
 - a. LED digital readout display (micro mho/cm)
 - b. High, Low, Normal conductance indicator lights (LED).
 - c. High or Low conductance alarm light (flash or steady switch). Trip points are field adjustable. Flash or Steady switch has a Silence position. Provide remote alarm contacts for connections to the BAS.
 - d. Illuminated Legend: "Alarm", whenever alarm condition exists. Cannot be disabled.
 - e. External Alarm Bell.
 - f. Recorder output 0-5 VDC.
 2. Inhibitor Treatment: The inhibitor feed control portion of the control panel shall have the following features and accessories:
 - a. Solid State Counter (1-15 field selectable).
 - b. Solid State Timer (adjustable 3 to 5 minutes).
 - c. Test switch.
 - d. HOA switch for chemical pump.
 - e. Illuminated Legend: "Feed", when pump is activated.
 - f. Solid State Lock-Out Timer (adjustable 3 to 3 hours) and indicator light. Lock-out timer deactivates the pump and activates the alarm circuits described in TDS control section.
 - g. Low chemical (supply) level detector with Illuminated Legend: "Low-Chem:/ Test switch will activate the "Low-Chem" mode. Low chemical supply deactivates the pump and activates the alarm circuits described in the TDS control section.
 - h. Panel totalizer (amount of make-up). Electro-mechanical type.
 3. Ph: the ph control portion of the control panel shall have the following features:
 - a. LED digital display 0 to 13.99.
 - b. Internal switch for conversion to millivolt display - 1999 to +1999.
 - c. Illuminated Legend: "feed", when pump is activated by either high or low ph.
 - d. Forward-Reverse switch so that pump can be activated by either high or low ph.
 - e. Recorder output - 0-5 volts with Zero and Slope and adjustments (Internal).
 - f. "Operate" light shown controller status independent of HOA switch.
 - g. High, Low, Normal ph indicator lights (LED).
 - h. High or Low ph alarm light (flash or steady switch). Trip points are field adjustable. Flash or steady switch has a Silence position.
 - i. Illuminated Legend: "Alarm"; whenever alarm condition exists. Cannot be disabled.
 - j. External Alarm bell.
 4. General
 - a. All control circuits shall be in a single steel enclosure.
 - b. Door shall be gasketed and windowed with a lockable hasp-type latch.
 - c. Modular solid-state circuitry.

2.8 PROPYLENE GLYCOL SYSTEMS

A. Glycol Addition and Control Equipment

1. Control System: Provide a control system consisting of the following components to automatically add inhibited propylene glycol to the closed system in proportion to the makeup water requirements (see detail on drawings):
 - a. A pressure switch shall be supplied for activating the glycol-water feed pump when system pressure drops below design pressure.
 - b. One (1) bronze rotary great pump with a close coupled AC motor shall be supplied for feeding glycol to the system. The pump shall be rated at 3.4 gallons per minute at 60 psi and shall have a 2 HP 1725 RPM 1/60/115-230-volt motor. The pump shall be an Oberdorfer series 992 or approved equal.
 - c. A low level alarm shall be supplied for the glycol-water supply drum. The alarm shall automatically shut off the pump when a low level is reached and illuminate a red warning light. Provide dry contacts for interface of the alarm to the building automation system.
 - d. The contractor shall pipe the pump from the supply drum to the closed system line using ½" piping. In addition, the contractor shall supply and install the wiring between the timer, low level alarm and pump.
 - e. Controls shall be wall mounted in a NEMA 12 steel enclosure, primed and painted.

B. Propylene Glycol Product

1. Propylene glycol for the initial fill of the system shall be provided by the contractor.

An initial spare supply of one (1) 55-gallon drum of an inhibited industrial grade propylene glycol based permanent antifreeze shall be supplied. Additional quantities shall be purchased by the Owner as needed.

The product shall be 95% propylene glycol and shall contain multimetal inhibitors.

2.9 WATER TREATMENT CONTROL TESTING EQUIPMENT

- A. Provide a test set complete with apparatus and chemical reagents for the determination of phosphonate (ortho), ph (7.6 - 9.2), nitrite and any additional test as required by water treatment company.

2.10 CLEANING OF PIPING SYSTEMS

A. Preliminary Cleaning:

1. Clean new piping internally by flushing prior to the application of pressure tests and before the chemical cleanout procedures specified herein. Provide temporary strainers at the inlet to the chilled water and hot water pumps before the start of cleaning procedures.
2. Block off and isolate circulating pumps, cooling coils, heating coils and steam traps during the preliminary flushing and draining process.
3. Thoroughly flush piping clear of foreign matter with City water under pressure, and then drain before proceeding with pressure testing. Blow down accumulations of grit, dirt and sediment at each strainer and each low point in the piping systems.
4. Clear compressed air piping of foreign matter by progressively blowing compressed air through the piping.
5. Provide bypass flush valves and required piping to permit full circulation of water during the washout of the piping systems. Close shutoff and balancing valves on branch piping to the terminal equipment units during the washout operation to prevent water circulation through the automatic control valves.

- B. Chemical Cleanout:
 - 1. After completion of pressure testing, chemically clean internally each recirculating water system (including chilled water, hot water, and condenser water).
 - 2. Provide temporary connections with valves to fill the piping and remaining equipment with water for the purpose of draining piping and equipment after completion of the chemical cleanout procedure. Provide temporary blind flanges and/or caps to isolate the piping and equipment noted herein.
 - 3. Provide temporary piping connections, valves, strainers, bypasses, and blank connections where required to clean out systems. Line each strainer basket with a fine mesh nylon screen and replace the screens at the end of each day's circulation until each system is thoroughly cleaned.
 - 4.
- C. Chilled Water and Condenser Water Systems:
 - 1. Clean these systems as described for the hot water heating systems with the following exceptions:
 - 2. Circulate the chemically treated water at ambient temperature.
 - 3. Accomplish the chemical cleanout during a minimum of three (3) 8-hour periods.
- D. Filling of Water Systems:
 - 1. After completion of the chemical cleanout, fill each water system with fresh water, air vent, and add chemical treatment.
 - 2. If the outdoor ambient temperature drops to 32°F., and the danger of freeze-up exists, drain water systems.

2.11 INTERNAL TREATING OF PIPING

- A. This work shall include the internal protective coating of all distribution systems on this construction such as, but not limited to, steam piping, hot water heating and cooling, chilled water and condenser water systems and components.
- B. This method of treating is to be applied to all piping supply and return and then back to the source of equipment.
- C. The Contractor shall clean the piping for the purpose of removing lime, oil, grease, oxides and other wastes therefrom. After the removal of these impurities, a protective coating shall be applied to all inner surfaces, which will inhibit oxidation as well as protect the metals against impurities that may be present in the water. This coating shall be guaranteed for five years from date of completion at no cost to the Owner, covering labor and materials. Valve-off heat exchangers to avoid coating surfaces.
- D. The treating materials use for this purpose must have been in use successfully for at least five years in comparable systems.
- E. It shall be compounded of non-corrosive, non-toxic, non-alkaline and non-injurious ingredients that have been investigated and reported as a "Neutral Compound" by a recognized engineering firm or laboratory, other than the submitting company's own laboratory. Brochures and unbiased test reports shall be submitted to the Architects within 90 days from job acceptance for approval. This treating firm shall show proof, that said firm has been established and accepted for this work, for a minimum of 10 years. The ingredients used shall have no deleterious effects on seals, O-rings, glands, packing, etc.

- F. It shall be the sole responsibility of the approved firm for the application of this process. He shall supply all labor, materials, and equipment for this purpose. A competent supervisor and/or equipment operator shall be kept at the site from commencement of his work until completion. None but experienced men shall provide treating of piping. Any repairs or servicing of components of these systems shall be done by the Contractor.

PART 3 - EXECUTION

3.1 INSPECTION

- A. Contractor shall examine location where this equipment is to be installed and determine space conditions and notify architect in writing of conditions detrimental to proper and timely completion of the work.
- B. Do not proceed with the work until unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install water treatment equipment where shown or specified, in accordance with manufacturer's written instructions, and with recognized industry practices, to ensure that water treatment systems comply with requirements and serve intended purposes.
- B. Coordinate with other work as necessary to interface installation of water treatment equipment with other components of systems.
- C. Check alignment and, where necessary (and possible), realign shafts of motors and equipment within tolerances recommended by manufacturer.

3.3 FIELD QUALITY CONTROL

- A. Upon completion of installation of equipment, and after motors have been energized with normal power source, test equipment to demonstrate compliance with requirements. When possible, field correct malfunctioning units, then retest to demonstrate compliance. Replace units which cannot be satisfactorily corrected.

END OF SECTION 23 25 00

SECTION 23 30 00.11

WELDING PRESSURE PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. This Section is coordinated with and complementary to the General Conditions and Supplementary General Conditions of the Work, wherever applicable to Mechanical Work.
- B. Section 01 31 46 - Special Requirements for Mechanical and Electrical Work shall apply.

1.2 SUMMARY OF WORK IN THIS SECTION

This section covers the welding of pressure piping systems. Deviations from applicable codes, approved procedures, and approved Shop Drawings will not be permitted without prior written approval. Materials or components with welds made off the site will not be accepted if the welding does not conform to the requirements of this Specification. Procedures shall be developed and qualified by the Contractor for welding all metals included in the Work. Welding shall not be started until welding procedures have been developed, and welders and welding operators have been qualified. Qualification testing shall be performed to the qualified procedures on-site in the presence of the Owner's Representative. Costs of such testing shall be borne by the Contractor. The Owner shall be notified at least seven (7) days in advance of the time of the tests. The Contractor shall maintain current records of the test results obtained in welding procedure, welding operator/welder performance qualifications, and nondestructive examination (NDE) procedures. These records shall be readily available at the site for examination by the Owner. The procedures for making transition welds between different materials or between plates or pipes of different wall thicknesses shall be qualified. ANSI B31.9 requirements for branch connections may be used in lieu of detailed designs. Unless otherwise specified, the choice of welding process will be the responsibility of the Contractor.

- A. Performance: The Contractor shall be responsible for the quality of all joint preparation, welding, and examination. All materials used in the welding operations shall be clearly identified and recorded. The inspection and testing defined in this Specification are minimum requirements. Additional inspection and testing shall be the responsibility of the Contractor when he deems it necessary to achieve the quality required. This shall be subject to the Owner quality assurance (QA).
- B. Definitions: Shall be in accordance with AWS A3 0.
- C. Symbols: Shall be in accordance with AWS A2.4.
- D. Safety: Shall conform to ANSI Z49.1.
- E. Delivery and Storage: All filler metals, electrodes, fluxes and other welding materials shall be delivered to the site in manufacturers' original packages and stored in a dry space until used. Packages shall be properly labeled and designed to give maximum protection from moisture and to assure safe handling.

1.3 APPLICABLE PUBLICATIONS

The publications listed below form a part of this Specification to the extent referenced. The publications are referred to in the text by the basic designation only.

- A. American National Standards Institute (ANSI) Publications:
 - 1. B31.9-1982 Building Service
 - 2. Z49.1-83 Safety in Welding and Cutting

- B. American Society of Mechanical Engineers (ASME) Publications:
 - 1. (1983) Boiler and Pressure Vessel Code
 - 2. Section I Power Boilers (1983; Addenda: Summer and Winter 1984)
 - 3. Section II Material Specifications: Part C - Welding Rods, Electrodes, and Filler Metals (1983; Addendum: Winter 1984)
 - 4. Section V Nondestructive Examination (1983; Addenda: Summer and Winter 1983; Winter 1984)
 - 5. Section IX Welding and Brazing Qualifications (1980; Addenda: Summer and Winter 1983; Summer 1984)

- C. American Society for Nondestructive Testing, Inc. (ASNT) Publication:
 - 1. SNT-TC-1A-1975 Personnel Qualification and Certification
Suppl A thru D in Nondestructive Testing

- D. American Welding Society (AWS) Publications:
 - 1. A2.4-79 Symbols for Welding and Nondestructive Testing, Including Brazing
 - 2. A3.0-80 Welding Terms and Definitions
 - 3. D10.9-80 Specification for Qualification of Welding Procedures and Welders for Piping and Tubing
 - 4. QCI-85 Standard for Qualification and Certification of Welding Inspectors

1.4 SUBMITTALS

The following submittals shall be made to the Engineer.

- A. Welding Procedure Qualification: Submit for approval.

- B. Welder Performance Qualifications: Submit certificates for the record.

- C. Shop Drawings: Submit Shop Drawings as follows: Drawings showing location, length, and type of welds, and indicating postweld heat treatment as required.

1.5 WELDING PROCEDURES QUALIFICATION

Qualification of the welding procedures for each group of materials to be welded is required as indicated in Section IX, "ASME Boiler and Pressure Vessel Code." Record in detail and qualify the "Welding Procedure Specifications" for every welding procedure proposed. Qualification for each welding procedure shall conform to the requirements of ANSI B31.9 and to this Specification. The welding procedures shall specify end preparation for butt welds, including cleaning, alignments, and root openings. Type of backing rings or consumable inserts, if used, will be described and, if they are to be removed, the removal process shall be described. Submit copies of the welding procedure Specifications and procedure qualification test results for each type of welding required in accordance with the paragraph "SUBMITTALS." Approval of any procedure does not relieve the Contractor of the sole responsibility for producing acceptable welds. This information shall be submitted on the forms printed in Section IX, "ASME Boiler

and Pressure Vessel Code," or their equivalent. Welding procedure qualifications shall be identified individually and shall be referenced on the Shop Drawings or suitable keyed to the Contract Drawings.

Whenever a rust inhibitor or preventative coating is used on weld ends and will not be removed prior to welding, the weld qualification tests shall be made with the coating applied.

1.6 WELDER AND WELDING OPERATOR PERFORMANCE QUALIFICATION

Each welder and welding operator assigned to Work covered by this Specification shall be qualified by performance tests using equipment, positions, procedures, base metals, and electrodes or bare filler wires from the same Specification, classification, or group number that will be encountered on assignment. Tests shall be conducted on site for each welder and witnessed by the Owner's Representative. Welders or welding operators who make acceptable procedure qualification tests will be considered performance-qualified for the welding procedure used. Performance qualification shall be determined in accordance with Section IX, "ASME Boiler and Pressure Vessel," ANSI B31.9 and as specified.

- A. Certification: Before assigning welders or welding operators to the Work, provide the Owner with their names, together with certification that each individual is performance-qualified as specified. No welding Work shall start prior to procedure qualification. The certification shall state the type of welding and positions for which each is qualified, the code and procedure under which each is qualified, date qualified, and the firm and individual certifying the qualification tests.
- B. Identification: Each welder or welding operator shall be assigned an identifying number, letter, or symbol that shall be used to identify all of its welds. A list of the welders' names and symbol of each shall be submitted. To identify welds, either written records indicating the location of welds made by each welder or welding operator shall be submitted, or each welder or welding operator shall apply his mark adjacent to this weld using an approved rubber stamp or felt-tipped marker with permanent, weatherproof ink or another approved methods that do not deform the metal. For seam welds, identification marks shall be placed adjacent to the welds at three (3) foot intervals. Identification by die stamps or electric etchers shall be confined to the weld reinforcing crown, preferably in the finished crater.
- C. Renewal of Qualification: Requalification of a welder or welding operator shall be required under any of the following conditions:
 - 1. When a welder or welding operator has not used the specific welding process for a period of three (3) months. The period may be extended to six (6) months if they have been employed on some other welding process.
 - 2. There is specific reason to question ability to make welds that will meet the requirements of the Specifications.
 - 3. The welder or welding operator was qualified by an employer other than those firms performing Work under this contract and a qualification test has not been taken within the preceding twelve (12) months. Renewal of qualification under this condition need by made on only a single test joint or pipe of any thickness, position, or material to reestablish the welder's or welding operator's qualification for any thickness, position, or material for which one had previously qualified.

1.7 QUALIFICATION TESTING FOR HIGH PRESSURE STEAM PIPING

Qualification testing for high pressure steam piping (greater than 90 psig) shall be performed by an agency listed with the NYC Department of Buildings.

PART 2 - PRODUCTS

2.1 WELDING MATERIALS

All welding materials shall comply with Section II, "ASME Boiler and Pressure Vessel Code." Welding equipment, electrodes, welding wire, and fluxes shall be capable of producing satisfactory welds when used by a qualified welder or welding operator using qualified welding procedures.

2.2 WELDING OPERATORS

Perform all welding in accordance with qualified procedures using qualified welders and welding operators. Welding shall not be done when the quality of the completed weld could be impaired by the prevailing working or weather conditions. The Contractor shall determine when weather or working conditions are unsuitable for welding. Welding of hangers, supports, and plates to structural members shall conform to AWS Specifications.

2.3 INSPECTIONS AND TESTS

Visual and nondestructive examinations may be performed by the Owner to detect surface and internal discontinuities in completed welds. The services of a qualified commercial inspection or testing laboratory or technical consultant may be employed by the Owner. When inspection and testing indicate defects in a weld joint, the weld shall be repaired by a qualified welder in accordance with the paragraph "CORRECTIONS AND REPAIRS." The Owner reserves the right to perform testing and inspection as seen fit.

If the Owner exercises his right to inspect welds, any of the following inspection procedures could be used.

- A. Visual Inspection: Weld joints shall be inspected visually as follows:
 - 1. Before welding -- for compliance with requirements for joint preparation, placement of backing rings of consumable inserts, alinement and fit-up, and cleanliness.
 - 2. During welding -- for conformance to the qualified welding procedure.
 - 3. After welding -- for cracks, contour and finish, bead reinforcement, undercutting, overlap, and size of fillet welds.
- B. Nondestructive Examination: Procedures for radiographic or ultrasonic tests and methods shall conform to Section V, "ASME Boiler and Pressure Vessel Code."
- C. Inspection and Tests by the Owner: The Owner may perform all field nondestructive or destructive tests. Correction and repair of defects and reexamination of weld repairs shall be performed by the Contractor at no additional cost to the Owner. Inspection and tests will conform to paragraphs "Visual Inspection" and "NDE," except that destructive tests may be required also. When destructive tests are ordered by the Owner and performed by the Contractor and the specimens or other supplemental examinations indicate that the materials and workmanship do not conform to the contract requirements, the cost of the tests, corrections, and repairs shall be borne by the Contractor. When the specimens or other supplemental examinations of destructive tests indicate that the materials or workmanship do conform to the Specification requirements, the cost of the tests and repairs shall be borne by the Owner. When destructive tests are made, repairs shall be made by qualified welders or welding operators using welding procedures which will develop the full strength of the members cut. Welding shall be subject to inspection and tests in the mill, shop, and field. When materials or workmanship do not conform to the Specification requirements, the Owner reserves the right to reject the Work at any time before final acceptance of the system containing the weldment.
 - 1.

2.4 ACCEPTANCE STANDARDS FOR OWNER INSPECTIONS

- A. Visual: The following indications are unacceptable:
1. Cracks -- external surface.
 2. Undercut on surface which is greater than 1/16 inch deep or 20 percent of the base metal thickness, whichever is less.
 3. Weld reinforcement greater than 3/16 inch.
 4. Lack of fusion of surface.
 5. Incomplete penetration.
 6. Convexity of fillet weld surface greater than 10 percent of longest leg plus 0.03 inch.
 7. Concavity in groove welds.
 8. Concavity in fillet welds greater than 1/16 inch.
 9. Fillet weld size less than indicated or greater than 13 times the minimum specified fillet leg length.
- B. Radiography: Welds that are shown by radiography to have any of the following discontinuities are unacceptable:
1. Porosity in excess of that shown acceptable in Appendix A.250 of Section I of "ASME Boiler and Pressure Vessel Code."
 2. Any type of crack or zone of incomplete fusion or penetration.
 3. Any other elongated indication which has a length greater than:
 - a. 1/4" for t up to 3/4", inclusive.
 - b. 1/2" for t from 3/4" to 2 1/4", inclusive.
 - c. 3/4" for t over 2 1/4" where t is the thickness of the thinner portion of the weld.
 4. Any group of indications in line that have an aggregate length greater than t in a length of 12t, except where the distance between the successive indications exceeds 6L and where L is the longest indication in the group.

("t" pertains to the thickness of the weld being examined. If a weld joins two members having different thicknesses at the weld, "t" is the thinner of these two (2) thicknesses.)
- C. Ultrasonic Examination: Linear-type discontinuities are unacceptable if the amplitude exceeds the reference level and discontinuities have lengths that exceed the following:
1. 1/4" for t up to 3/4".
 2. 1/2" for t from 3/4" to 2 1/4".
 3. 3/4" for t over 2 1/4".
- ("t" is the thickness of the weld being examined. If the weld joins two members having different thickness at the weld, "t" is the thinner of these two thicknesses. Where discontinuities are interpreted to be cracks, lack of fusion, and incomplete penetration, they are unacceptable regardless of length.)

2.5 CORRECTIONS AND REPAIRS

- A. Defects shall be removed and replaced as specified in ANSI B31.9 unless otherwise specified. Defects discovered between weld passes shall be repaired before additional weld material is deposited. Wherever a defect is removed, and repair by welding is not required, the affected area shall be blended into the surrounding surface eliminating sharp notches, crevices, or corners. After defect removal is complete and before rewelding, the area shall be examined by the same test methods which first revealed the defect to ensure that the defect has been eliminated. After rewelding, the repaired area shall be reexamined by the same test methods originally used for that area. Any indication of a defect shall be regarded as a defect unless reevaluation by NTE and/or

by surface conditioning show that no unacceptable defects are present. The use of any foreign material to mask, fill in, seal, or disguise welding defects will not be permitted.

PART 3 - EXECUTION

The choice of the welding process shall be the responsibility of the Contractor.

3.1 PROCEDURES

- A. All welding, nondestructive examination, testing, and repair welding shall be performed in accordance with written procedures prepared by Contractor and B31.9.

3.2 WELDING MATERIAL CONTROLS

- A. Control methods: The contractor shall install controls for all weld filler materials. The controls shall be documented in a welding material control procedure acceptable to the Owner. This procedure shall be sufficient to prevent inadvertent misapplication of weld filler materials. The procedure shall provide for the following:
 - 1. Positive identification of all filler materials.
 - 2. Segregation of filler materials by classification, alloy, size, and type.
 - 3. Storage and conditioning of covered filler materials, flux cored wire, and welding fluxes in accordance with the manufacturer's recommendations or the ASME BPVC.
 - 4. Storage of bare filler materials to prevent contamination.
 - 5. Issuance to a welder of welding material types for use on only on P-number base metal at any one time.
- B. Storage and Conditioning: Filler materials shall be stored and conditioned in accordance with the manufacturer's recommendations.
- C. Return of Welding Materials: Identifiable filler materials may be returned for storage and shall be stored in accordance with this Specification. Unidentifiable welding materials shall be discarded immediately. All waste filler material such as stubs and sections of inserts shall be removed from the work area and discarded at least daily.

3.3 FILLER MATERIALS

- A. Carbon Steels (ASME Group P-1): Covered electrodes shall conform to ASME SFA 5.1 low-hydrogen type; Classification E7016 or E7018.
 - Bare wire and consumable inserts shall conform to ASME SFA 5.18 Types ER70S, ER70S-5, or ER70S-6.
 - Flux cored electrodes shall conform to ASME SFA 5.20, Type E70 T-X.
 - Bare mild steel and flux combinations shall conform to ASME SFA-5.17, Type F72-EM 12K.
- B. Low-Alloy Steels (ASME Groups P-3, P-4, P-5)
 - Covered electrodes shall conform to ASME SFA 5.5 low-hydrogen type classification as follows:
 - P-3 - E7018-A1
 - P-4 - E8016-B2 or E8018-B2
 - P-5 - E9016-B3 or E9018-B3

Bare wire and consumable inserts shall be capable of depositing weld metal similar to the base material composition.

3.4 WELDING OPERATIONS

- A. Edge Preparation: Edge preparation of the base metals shall be accomplished by machining, chipping, grinding, or cutting methods specified below. The weld preparation and adjacent base metal surfaces shall be smooth, clean, and free of any foreign material.
- B. Cleaning: The edge preparation and each weld bead shall be cleaned free of slag, flux, oxide, and all foreign material before applying the next bead. Only stainless-steel wire brushes shall be used on stainless steel and nickel alloys.
- C. Grinding wheels, abrasives, and wire brushes that have been used on other materials shall not be used on stainless steel or nickel alloys. Grinding wheels and abrasives used on stainless steel and nickel alloys shall not contain iron, iron oxide, or zinc.
- D. Weld Joint Buildup: Where the weld gap for field welds exceeds that in the welding procedure, Owner's permission is required prior to refitting or weld joint buildup.
- E. The filler material used for joint buildup shall be of the same F number as the production weld. Where radiographic or ultrasonic examination is specified for the production weld, the built-up areas shall be subjected to the same requirements.
- F. Backing Strips: The use of backing strips for field welds in vessels is prohibited without Owner's permission. Spacer blocks may be used in the weld groove provided:
 - 1. They are of the same P-number as the base material;
 - 2. They are attached by evenly spaced tack welds as indicated below;
 - 3. They are not incorporated into the final weld.
- G. Piping: Where piping other than tubular members used in the construction of steel structures is butt welded without backing rings, the GTAW process shall be used for the root pass and until 3/16" thickness is deposited; consumable inserts, when used, shall be of the same nominal composition as the filler metal; and inert gas purging is required for the first two layers of such butt joints or until 3/16" thickness is deposited except where Contractor demonstrates the suitability of an alternative technique to Owner's satisfaction.
- H. Shielded Metal-Arc Welds: Stringer beading is preferred. Where weave beading is used, the total width of the deposited bead shall be limited to six (6) times the electrode core diameter.
- I. Weld Details: Arc strikes shall be removed by grinding and the area examined for freedom from defects by liquid penetrant. Any crack or linear indication is unacceptable.
- J. Grinding shall not result in a reduction in wall thickness below the minimum required by the applicable code, material specification, or design calculation.
 - 1. Each weld shall be uniform in width and size throughout its full length.
 - 2. The welder shall examine the root and intermediate weld layers to ascertain proper fusion, freedom from cracks, surface porosity, scale, dirt, slag, and flux before depositing the next layer of weld metal.
 - 3. Any cracks, blow holes, or other defects that appear on the surface of the weld beads shall be removed by chipping or grinding before the next covering of weld bead is deposited.

4. Temporary welds shall be located where possible on edges and areas that will be trimmed off.
 5. The permissible gap or root opening between abutting edges of butt weld and weld grooves for nozzle attachments shall conform to the approved welding procedure.
 6. Wash pass welding (remelting cover pass to smooth weld contour) is prohibited.
 7. Where inert shielding gas or purging gas is used, the gas shall be welding grade argon or helium, 99.5 percent minimum purity, with a dew point of minus 40E F or lower.
- K. Peening: Peening is prohibited both for the initial root layer, or until 3/16" thickness is deposited, and for the cover layer of weld metal.
- L. Tack Welds: All tack welds shall be made in accordance with an approved welding procedure by a qualified welder with the same grade electrode or filler metal as the final weld. Where inert gas purging is used for welding, tack welds shall also be purged. Cracked or broken tack welds or those of poor quality shall be removed.
- M. Butt Welds: Butt welds shall be full penetration. For butt joints welded from both sides, the reverse side of the first root pass shall be ground or chipped to clean metal. Arc gouging is not permitted.
- N. Socket Welds: The depth of insertion of pipe or tube within the socket or sleeve shall be d" minimum.
- O. Attachment Welds: All temporary welded attachments used for erection purposes shall be removed by mechanical cutting or air-arc cutting the attachment a distance from the supporting metal surface sufficient to preclude damage, but in no case less than c". The remainder of the attachment shall be ground flush with the base metal surface. The ground area shall then be examined visually to ensure freedom from defects. Under no conditions are temporary attachments to be removed by hammer blows.
- P. Dissimilar Metal Welds: Austenitic-to-ferritic steel welds shall be welded using 309 filler metal.
1. Where a consumable insert is used in a joint requiring buttering, the insert shall be of NiCrFe composition.
 2. Dissimilar metal welds in piping 2" diameter and under shall be full penetration butt welds. The filler material shall be 309.
 3. ENiCrFe-3 shall not be used for any welding.
- Q. Restricted Accessibility: In any butt joint or welded branch connection of a steam or feedwater line where the nominal pipe size is 2" or larger, and where the accessibility is restricted to a degree that interferes with the welder's direct observation of the arc or the puddle in any area of the weld or which requires the use of mirrors or extensions to the torch handle or electrode holder, the weld shall be radiographed in accordance with and shall conform to the acceptance standards in ASME BPVC, Section VIII, Division 1, UW51. Alternatively, the weld may be examined ultrasonically in accordance with, and conform to the acceptance criteria of ASME BPVC, Section VIII, Division 1, Appendix 12. The Owner shall be responsible for testing. The Contractor shall identify all such welds to the Owner.
- R. Repair Welding: All repair welds shall be made using procedures and personnel qualified in accordance with the requirements of this Section. Cavities prepared for welding shall be examined visually for the adequacy of defect removal except where the defect is a crack. Cavities prepared for the removal of a crack, or a crack-like imperfection shall be examined for

complete removal of the imperfection by a magnetic particle or liquid penetrant method. Only stringer bead welding may be used; weaving or accumulating a molten pool in the cavity is prohibited. The completed repair shall be examined by the methods specified for the joint or material repaired.

- S. Workmanship: Workmanship and finish shall be subject to inspection by Owner. All welds shall be free of cracks, inadequate penetration, incomplete fusion, scale, dirt, flux, and other foreign substances. The surface of welds shall be sufficiently free from coarse ripples, grooves, overlaps, and abrupt ridges and valleys for the proper interpretation of the required examinations. Undercuts shall not exceed 1/32" and shall not encroach on the required section thickness.

END OF SECTION 23 30 00.11

SECTION 23 31 13

SHEET METAL DUCTWORK

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

- A. This Section is coordinate with and complementary to the General Conditions and Supplementary General Conditions of the work, wherever applicable to Mechanical Work.
- B. Section 01 31 46 - Special Requirements for Mechanical and Electrical work shall apply.

1.2 DESCRIPTION OF WORK

- A. The work includes the providing of all labor, materials, equipment, accessories, services and tests necessary to complete and make ready for operation by the Owner, all Sheet Metal Ductwork as shown on the drawings and hereinafter specified.

1.3 QUALITY ASSURANCE

- A. Fabrication and installation shall be by a single firm specializing and experience in metal ductwork for not less than 10 years.
- B. Comply with SMACNA's (Sheet Metal and Air Conditioning Contractors National Association) 2005 HVAC Duct Construction Standards, Metal and Flexible, Third Edition recommendations for fabrication, construction and details and installation procedures, except as otherwise indicated.
- C. Comply with ASHRAE (American Society of Heating Refrigeration and Air Conditioning Engineers) recommendations, except as otherwise indicated.
- D. Compliance to SMACNA and ASHRAE is a minimum requirement. In case of disagreement between sheet metal work described in this Section and SMACNA or ASHRAE, the specification shall govern.

1.4 SUBMITTALS

- A. Refer to Section 01 31 46 - Special Requirements for Mechanical and Electrical work and submit shop drawings and coordinate drawings.
- B. Before submitting any sheet metal drawings, submit a complete set of shop standards for review and approval. Sheet metal shop drawings may be submitted only after approval of the shop standards.

1.5 COORDINATION

- A. Refer to Section 01 31 46 - Special Requirements for Mechanical and Electrical work.

1.6 GUARANTEE

- A. Refer to Section 01 31 46 - Special Requirements for Mechanical and Electrical work.

- B. The contractor will guarantee all work for one year from the date of acceptance against all defect in material, equipment and workmanship. This guarantee shall include repair of damage to any part of the premises resulting from leaks or other defects in material, equipment or workmanship.

1.7 PRODUCT HANDLING

- A. Protect shop fabricated ductwork, accessories and purchased products from damage during shipping, storage and handling. Protect ends of ductwork and prevent dirt and moisture from entering ducts and fittings.
- B. Where possible, store ductwork inside and protect from weather. Where necessary to store outside, store above grade and enclosed with waterproof wrapping.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR DUCTWORK

- A. Furnish and install the size, connections and run of ducts as indicated on the drawings.
- B. While the Drawings shall be adhered to as closely as possible, the Architect's right is reserved to vary the run and size of ducts during the progress of the work if required to meet structural conditions.
- C. Install all ductwork in strict adherence to the ceiling height schedule indicated on the Architect's Drawings. Consult with the Plumbing, Fire Protection and Electrical Contractors and, in conjunction with the above Contractors, establish the necessary space requirements for each trade.
- D. The sheet metal ductwork shall, whether indicated or not, rise and/or drop and/or change in shape to clear any and all conduits, lighting fixtures, piping and equipment to maintain the desired ceiling heights and to provide adequate maintenance room and headroom in mechanical equipment rooms.
- E. The ductwork shall be continuous, with airtight joints and seams presenting a smooth surface on the inside and neatly finished on the outside. Ducts shall be constructed with curves and bends so as to affect an easy flow of air. Unless otherwise shown on the Drawings, the inside radius of all curves and bends shall be not less than width of ducts in plane of bend.
- F. All rectangular ductwork, unless otherwise noted, shall be built from galvanized sheet steel and thoroughly braced and stiffened.
 - 1. Provide 18" x 18" access doors for every 30'-0" run of supply and return air duct for cleaning purposes. For ducts whose height or width is less than 20", provide access doors which are 18" wide by a height calculated as 2" less than the height of the duct (thereby providing 1" of clearance between the bottom of the access door and the bottom of the duct, and similar for the top).
- G. All outside air intake air ducts and plenums between intake point and air handling unit or mixed air duct or plenum, for at least 10 feet of duct length, shall be aluminum construction with all joints sealed with Foster 32-19, Childers CP-146 or 3M EC-800 sealer.

- H. All air ducts exposed to the weather and not insulated shall be constructed of aluminum or stainless steel and shall be properly braced and supported and secured to the building construction. All seams shall be sealed with Foster 32-19, Childers CP-146 or 3M EC-800 sealer.
 - 1. The construction of ductwork shall be same as conventional ductwork except where transverse reinforcing angles not required, provide 1" x 1" x 1/8" black iron bracing angles matched angles at joint and 1" x 1" x 1/8" black iron between joints 4'-0" from joints.
 - 2. Provide 1/8" thick gasket (3M EC-1202 or equal) for all matched angles.
 - 3. Edge of ducts shall be bent 1/2" over matched angles to obtain watertight seal.
 - 4. Rivet angles to duct and seal with Foster 32-19, Childers CP-146 or 3M EC-800 sealer.
 - 5. Paint black iron angles after installation.

2.2 DUCT PENETRATION THRU FLOOR

- A. Provide 4" high and 4" wide concrete curb all around opening at duct penetration thru floors. Fill in space between duct and floor construction with mineral wool.

2.3 DRAIN PANS

- A. Drain pans for cooling coils shall be aluminum or stainless steel with welded seams and joints and shall be rigidly braced with stiffening angles.
- B. Each coil section composing the coil bank of a built up unit shall have an individual drain pan extending 9" on both sides of the coil with a minimum 2" vertical lip downstream of the coil. The top edge of the lip shall be turned backward. The pans shall be connected with piping tube to permit drainage to the bottom drain pan. Pans shall be pitched to the drain. As an alternate to aluminum, 14 gauge stainless steel, all welded, may be used.
- C. Provide insulation under drain pans for cooling coils, consisting of 2" thick rigid insulation.

2.4 DRIP PANS

- A. Provide aluminum drip pans and gutters under all equipment subject to leaks mounted above electrical equipment. Each drip pan shall be properly pitched and a drain outlet provided and piped to drain. See "Drip Pans" under Section 01 31 46 - Special Requirements for Mechanical and Electrical Work.

2.5 AUXILIARY AND SECONDARY DRAINS

- A. A secondary/auxiliary drain pan shall be provided below air handling and fan coil units providing cooling which are suspended above a hung ceiling or hung from the slab or building structure above with no hung ceiling.
- B. Requirement for secondary/auxiliary drain pans shall not apply to units hung in mechanical equipment rooms.
- C. The secondary/auxiliary drain pan shall comply with the following:
 - 1. Shall have a separate drain line from the primary drain pan in the unit
 - 2. The drain line shall be piped to the nearest floor drain or slop sink, if not, specifically routed and shown on the drawings
 - 3. Drain pan shall have a minimum depth of 1.5 inches and shall be not less than 3 inches larger than the unit or coil dimension width and length
 - 4. Pan shall be galvanized steel minimum thickness 0.0276 inches

2.6 MOISTURE ELIMINATORS

- A. Provide moisture eliminators immediately downstream of all humidifiers cooling coils/and where shown on the drawings.
- B. Construct the eliminators to provide three changes of direction for the air stream. Provide projections at each change of direction to prevent carry-over of water droplets that impinge on each blade and to facilitate draining into drain pan. Provide intermediate bracing of the same material and gage as the eliminator blade to prevent vibration and distortion of the blades.
- C. Make eliminators equal to the entire bank of cooling coils and equal outside air duct size in height and width and 6" long overall in the direction of air flow. Drain eliminators into the cooling coil drain pan. Make the pan of adequate length to accommodate the drippings.
- D. Construct all fasteners and supports of the same material as the eliminator blades.
- E. Construct eliminators of 32 ounce copper for cooling coils.

2.7 MISCELLANEOUS DUCTWORK

- A. All ductwork from all laboratory fume hoods shall be 18 gage type 304 stainless steel construction. All joints shall be sealed tight with Foster 32-19, Childers CP-146 or 3M EC-800 or approved equal sealer. Connections from fume hood ductwork to fans shall be thru acid resistant rubber, not less than 6" long, fume tight and securely fastened with copper metal bands.
- B. ¹*All shower exhaust ductwork up to a distance as indicated on the drawings but not less than 15'-0" from the registers shall be aluminum construction. All joints shall be sealed tight with Foster 32-19, Childers CP-146 or 3M EC-800 sealer or approved equal. Ductwork shall pitch toward the registers.
- C. *Where humidifier in the ductwork is called for that portion of ductwork shall be 18 gauge stainless steel 4'-0" upstream and downstream welded with flanged joints.
- D. **All ductwork on downstream side of terminal humidifiers including humidifier section shall be for the entire run to the diffusers, stainless steel, sealed type 304 watertight with Foster 32-19, Childers CP-146 or 3M EC-800 sealer or approved equal. Gauge of stainless steel duct shall be same as for steel duct. Terminal humidifiers are defined as humidifiers located in the branch ductwork of an air conditioning unit. Aluminum may be used as an alternate to stainless steel.
- E. *All ductwork from Hydrotherapy Suite up to a distance as indicated on the Drawings but not less than 15'-0" from registers shall be aluminum construction. All joints shall be sealed tight with Foster 32-19, Childers CP-146 or 3M EC-800 sealer or approved equal. Ductwork shall pitch toward the exhaust register.
- F. For any shower exhaust or hydrotherapy exhaust duct where registers are less than 15 feet from main duct, i.e., branch duct to register is less than 15 feet long, then a portion of the main duct shall also be aluminum or stainless steel, so as to ensure a total distance of 15 feet from register.

2.8 INSTALLATION OF HVAC DEVICES

- A. Installation of Duct Smoke Detectors: Duct smoke detectors shall be furnished by the Electrical Contractor and shall be installed in the ductwork under this Section. Provide an access door to each smoke detector.
- B. Installation of Dampers: Refer to Drawings and temperature control specification for smoke dampers and other automatic dampers and install them in ductwork.
- C. Installation of variable air volume system control devices: Install in sheet metal ductwork all control devices furnished by the manufacturer of the variable air volume system controls. Provide an access door at each location.

2.9 DUCT FABRICATION

- A. Ducts shall be neatly finished on the outside with all sharp edges removed.
- B. Inside surfaces shall be smooth with no projections into the air stream except where otherwise indicated.
- C. Longitudinal joints shall be Pittsburgh lock at corners or Acme lock on flat surfaces double seams hammered tight and shall be located above the horizontal axis of the duct. A snap lock seam shall not be permitted as a substitute for the Pittsburgh lock at corners of ducts.
- D. Transverse joints shall be made airtight with all laps in the directions of air flow.
- E. All fasteners and attachments shall be made of the same material as the ducts.
- F. Furnish test wells 12" on the center horizontally and vertically in the suction and discharge duct of each fan. Test wells shall consist of a 1" x $\frac{3}{4}$ ", 125 lb., bronze, screwed hex bushing, secured to the duct with a bronze hex locknut on the inside of the duct. A $\frac{3}{4}$ " x 2" long standard weight bronze, screwed nipple and cap shall be fitted to the housing on the outside of the duct. Test wells shall be No. 699 as made by Ventlok or approved equal.
- G. All turns in ductwork shall be accomplished using radius elbows rather than square elbows. Square elbows will only be permitted in instances where the Contractor, through depiction on their sheet metal shop drawings, proves that only a square elbow may be installed due to such limited space availability. All radius elbows shall have a minimum centerline radius of 12 times the width of the duct.
- H. All square elbows shall have factory-designed and built single thick turning vanes. Shop fabricated vanes will not be approved. Where turning vanes are in conflict with the access doors to fire dampers, they shall be made movable so that fire dampers shall be accessible.
- I. Dissimilar metals shall be connected with flanged joints made up with fiber or neoprene gaskets to prevent contact between dissimilar metals. Flanges shall be fastened with bolts protected by ferrules and washers made of the same materials as the gaskets. Where an aluminum duct is to be connected to a galvanized steel duct, the end of the galvanized steel duct shall be coated with heavy black asphaltum paint before connecting it to the aluminum duct.

- J. Changes in shape and dimension shall conform to the following: Except where otherwise noted, for increases in cross-sectional area, the shape of the transformation shall not exceed 1" in 7". Except where otherwise noted, for reductions in area, the slope shall not be less than 1" in 4" but 1" in 7" preferred.
- K. Wherever it may be necessary to make provisions for vertical hangers of the ceiling construction passing through ducts, provide streamlined shaped sleeves around such ceiling construction hangers as to fully protect the duct from being penetrated with holes for the passage of such hangers. Any such streamlined sleeves shall be made air tight at top and bottom of ducts. In no case shall there be more than two rods in any 9 sq. ft. area. No rods shall pierce ducts smaller than 12" in horizontal area.
- L. Ductwork shall be constructed in accordance with the latest version of the SMACNA Duct Construction Standards for both rectangular and round duct. The duct Pressure Class for each duct system shall be determined from the maximum possible (shut-off) static pressure achievable by the supply, return or exhaust fans, and in no instance shall the minimum pressure class be lower than 1" WC. The Sheet Metal Subcontractor shall obtain the associated fan curves from the Mechanical Contractor in order to confirm the maximum static (shutoff) pressure of the fan(s). This pressure class shall extend from the air handlers to the first automatic damper (including fire dampers, smoke dampers and combination fire/smoke dampers). For VAV systems, the pressure class of the ductwork between the first automatic damper and the VAV or CV boxes shall be equal to the external static pressure (ESP) rating of the fan.²
- M. Seal Class: All ductwork shall be sealed to SMACNA Seal Class A, with no exceptions.
- N. Ductwork Testing:
1. The intent is to test all ductwork and all ducted systems. All ductwork shall be tested in accordance with SMACNA Procedures, including SMACNA Duct Performance Test Standard m DPTS-1995 and the latest editions of the SMACNA HVAC Duct Construction Standards and the SMACNA HVAC Air Duct Leakage Test Manual.
 2. Additional requirements for all ductwork:
 - a. The testing of all joints for air leakage after erection and the repair of any leaks are positive requirements. Leakage must be kept to a specified minimum. The test for air leakage is divided into two phases; namely, testing of individual vertical risers and testing of all branches. Provide all required instruments.
 - b. All risers, branches and runouts shall be tested after installation before insulation is applied and before the air mixing units are installed. The total allowable leakage for the entire system shall be tested, measured and proven to be in accordance with Table 4-1, Applicable Leakage Classes, of the SMACNA HVAC Air Duct Leakage Test Manual; joints, seams and all wall penetrations shall meet Leakage Class 6 for rectangular ducts and Leakage Class 3 for round ducts.
 - c. Equipment necessary for performing this test shall include a rotary hand blower calibrated orifice section and a "U" tube gauge board complete with cocks and rubber tubing. The test hookup, as well as details for the fabrication of the orifice section shall be in accordance with the recommendation of the "High Velocity Duct Manual" of Sheetmetal and Air Conditioning Contractors National Association, Inc.

- O. The construction for low pressure rectangular sheet metal ducts shall be made in accordance with recommendations of ASHRAE Guide, Latest Edition, or as per SMACNA Manual but not less than the following weights and construction:

LOW PRESSURE - RECTANGULAR DUCTWORK				
Dimension Longest Side Inches	Sheet Metal Gauge All Four Sides			Transverse Reinforcing at Joints and Between Joints
	Steel Gauge	Aluminum Thickness In.	Copper Oz. Per Sq. Ft.	
Up thru 12	26	0.020	16	1" pocket lock 24 gauge, standing seam joint 24 gauge, 1" standing S slip 24 gauge. Joint max. on 8 ft. centers.
13 thru 18	24	0.025	24	Same as for up thru 12.
19 thru 30	24	0.025	24	1" pocket lock 22 gauge. Joints max, on 8 ft. centers with 1 x 1 x c in. angles 4 feet from joint.
31 thru 42	22	0.032	32	Same as for 19 thru 30.
43 thru 54	22	0.032	32	1" standing S slip 22 gauge with 1½" x 1½" x ⅛ in. angles, 1½" standing seam joint, 1½" pocket lock 22 gauge. Joints on 8 ft. centers with 1½" x 1½" x ⅛ in. angles max. 4 feet from joint.
55 thru 60	20	0.040	36	Same as for 43 thru 54.
61 thru 84	20	0.040	36	1" standing S slip gauge with 1½" x 1½" x ⅛ in. angles, 1½" standing seam joint, with 1½" x 1½" x ⅛ in. angles, 1½" in. pocket lock 22 gauge with 1½" x 1½" x ⅛ in. angles. Joints max. on 8 ft. centers with 1½" x 1½" x ⅛ in. angles max on 2 ft. centers.
85 thru 96	18	0.050	48	Same as for 61 thru 84 except all angles shall be 1½" x 1½" x 3/16 in.
over 96	18	0.050	48	Same as for 61 thru 84 except all angles shall be 2 x 2 x ¼ in.

1. Flat areas of duct over 18 in. wide shall be stiffened by cross breaking of beading.
2. All joints to have corner closures.
3. All joints (longitudinal and transverse) shall be sealed with Foster 32-19, Childers CP-146 or 3M EC-800 mastic or equal UL181A approved mastic, to provide sealing equivalent to SMACNA Seal Class A.

P. Ductwork for medium pressure systems shall conform to the following:

1. Medium pressure ductwork is defined as static pressure above 3" of water column and below 5" of water column.
2. Duct construction shall consist of gauges and reinforcing framing specified in latest ASHRAE Guide for medium pressure ductwork or as per SMACNA Manual, but not less than the following weights and construction.

Construction for Rectangular Medium Pressure Duct		
Dimension of Longest Side Inches	Galvanized Sheet Gauge (All 4 Sides)	Transverse Reinforcing Between Joints and at Joints
Up thru 12	24	Inside slip joint, double S slip, welded flange, standing seam, flanged joint, pocket lock, companion angle flanged joint with 1¼ x 1¼ x ⅛ angles. No tie rods required at joints. Joints max. on 8 ft. centers.
13 thru 18	24	<u>Between Joints:</u> 1 tie rod at 48 in. intervals on centerline of ductside or without tie rods with 1 x 1 x 16 gauge angle @ 48 in.
		<u>At Joints:</u> Inside slip joint, double S Slip and welded flange, each with 1 x 1 x 16-gauge angle. Standing seam, flanged joint, pocket lock, companion angle flanged joint with 1¼ x 1¼ x ⅛ angles. Joints max. on 8 ft. centers.
19 thru 24	22	<u>Between Joints:</u> 1 tie rod @ 48 in. intervals on centerline of duct side or without tie rods with 1 x 1 x ⅛ angle @ 48 in.
		<u>At Joints:</u> Inside slip joint, double S slip and welded flange, each with 1 x 1 x ⅛ angle. Standing seam, flanged joint, pocket lock, companion angle flanged joint with 1¼ x 1¼ x ⅛ angle. Joint max. on 8 ft. centers.
25 thru 36	22	<u>Between Joints:</u> Without tie rods with 1 x 1 x ⅛ angle @ 32 in. or 1¼ x 1¼ x ⅛ angle @ 40 in.
		<u>At Joints:</u> Inside slip joint, double S slip, welded flange, each with 1¼ x ⅛ angles. Standing seam, flanged joint, pocket lock, companion angle flanged joint with 1¼ x 1¼ x ⅛ angles. Joint max. on 8 ft. centers.
37 thru 48	22	<u>Between Joints:</u> Without tie rods with 1½ x 1½ x ⅛ angle @ 30 in.
		<u>At Joints:</u> Inside slip joint, double S slip, welded flange, each with 1½ x 1½ x ⅛ angles. Reinforced standing seam, with 1½ x 1½ x ⅛ angles, companion angle flanged joint with 1¼ x 1¼ x ⅛ angles. Joints max. on 8 ft. centers.
49 thru 60	20	<u>Between Joints:</u> 1½ x 1½ x ⅛ angle @ 24 in. with tie rod in center or without tie rods with 2 x 2 x ⅛ angle @ 24 in.
		<u>At Joints:</u> Inside slip joint, double S slip, welded flange, each with 2 x 2 x ⅛ angles or 1½ x 1½ x ⅛ angles with tie rod in center. Reinforced standing seam with 2 x 2 x ⅛ angle, companion angle flanged joint with 1½ x 1½ x ⅛ angles. Joints max. on 8 ft. centers.
61 thru 72	20	<u>Between Joints:</u> 1½ x 1½ x ⅛ angle @ 24 in. with tie rod in center or without tie rods with 2½ x 2½ x 3-16 angle @ 24 in.
		<u>At Joints:</u> Inside slip joint, double S slip, welded flange, each with 2½ x 2½ x 3/16 angles or 1½ x 1½ x ⅛ with tie rod in center. Reinforced standing seam with 2½ x 2½ x 3/16 angles. Companion angle 2 x 2 x 3/16. Joints max. on 8 ft. centers.

Construction for Rectangular Medium Pressure Duct		
Dimension of Longest Side Inches	Galvanized Sheet Gauge (All 4 Sides)	Transverse Reinforcing Between Joints and at Joints
73 thru 84	18	Same as for 61 thru 72.
85 thru 96	18	<u>Between Joints:</u> 1½ x 1½ x ⅛ angles @ 24 in. with tie rod in center.
		<u>At Joints:</u> Inside slip joint, double S slip, welded flange each with 1½ x 1½ x ⅛ angles with tie rod in center. Companion angle flanged joint with 2 x 2 x 3/16 angles or 1¼ x 1¼ x ⅛ angles with tie rod in center. Joints max. on 8 ft. centers.
97 and over	18	<u>Between Joints:</u> 2 x 2 x ⅛ angle @ 24 in with tie rods @ 48 in. along angle.
		<u>At Joints:</u> Inside slip joint, double S slip, welded flange, each with 2 x 2 x ⅛ with tie rods @ 48 in. along angle. Companion angle flanged joint with 1½ x 1½ x ⅛ angles with tie rods @ 48 in along angle. Joints max. on 4 ft. centers.

3. Transverse reinforcing must be applied on all four sides and tied together at each corner by riveting, bolting or welding, to prevent air leakage and shall be installed with ⅛" thick 3M gasket EC-1202. Gaskets shall have overlapped corners and cove entire frame. Connecting angles shall be bolted to each other with stove bolts, spaced not more than 6" apart. In addition, each such angel frame shall be itself welded at the corners for rigidity. The longitudinal spacing of the transverse reinforcing between joints may necessarily be less than the spacings recommended in the table in order to conform to the selected length module.
4. In addition to the above, all medium pressure ductwork at supply fans, for a minimum of 30 ft. - 0 in. from supply fan shall have bracing, on each of four sides, as follows:

Up to 60 inches	On 2 ft. - 0 in centers
Over 60 inches	On 2 ft. - 0 in. centers, plus a longitudinal angle on sides over 60 inches.
5. All bracing angles shall be 2" x 2" x ⅛" and shall be tack welded or spot welded to the ducts.
6. All joints (longitudinal and transverse) shall be sealed with Foster 32-19, Childers CP-146 or 3M EC-800 mastic to provide sealing equivalent to SMACNA Seal Class A.

2.10 DAMPERS

- A. At each main branch take-off and in such other locations where required to properly balance the system, provide volume dampers of the opposed blade, multi-louvered type, which shall be operated by indicating locable quadrants and set screws, for adjusting the system.
- B. Volume dampers shall be constructed as follows: Damper blades shall not be wider than 12", shall be complete with heavy angle iron frames, connecting and operating links, brass trunnions, and bronze bearings. Dampers, unless otherwise noted, shall be fabricated with not less than No. 16 gauge sheet steel. Blades shall overlap and shall be provided with continuous stops on all four

sides of dampers to prevent leakage. Blades shall be galvanized. Blades of dampers shall be set into a flat steel frame with frame securely bolted to the duct. All dampers shall be fitted with a hexagonal brass spindle which shall extend through the exterior of duct and be fitted with an indicating self-locking regulator. Regulator shall be similar to Ventlok 641 or approved equal. All hardware shall be Ventlok or approved equal. For insulated ductwork provide No. 644 self-locking regulator as made by Ventlok or approved equal.

- C. All automatic dampers shall be furnished as a part of the automatic temperature control system by the automatic temperature control manufacturer. Install dampers and provide safing in ductwork for automatic dampers smaller than duct size.
- D. For stainless steel and aluminum ductwork, provide dampers of same material as ductwork.
- E. All dampers shall be made accessible from building construction. Access doors in building structure shall be furnished or provided as herein before specified.

2.11 SMOKE DAMPERS

- A. Smoke dampers shall be classified and labeled in accordance with UL 555S, "Standard for Leakage Rated Dampers for Use in Smoke Control System." Smoke dampers shall be of UL 555 S leakage class I, 4 CFM/Ft² at 1" w.g.; 8 CFM/Ft² at 4" w.g.
- B. Smoke dampers installed at smoke barriers shall be installed no more than 2 ft. from the barrier and between any branch takeoff or duct inlet and outlets and the smoke barrier.
- C. Smoke dampers shall be automatically return to closed position in the event of loss of electricity. All wiring required to interconnect the dampers with fire detection, fire alarm and fire alarm supervisory control systems shall be provided under the Division 26 of the Specification. Pneumatic control system for damper actuators shall be provided under Section 23 09 00, as specified hereinafter. All combination fire/smoke dampers and smoke dampers shall be provided with 120 VAC actuators. Power wiring for all combination fire/smoke dampers and all smoke dampers shall be through the fire alarm system control relay and through a BAS relay and control module. The Electrical Contractor shall provide all such wiring; the ATC Sub-Contractor shall provide a BAS relay which must be installed for each combination fire/smoke damper and each smoke damper. If the air handling system is shut down, all associated combination fire/smoke dampers and all smoke dampers shall close. The fire alarm relay shall, if necessary, override the BAS relay. Each damper shall be individually powered and controlled.
- D. Smoke dampers shall be constructed as described above for dampers.
- E. Damper actuators shall be as specified in Section 23 09 00.
- F. For fire/smoke dampers, provide two (2) damper end switches that are blade actuated to signal the fire alarm system when dampers are in the open and closed position. For smoke and fire/smoke dampers which can isolate a fan from its distribution ductwork or as otherwise required by the Sequence of Operation, provide an additional end switch which shall be wired to the fan starter (VFD) control wiring to prevent the fan from operating unless the damper is open.
- G. Apply a bead of sealant between damper and sleeve and between dampers for multiple damper assemblies, as defined below for combination smoke and fire dampers.

2.12 FIRE DAMPERS

- A. Fire dampers and sleeve installation shall be in accordance with NFPA-90A recommendations and shall bear U.L. Label in compliance with U.L. 555.
- B. Clearly indicate fire damper location on shop drawings. Provide access doors in the ducts and supply access doors or panels at building construction at each damper of sufficient size and type to permit inspection and replacement of linkage. Assume responsibility to coordinate all locations of duct access doors with the other Contractors to conform with whatever architectural access openings may be necessary and supply access doors or panels in building construction. Provide shop drawings indicating location of access panels or doors for Architect's approval.
- C. It is the intention of these plans and specifications to be complete. However, it is the responsibility of the Contractor, as being completely cognizant of local regulations, to determine where fire dampers are required and to advise the Architect prior to construction as to any discrepancies or questions in the plans or specifications.
- D. Fire dampers shall be enclosed in sleeve of fourteen gage metal. Sleeve shall be secured at both sides of fire partitions with $1\frac{1}{2}$ x $1\frac{1}{2}$ x 14 ga. mounting angles secured to sleeves only: retaining angles must lap structural opening 1" minimum and cover corners of opening. Provide duct breakaway connections, see detail on drawings. Breakaway connections shall be located within 6 inches of the fire wall on both sides of the fire wall.
- E. Dampers shall be steel plate, mounted to turn freely, in steel plate frame inserted in duct. Dampers shall be proportioned and weighted to close at once, if released from link with spring catches to hold closed, until manually reset. Dampers and frames to have suitable standard fusible-links, normally holding them open, but releasing upon contact with fire. Damper blades shall be mounted on corrosion resisting bearings. Damper shall close by gravity, moving with the air stream to full closed position against one-eighth ($\frac{1}{8}$) inch angle stop. Steel spring catch shall hold damper closed. Radius arm on shaft shall show position of damper. Submit details for approval.
- F. Fire dampers shall be as made by Ruskin, Lau, Arlan Damper Corp. (631-589-7431) or approved equal, U.L. labeled.
- G. Damper shall be fully out of the air stream (type B) U.O.I.
- H. In stainless steel and aluminum ductwork, provide stainless steel construction fire dampers.

2.13 COMBINATION SMOKE AND FIRE DAMPERS

- A. In lieu installing separate fire and smoke dampers in fire walls with a rating of two hours or less, a combination fire/smoke damper can be installed. Fire walls with a rating exceeding two hours must use separate fire and smoke dampers.
- B. Combination fire/smoke dampers shall be model FSD36 as manufactured by Ruskin, Lau, Arlan Damper Corp. (631-589-7431) or approved equal.
- C. Combination fire/smoke dampers shall be installed in sleeves in accordance with NFPA-90A, UL555 and manufacturer's installation instructions. Dampers shall be UL rated, UL555S, leakage class II, 4 CFM/Ft² at 1-inch w.g.; 8 CFM/Ft² at 4" w.g., and UL555 1½ hour fire rated. Each damper shall bear a UL label attesting to these qualifications, in accordance with established UL labeling procedure.

- D. Damper manufacturer shall have tested and qualified with UL, a complete range of damper sizes covering all combination smoke and fire dampers required for this project.
- E. Damper actuators shall be pneumatic or electric as specified in Section 23 09 00. Damper actuators shall be installed by the damper manufacturer at the time of damper fabrication; damper and actuator shall be supplied as a single entity which meets all applicable UL555S qualifications for both dampers and operators. Damper and actuator shall be qualified under UL555S and UL555 to an elevated temperature of 250 deg. F.
- F. Each combination fire/smoke damper shall be equipped with a fusible link which shall melt at 165° F causing the damper to close and lock in the closed position.
- G. Dampers shall automatically return to closed position in the event of loss of electric power.
- H. Each combination fire/smoke damper shall have a factory installed sleeve of length and gauge required for satisfactory installation and with the damper actuator factory installed on the exterior of the sleeve and properly linked to the damper operating shaft. Contractor shall coordinate space requirements where dampers are located, providing required service clearance for actuators.
- I. All wiring required to interconnect the dampers with fire detection, fire alarm and fire alarm supervisory control systems shall be provided under the Division 26 of the Specification. Pneumatic control system for damper actuators shall be provided under Section 23 09 00, as specified hereinafter. All combination fire/smoke dampers and all smoke dampers shall be provided with 120 VAC actuators. Power wiring for all combination fire/smoke dampers and all smoke dampers shall be through the fire alarm system control relay and through a BAS relay and control module. The Electrical Contractor shall provide all such wiring; the ATC Sub-Contractor shall provide a BAS relay which must be installed for each combination fire/smoke damper and each smoke damper. If the air handling system is shut down, all associated combination fire/smoke dampers and all smoke dampers shall close. The fire alarm relay shall, if necessary, override the BAS relay. Each damper shall be individually powered and controlled.
- J. For fire/smoke dampers, provide two (2) damper end switches that are blade actuated to signal the fire alarm system when dampers are in the open and closed position. For smoke and fire/smoke dampers which can isolate a fan from its distribution ductwork or as otherwise required by the Sequence of Operation, provide an additional end switch which shall be wired to the fan starter (VFD) control wiring to prevent the fan from operating unless the damper is open.
- K. Clearly indicate fire damper location on shop drawings. Provide access doors in the duct and supply access doors for installation at building construction, at each damper, of sufficient type to permit inspection and replacement of damper actuators and linkage. Assume responsibility to coordinate all locations of access doors with other contractors. Provide shop drawings indicating locations of access doors, both duct and building construction, for Architect's approval.
- L. It is the intention of these plans and specifications to be complete. However, it is the responsibility of the Contractor, as being completely cognizant of local regulations, to determine where combination fire/smoke dampers are required and to advise the Architect prior to construction as to any discrepancies or questions in the plans or specifications.
- M. Combination fire/smoke dampers shall be enclosed in a sleeve of fourteen gauge metal set and grouted into the fire partition. The sleeve shall be secured on both sides of the fire partition with 1½ x 1½ x 14 gauge mounting angles secured to the sleeves only. Retaining angles must lap structural opening 1 inch minimum and cover corners of the opening.

- N. Multiple damper assemblies shall be installed and fastened together per manufacturers instructions. Unless the manufacturer's instructions indicate otherwise multiple damper assemblies shall be fastened together with ¼"-20 bolts, No. 10 screws or ½" long welds staggered intermittently on both sides. Fasteners shall be spaced 6" on center and a maximum of 2" from the ends of the joining sections or from the corner. A continuous ⅛" bead of Dow-Corning 100% silicon rubber, Dow-Corning Selastic 732 or GE RTV 108 sealant shall be applied on the mullion joint. Press the surface of the sealant in place to dispel any air.
- O. A bead of sealant, as described above, shall be applied between the damper and the sleeve.
- P. Fire/smoke dampers shall be provided with end switches (Ruskin SP100 or equal) for status indication.
- Q. In stainless steel and aluminum ductwork, provide stainless steel construction combination fire/smoke dampers.

2.14 ACCESS DOORS IN SHEET METAL WORK

- A. Wherever necessary in ductwork, casings or sheet metal partitions, provide suitable access doors and frames to permit inspections, operation and maintenance of all valves, coils, humidifiers, controls, smoke dampers, smoke detectors, fire dampers, filters, bearings, traps, or other apparatus concealed behind the sheet metal work. All such doors shall be of double construction of not less than No. 20 gauge sheet metal and shall have sponge rubber gaskets around their entire perimeter. Doors in insulated ducts of insulated casings shall have rigid insulation between the metal panels.
- B. All access doors in sheet metal ducts shall be hung on heavy flat hinges and shall be secured in the closed position by means of cast zinc clinching type latches. Where space conditions preclude hinges, use four heavy window type latches. Doors into ducts shall in general not be smaller than 24" x 24" except for access door to fire dampers which will depend on size of fire damper.
- C. In no case shall access to any items of equipment requiring inspection, adjustment, or servicing require the removal of nuts, bolts, screws, wing nuts, wedges, or any other screwed or loose device.
- D. Each sheet metal chamber or plenum shall have access doors for access to all parts of the system (outside air intake, exhaust and return air). Doors shall be fitted with cast zinc door latches, two per door. Latches shall be operable from both sides of casing. Hinges shall be extra heavy, zinc plated hinges, minimum of two per door. The doors shall be felted or provided with rubber gaskets so as to make them airtight. The doors shall be made with inner and outer shells 2 inches apart so that they may be properly insulated and properly operated. Doors shall be a minimum size of 20" x 48".
- E. Hinges shall be Ventlok No. 150 or 260 with or without screw holes or approved equal. Latch for walk-in access doors shall be No. 260 as made by Ventlok Co. or approved equal. Latch for access door in ductwork shall be Ventlok No. 100 or approved equal.
- F. Where reheat coils are installed in ductwork, provide two (2) access doors; one on the upstream side of the coil and one on the downstream side of the coil, both within 2'-0" of the coil.
- G. Access doors at humidifier locations shall be provided on both sides of duct.

- H. Provide access doors of adequate size to allow easy access to the equipment that will require maintenance. Provide insulated or acoustically lined doors to prevent condensation where applicable.
- I. Manufacturer to provide an installed neoprene gasket around perimeter of access door for airtight seal.
- J. Systems 3" w.g. or less shall utilize a hinged, cam, or hinged & cam square-framed access door.
- K. Systems 3" w.g. and above shall utilize a sandwich-type access door. Construct doors in accordance with Figure 7-3 of the 2005 SMACNA Manual, HVAC Duct Construction Standards, Metal & Flexible Third Edition.
 - 1. Approved Manufacturer: Ductmate Industries Sandwich style door or approved equal.

2.15 FLEXIBLE CONNECTIONS

- A. All fan and air supply unit connections, both at inlet and discharge shall be made with material as hereinafter specified, so as to prohibit the transfer of vibration from fans to ductwork connecting thereto.
- B. The flexible connections shall be a minimum of 6" long including bands using extra wide fabric as specified and held in place with heavy metal bands, securely attached, to prevent any leakage at the connection points.
- C. Flexible connections shall be fabricated from the following materials unless otherwise required by Local Authorities.
 - 1. Range Hood Exhaust - DDFDC-995 by Duro Dyne or equal (rated for 500EF).
 - 2. Low Pressure Systems - neoprene coated glass fabric - 30 ounce/sq. yd.
 - 3. Medium & High Pressure Systems - neoprene coated glass fabric - 30 ounce/sq. yd.
- D. Flexible connections shall not be painted.
- E. Flexible air connectors shall be listed and labeled to the requirements of UL 181 for class 0 or class 1 flexible air connectors and shall be so identified.

2.16 SOUND REDUCTION

- A. Furnish and install all soundproofing material specified, indicated or necessary to that all systems will comply with requirement of quiet operation. In general, noise level in any part of building (except in machinery rooms), due to air conditioning or ventilating equipment, ducts, and outlets, shall not exceed 40 decibels at 1200-2400 cycles per second, except as otherwise hereinafter specified.
- B. Furnish and install sound-absorptive lining in ductwork for locations and lengths as indicated and/or hereinafter specified. All soundproofing material, installation and arrangement, shall be as approved. Where ducts are acoustically lined and insulation is required per 15850 (23 07 00), external insulation may be omitted provided a minimum R value 6 is maintained for indoor ducts. Dimensions noted for lined ducts are inside clear dimensions. Duct sizes shall be increased for liner.
- C. Sound Absorbent Duct Lining for Low Pressure Ductwork - Furnish and install as herein specified and/or shown on the drawings (except where otherwise noted) 2" thick, meeting ASTM C1071

Type I flexible with a NRC of .70 tested per ASTM C423 using a type "A" mounting, fibrous glass duct lining meeting the requirements of NFPA 90A with a FHC of 25/50, limited combustible and ASTM C411 at 250 deg. F.

- D. Liner shall be adhered to all interior sides of duct with minimum 90% coverage of fire-retardant adhesive similar to Foster 85-60 or Childers CP-127 and with weld pins and washers or equivalent mechanical fastening starting 3" from edges and sides, 12" on center all sides. Minimum one row per side for duct size of 12" or less. Mechanical fasteners shall cause quilting of surface. Acrylic coated surface shall be toward air stream. Before installing liner, seal all butting edges and final edges with heavy coat of adhesive to seal off air between lining and duct unless the material has factory applied edge coating. All exposed edges of lining shall be installed with sheet metal nosing 12" wide, two gauges heavier than duct at fan discharge and at any section preceded by an unlined section. Installation shall be suitable for duct velocities up to 3,000 fpm. Low pressure duct lining shall be provided where specified and/or where shown and noted on the drawings.
- E. Duct sizes indicated on drawings are clear inside dimensions. Increase sheet metal sizes as required to install acoustic lining.
- F. Do not install lining within 5'-0" (downstream and upstream) of humidifier in ductwork. This portion of ductwork shall be externally insulated.
- G. The following ductwork shall be acoustically lined whether or not shown on Drawings.
 - 1. All conditioned air rectangular supply/return ductwork within mechanical equipment rooms, and not less than 20 ft. from fan towards occupied space for supply, exhaust and return fans.
 - 2. Return air fan and toilet exhaust plenum walls and ceiling, except that the lining shall be 2 inch thick 4 lb. density, and inner liner of perforated galvanized sheet metal (7/64" dia. holes on 3/16" staggered centers) shall be used.
- H. Sound Absorbent Duct Lining for Medium and High Pressure Ductwork.
 - 1. Furnish and install 1" thick meeting ASTM C1071 Type II (board) with a NRC of .80 tested according to ASTM 423 using a Type "A" mounting, acoustical lining and meeting requirements of NFPA 90A with a FHC of 25/50, limited combustible and ASTM C411 at 250 deg. F, as herein specified and/or as shown on the drawings.
 - 2. Liner shall be adhered to all interior sides of duct and plenums with minimum 90% coverage of fire-retardant adhesive similar to Foster 85-60 or Childers CP-127 and with weld pins and washers or equivalent mechanical fastening on not more than 16" centers on all sides, top and bottom of duct. Acrylic coating surface shall be toward air stream. Before installing liner, caulk all butting edges and final edges with heavy coat of adhesive to seal off air between lining and duct unless material has factory applied edge coating. Coat cap of fasteners with brush coat of fire retardant Foster Eclipse 40-11 insulation coating. Use metal corners and nosing to protect leading edges of liner insulation at fan discharge or after and any section preceded by an unlined section and at any section with an air velocity in excess of 4000 fpm. Apply light brush coat (150 sq. ft. per gallon) of fire retardant Foster Eclipse 40-11 insulation coating over all interior insulation surfaces. Installation shall be suitable for duct velocities up to 5,000 fpm.
 - 3. The Contractor has the option to use elastomeric closed-cell insulation for lining medium and high pressure ducts. Refer to the low pressure duct lining section covering elastomeric closed-cell lining for requirements.
 - 4. When indicated in the drawings, the sound absorption material in mechanical and high pressure ducts shall be faced with a galvanized perforated metal facing having the same

dimensions as the unlined ductwork connecting to the lined section of the ductwork. The perforated metal shall be 26 gauge and have one of the following perforation patterns or approved equal.

	<u>Open Area</u>
7/64" round holes on 3/16" staggered centers	29%
1/8" round holes on 7/32" staggered centers	29%
1/8" round holes on 1/4" staggered centers	23%
.085" round holes on 5/32" staggered centers	29%
1/16" round holes on 1/8" staggered centers	22.5%

5. Duct sizes indicated on drawings are clear inside dimensions. Increase sheet metal sizes as required to install acoustic lining.

2.17 ACOUSTICAL PERFORMANCE SPECIFICATIONS - GENERAL

- A. It is the intent of this Specification that noise levels due to air conditioning and/or ventilating equipment, ducts, grilles and registers, diffusers and air light fixtures, will permit attaining sound pressure levels in occupied spaces conforming to the following NC curves as explained in the ASHRAE Guide and Data Book.

Room Type	NC Level
Offices and Conference Rooms	NC 25-35
Corridors and Public Spaces	NC 35-45
Auditoria/Large Lecture	NC 25-35

2.18 ACOUSTICAL PERFORMANCE WITHIN EQUIPMENT SPACES

- A. Equipment room noise levels and noise transmission to adjacent buildings shall comply with all Federal, State, and City Noise Ordinances.
- B. Motor Acoustical Performance:
 1. Motor drives for pumps and refrigeration machine when installed per plans and specifications shall operate with noise levels not to exceed 80 dbA.
 2. Noise levels shall be determined in accordance with IEEE Standard #85 test "procedure for Air-Borne Noise Measurements on Rotating Electric Equipment".

PART 3 - EXECUTION

3.1 INSPECTION

- A. Contractor shall examine location where ductwork is to be installed and determine space conditions and notify Architect in writing of conditions detrimental to proper and timely completion of the work.
- B. Do not proceed with the work until unsatisfactory conditions have been corrected.

3.2 INSTALLATION OF DUCTWORK

- A. Install ductwork in accordance with recognized industry practices, to ensure that ductwork complies with requirements and serve intended purposes.
- B. Coordinate with other work as necessary to interface installation or ductwork with other components of systems.
- C. Duct sizes shown on the drawings at connection to fans or other equipment may vary in actual installation. Contractor shall provide transition pieces as required.
- D. Ducts, casings and hangers shall be installed straight and level and shall be free of vibration and noise when fans are operating.
- E. Ducts at ceilings shall be suspended from inserts in concrete slabs except where otherwise indicated. Inserts shall be Grinnell Fig. 279, 282, or 152 as required. Ducts at floor shall be supported by steel angles suitably anchored to floor construction. Each duct shall be independently supported and shall not be hung from or supported by another duct, pipe, conduit or equipment of any trade.
- F. Supports shall be placed at each joint and change in direction up to a maximum spacing of 8 feet on centers. Prevent buckling of ductwork.
- G. All fastenings to building structure shall be adequate to insure permanent stability of sheet metal work and shall be capable of resisting all applied forces.
- H. Vertical ducts in shafts or passing through floors shall be supported by steel angles or channels, welded, riveted, screwed or bolted to ducts and fastened to building structural members at each floor level. Provide safing to close all floor openings around ductwork - pack annular space with rockwool and 18 gauge sheet metal safing. Floor openings in plenums shall have ½ inch diameter steel bars.
- I. Rigid connections between ductwork and non-rotating equipment shall be made with flanged joints, sealed with fireproof material (Fiber or Neoprene gaskets).
- J. It is the intent to obtain low pressure ductwork construction with minimum leakage. The construction noted in Specifications can produce low or high leakage rates, depending upon the workmanship, particularly with regard to the connection at the top of the ducts. Guarantee that total diffuser volume, measured by means of velometer, shall be at least 95% of actual fan supply (measured by means of a duct traverse taken with a Pitot tube and water manometer). Seal the ductwork at all joints (longitudinal & transverse and duct wall penetrations) with suitable sealers Foster 32-19, Childers CP-146 or 3M EC-800 and tape equivalent to SMACNA Seal Class A. Use of "HARDCAST" or any other material is subject to Architect's approval.
- K. For leakage test for medium and high pressure ductwork refer to Section "Testing and Balancing".

3.3 DUCT HANGERS

- A. Low pressure ducts up to 24" on a side or up to 20" diameter shall be suspended with 16 gauge, galvanized strap hangers, 1" wide.

- B. Low pressure ducts 25" to 40" on a side or 21" to 42" diameter shall be suspended with galvanized strap hangers 1" wide by 1/8" thick.
- C. Strap hangers shall be bent 90°, extended down sides of ducts and turned under bottom of ducts a minimum of 2". Strap hangers shall be fastened at ceiling with nuts, bolts and lock washers and to sides and bottom of ducts with sheet metal screws.
- D. All ductwork 43" and larger on a side or diameter and all roof-mounted ducts (regardless of size) shall be suspended with steel angle type hangers with rod and angle steel trapeze. The use of strut for support of any HVAC work (ducts, piping or equipment) is prohibited.
- E. No screws shall penetrate medium and high pressure ductwork.
- F. For any ducts which require seismic bracing, provide trapeze and rod type hangers regardless of duct size.
- G. Trapeze type hangers shall have steel rods threaded at both ends and bottom bracing angles on ducts, with nuts and lock washers. Threaded rod diameter shall be as scheduled on the drawings based on the size of the duct supported.
- H. Angle type hangers shall be extensions of side bracing angles on ducts, bent 90 at ceiling and fastened with nuts, bolts and lock washers.
- I. The minimum spacing intervals for all duct supports shall be as scheduled on the drawings based on the size of the duct supported.
- J. Hangers for vertical ducts shall be as per SMACNA Duct Manual.
- K. Stainless steel ductwork shall be supported with rod or angle type hangers, so that there will be no penetration of the stainless steel ducts.
- L. Any steel and hardware used for support of aluminum ductwork or any supports for ductwork located outdoors shall be constructed of hot-dipped galvanized or stainless steel. Carbon steel, painted steel or zinc-coated steel is unacceptable.

3.4 CLEANING AND PROTECTION

- A. Clean ductwork internally, unit by unit as it is installed of dust and debris. Clean external surfaces of foreign substances, which might cause corrosion, deterioration of metal or interfere with painting.
- B. At end of ducts which are not connected to equipment or air distribution devices at the time of ductwork installation, provide temporary closure of polyethylene film or other covering.
- C. Cleaning of new and existing supply ductwork: After completion of ductwork installation clean ductwork as follows.
 - 1. Cover all supply registers and diffusers with temporary filter mesh.
 - 2. Use supply fan or install temporary fan to provide air to the system for four (4) hours.
 - 3. Remove temporary filter mesh.

END OF SECTION 23 31 13

SECTION 23 34 00

FANS AND GRAVITY VENTILATORS

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

- A. This Section is coordinate with and complementary to the General Conditions and Supplementary General Conditions of the Work, wherever applicable to Mechanical Work.
- B. Section 01 31 46 - Special Requirements for Mechanical and Electrical Work shall apply.

1.2 DESCRIPTION OF WORK

- A. The work includes the providing of all labor, materials, equipment, accessories, services and tests necessary to complete and made ready for operation by the Owner, all fans and ventilators as shown on the drawings and hereinafter specified.

1.3 QUALITY ASSURANCE

- A. Firms regularly engaged in manufacture of this material with characteristics and capacities required, whose products have been in satisfactory use in similar service for not less than 10 years.
- B. Provide product produced by the manufacturers, which are listed in Section 23 05 12, "Approved Manufacturer's List".
- C. Provide equipment whose performance, under specified conditions, is certified by the manufacturer.

1.4 SUBMITTALS

- A. Refer to Section 01 31 46 - Special Requirements for Mechanical and Electrical Work and submit shop drawings.

1.5 COORDINATION

- A. Refer to Section 01 31 46 - Special Requirements for Mechanical and Electrical Work.

1.6 GUARANTEE

- A. Refer to Section 01 31 46 - Special Requirements for Mechanical and Electrical Work.

PART 2 - PRODUCTS

2.1 CENTRIFUGAL FANS (CLASS I)

- A. Furnish and install as shown on the plans non-power overloading centrifugal fans with airfoil blades in sizes 24 and larger and plate-type blades in sizes 22 and smaller. Fans shall be of the

specified size, arrangement, class and capacity. Fans having outlet velocities greater than those shown will not be acceptable.

- B. Housings of fans, Class I, having wheel diameters 36" and smaller shall be convertible for various directions of discharge. Side sheets shall be fastened to scroll sheets by means of a deep lockseam. Housing supports shall be of one-piece welded constructed. Housing for Class I fans, having wheel diameters over 36", shall have side sheets welded to scroll sheets. Housings shall be split into two or more sections with heavy flanges on each section for bolting together. Flanges joints shall be gasketed for air-tightness. Sealer shall be applied to joints between housing, inlet and housing support to prevent air leakage. The cutoff shall be of the rolled slope type and shall be wider and closer to the shaft at the suction side, then the drive side, for single width fans. Inlet collars on all sizes of single width fans shall extend beyond the fan housing to provide a continuous duct connection. Inlet collars on convertible housings shall be round and on nonconvertible housings shall be square. Both inlet and discharge duct collars shall be drilled or punched at uniform intervals. Inlet cones shall be spun or die-formed to provide smooth air flow into the wheel with minimum shock and turbulence.
- C. Fan wheels shall be constructed of twelve deep airfoil blades, plate type blades in sizes 22 and smaller, backward inclined from the direction of rotation. Blades shall be securely welded to the spun rim and hub plate. Hubs shall be of close grained cast iron, securely riveted to the hub plate. All wheels shall be carefully trued after assembly and shall be dynamically balanced.
- D. Fan shafts shall be of SAE 1040 hot rolled steel, accurately turned, ground and polished. Close tolerances shall be maintained where shaft makes contact with bearings and fan wheel hub.
- E. Fans shall be equipped with precision anti-friction extra heavy duty bearings of the self-aligning, grease-packed, pillow block type having a grease seal that will prevent loss of lubricant and exclude dirt from the bearings. Lubrication fittings shall be provided on exterior of cabinet or housing. Average bearing life shall be min. 200,000 hrs.
- F. All fans shall be given a bonding coat before painting. After the cleaning and surface conditioning process, but before assembly, parts shall be spray painted with one coat of gray primer-finisher. A second coat of the same paint shall be applied to the exterior and all accessible interior surfaces after the fan is assembled. Shafts shall have a rust-preventive coating.
- G. Fan ratings shall be based upon tests performed in strict accordance with the test code adopted jointly by the Air Moving and Conditioning Association and the American Society of Heating, Refrigeration and Air Conditioning Engineers. Each fan shall carry, near the manufacturer's nameplate, the seal authorized by AMCA indicating that ratings are certified. Fans not bearing this seal will not be acceptable.
- H. Fans shall be as scheduled on the Drawings.
- I. Provide 2" wire mesh inlet screens with each fan.

2.2 HIGH PRESSURE TYPE CENTRIFUGAL FANS (CLASS III)

- A. Furnish and install as shown on the Drawings non-power overloading centrifugal fans and airfoil blades. Fans shall be of the specified size, arrangement, class and capacity as scheduled on the drawings. Fans having outlet velocities greater than those shown shall not be acceptable.

- B. Side sheets shall be fastened to scroll sheets by means of a deep lockseam. Housing supports shall be of one-piece welded construction. Housings for fans shall have side sheets welded to scroll sheets. Fans shall be split horizontally with flanges on both sections for assembly. Flanged joints shall be gasketed. Sealer shall be applied to joints between housing, inlet and housing support to prevent air leakage.
- C. The cutoff shall be of the rolled slop type and shall be wider and closer to the shaft at the suction side, then the drive side, for single width fans. On double width fans, the cutoff shall be a "V" section.
- D. Fans wheels shall be constructed of airfoil blades backward inclined from the direction of rotation. Blades shall be securely welded to the spun rim and hub plate. Hubs shall be of cast steel riveter to the hub plate. All wheels shall be dynamically balanced.
- E. Fan shaft shall be SAE 1040 hot rolled steel.
- F. Fans shall be equipped with precision anti-friction extra heavy duty bearings of the self-aligning, grease-packed, pillow block type having a grease seal that will prevent loss of lubricant and exclude dirt from the bearings. Bearings shall have a min. lift of 200,000 hrs.
- G. All fan parts shall be given a bonding coat before painting. Parts shall be sprayed painted with one coat of grey primer-finisher. A second coat of the same paint shall be applied to the exterior and all accessible interior surfaces after the fan is assembled. Shafts shall have a rust-preventive coating.
- H. Fan ratings shall be based upon tests performed in strict accordance with the test coat adopted jointly by the Air Moving and Conditioning Association and the American Society of Heating, Refrigeration and Air Conditioning Engineers. Each fan shall carry, near the manufacturer's nameplate, the seal authorized by AMCA indicating that ratings are certified. Fans not bearing this seal will not be acceptable.
- I. Furnish and install 2" wire mesh inlet screens with each fan. Where inlet bearings are used, screens shall be mounted inside inlet van bearings.

2.3 UTILITY FANS

- A. Furnish and install utility type centrifugal fans of the sizes and types called for in the equipment schedule and as shown on the plans. All fans shall be rated and tested in accordance with the AMCA test code and shall bear the certified rating label of AMCA.
- B. Fan and motor housings (weatherproof hood) shall be constructed of heavy gauge steel of lockseam construction with Bonderite finish and shall be constructed to permit rotation on the job to any discharge position, in 45 deg. increments. Fan wheels are to be of the type as scheduled on the drawings, except as noted below, with blades riveted to the back plate and inlet shroud. Wheels shall be locked in position on cold rolled steel shaft with a tapered key. Fan bearings shall be of the heavy duty cast iron pillow block grease lubricated type, supported independent of the fan housings. Wheels shall be dynamically balanced at the factory.
- C. Where belt driven fans are indicated in the equipment schedule "V" belt drive shall be of the high capacity type. Fan sheave shall be located outboard of the two bearings supported fan shaft to permit replacement of drives without removing bearings or disturbing position of wheel and shaft.

Motor base shall be fully adjustable in all directions to provide for proper drive alignment and to allow for adjustment of belt tension.

- D. All indoor fans shall have electrically operated discharge dampers and damper motors furnished by Automatic Temperature Control manufacturers.
- E. All roof-mounted fans shall have electrically operated discharge dampers and damper the motors furnished by fan manufacturer.
- F. All roof-mounted fans shall be completely weatherproof. Provide outdoor covers on motor and drive. Unit to be hot-dip galvanized and painted with an extra coat of zinc chromate iron oxide paint.
- G. All fans shall be driven by two (2) belts. All sheaves shall be of the double pulley type.

2.4 ROOF FANS

- A. Furnish and install the roof fans where indicated on the Drawings.
- B. The fans shall have spun aluminum housings, or sectionalized aluminum housing, non-overloading sparkproof blades, air cooled motor out of the air stream, sheaves and V-belt drives, electrically operated aluminum draft dampers, and motor disconnect switch, and aluminum bird screen. Damper motors shall have inherent overload protection.
- C. For 460 volt fan motors, provide a 460/120 volt transformer with primary protection under the hood to wire damper motor. For 208 volt fan motors, provide a 208/120 volt transformer with primary protection under the hood to wire damper motor.
- D. The fans shall have the capacities indicated on the drawings.
- E. Each roof fan shall be furnished with a prefabricated roof curb as hereinafter specified.
- F. Fiber-Aire as manufactured by Swartwout, Inc. shall be approved equal.

2.5 IN-LINE FANS

- A. Furnish and install In-line Centrifugal Fans (direct or belt drive) of size and capacities as indicated on Drawings.
- B. The fans shall be the square shaped and of heavy gauge formed steel. One of the sides shall be hinged and shall support the entire drive assembly (motor only for direct drive fans) and wheel allowing the assembly to swing out for cleaning, inspection or service without dismantling the unit in any way.
- C. For direct drive fans, the motor shall be isolated from the air stream by a motor enclosure and shall draw cooling air from outside the fan housing.

- D. For belt drive fans, the motor shall be mounted on the hinged side exterior isolated from air stream. The belt and pillow block ball bearings shall be protected from air stream by an enclosure. The shaft shall be keyed to both the wheel and pulley. Provide double groove sheaves and two (2) belts per fan.
- E. The fan inlet shall be spun Venturi throat overlapped by a backward curved centrifugal wheel with spun cone for maximum performance.
- F. Air and sound shall be A.M.C.A. certified.

PART 3 - EXECUTION

3.1 INSPECTION

- A. Contractor shall examine location where this equipment is to be installed and determine space conditions and notify Architect in writing of conditions detrimental to proper and timely completion of the work.
- B. Do not proceed with the work until unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install equipment where shown, in accordance with manufacturer's written instructions, and with recognized industry practices, to ensure that equipment comply with requirements and serve intended purposes.
- B. Coordinate with other work as necessary to interface installation of equipment with other components of systems.
- C. Check alignment and, where necessary (and possible), realign shafts or motors and equipment within tolerances recommended by manufacturer.

3.3 FIELD QUALITY CONTROL

- A. Upon completion of installation of equipment, test equipment to demonstrate compliance with requirement. When possible, field correct malfunctioning units, then retest to demonstrate compliance. Replace units which cannot be satisfactorily corrected. Refer to Section 23 05 93 - Testing and Balancing.

END OF SECTION 23 34 00

SECTION 23 40 00

AIR FILTERS

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

- A. This Section is coordinate with and complementary to the General Conditions and Supplementary General Conditions of the Work, wherever applicable to Mechanical Work.
- B. Section 01 31 46 - Special Requirements for Mechanical and Electrical Work shall apply.

1.2 DESCRIPTION OF WORK

- A. The work includes the providing of all labor, materials, equipment, accessories, services and tests necessary to complete and made ready for operation by the Owner, all air filters as shown on the drawings and hereinafter specified.

1.3 QUALITY ASSURANCE

- A. Manufacturing firms regularly engaged in manufacture of this material with characteristics and capacities required, whose products have been in satisfactory use in similar service for not less than 10 years.
- B. Provide product produced by the manufacturers, which are listed in Section 23 05 12 "Approved Manufacturer's List".
- C. Provide equipment whose performance, under specified conditions, is certified by the manufacturer.
- D. Equipment shall be shipped in its original package to prevent damage or entrance of foreign matter. All handling and shipping shall be performed in accordance with manufacturer's recommendations. Provide protective coverings during construction.
- E. Standards:
 - 1. ASHRAE Standard 52.1
 - 2. Underwriters Laboratories: U.L. 900, U.L. 586
 - 3. NFPA Standard 90A
- F. Design Criteria
 - 1. Air flow not to exceed rated capacity
 - 2. Initial and final resistance not to exceed scheduled values

1.4 SUBMITTALS

- A. Refer to section 01 31 46 Special Requirements for Mechanical and Electrical Work and submit shop drawings.

1.5 COORDINATION

- A. Refer to section 01 31 46 Special Requirements for Mechanical and Electrical Work.

1.6 GUARANTEE

- A. Refer to section 01 31 46 Special Requirements for Mechanical and Electrical Work.

PART 2 - PRODUCTS

2.1 GENERAL

- A. Furnish and install the air filters shown on the Drawings. The filters shall be component sections of air handling units or shall be installed in ductwork as indicated on the drawings.
- B. The filter arrangements shall be as indicated in the schedule on the Drawings.
- C. Furnish and install filters as shown on drawings. Filters for factory fabricated AHU's shall meet all specification requirements.
- D. Filters shall be as manufactured by American Air Filter, Flanders Precisionaire, National Air Filter, or approved equal as approved by Architect.
- E. Filters shall be as indicated in the schedules on the drawings.
- F. Fans and systems shall not be operated until protective filters meeting a minimum of MERV 8 have been installed. All systems are to have a minimum of MERV 8 filters installed during all operating phases of construction.
- G. At the time of acceptance by the owner, the contractor shall install new filtering media for all air handling systems.
- H. Before balancing and prior to acceptance by the owner, each MERV 8 filter shall be replaced with new media to consist of prefilters and final filters as scheduled and specified.

2.2 ACCEPTABLE MANUFACTURERS

- A. Filters:
 - 1. American Air Filter
 - 2. Flanders Precisionaire
 - 3. Camfil
 - 4. As equal as approved by the Architect.
- B. Accessories
 - 1. Framing Modules - Holding Frames by filter manufacturer.
 - 2. Side Access Housings by filter manufacturer.
 - 3. Air Filter Gages - Dwyer Instruments, Inc.

2.3 FILTER CARTRIDGES

- A. Pleated Media Filters (MERV 8 rating (2")) . Filter media shall be high efficiency synthetic media.

1. Efficiency shall not be based on electrocharged technology.
2. Media support shall be continuously laminated to an expanded metal grid on the air leaving side.
3. Pleat design shall be a radial wedge.
4. Media frame shall be constructed from two pieces of die cut high wet strength carrier board. The frame shall be designed with diagonal and horizontal support members bonded to the media on the air entering and leaving sides.
5. Filters shall be U.L. 900 Class 2 listed.
6. Basis of design: American Air Filter PerfectPleat SC M8

B. Medium and High Efficiency Rigid Filters. Separator Type U.L. 900 Class 1. Efficiency levels of MERV 15 12" Filter Construction

- a. Filters shall be the totally rigid type with a wet laid microfibre fiberglass filter. The media shall be folded into close spaced pleats supported by hemmed edge corrugated aluminum separators.
2. Enclosing Frame
 - a. The enclosing frame shall be manufactured of 24 gauge galvanized steel and furnished with horizontal and diagonal support members to stabilize and protect the media pack.
3. Basis of design: American Air Filter VariCel RF

2.4 SIDE ACCESS HOUSINGS, FACTORY ASSEMBLED

A. Housings for 2 in. and 12", Filters (Minimum Inline Depth)

1. Housing shall be factory manufactured of 16 gauge galvanized steel and reinforced with "Z" channel bracing to eliminate twisting or racking.
2. 16 gauge access doors shall be gasketed along the periphery to maintain a proper seal.
3. Filter track shall be extruded aluminum and furnished with a polypropylene fin seal gasket.
4. Access doors shall be provided with continuous gasketing on the perimeter and positive locking latches with easy grip knobs. Both prefilter and final filter tracks shall be extruded aluminum with polypropylene fin seal gasket to create a positive seal of the filter to the track.
5. Factory installed gasketing shall be provided on the vertical sides of cartridges to prevent leakage between cartridges and between cartridges and doors. Filter cartridges shall be capable of removal and loading through either access door.
6. The leakage rate of the housing shall be less than 0.5% of air-flow at 6.0 in. w.g. internal static pressure.
7. Basis of design: American Air Filter Housing.

2.5 AIR FILTER GAGES

- A. Dial type, diaphragm-actuated with external zero adjustment and nominal 4 in. diameter dial.
- B. Provide with two (2) static pressure taps, 2-way valves, tubing and mounting plate (and adjustable signal flag if specified as an option).
- C. Range shall be as recommended by filter manufacturer.
- D. Basis of design: Dwyer 2000 Series Magnehelic.

PART 3 - EXECUTION

3.1 INSPECTION

- A. Contractor shall examine location where this equipment is to be installed and determine space conditions and notify architect in writing of conditions detrimental to proper and timely completion of the work.
- B. Do not proceed with the work until unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install filters and housings where shown, in accordance with manufacturer's written instructions, and with recognized industry practices, to ensure that equipment comply with requirements and serve intended purposes.
- B. Coordinate with other work as necessary to interface installation of equipment with other components of systems.
- C. Filter Bank Construction
 - 1. Filter banks of individual holding frames shall be installed leak tight and structurally sound to eliminate air bypass.
 - 2. Filter banks four filters high or higher shall be provided with proper steel stiffeners between each vertical row of filters. Caulk frames before installing. After installation caulk any gaps appearing at the leading edge of the holding frames.
 - 3. Framing modules require sealant and blanking off between modules and around the periphery.
- D. Filter gages shall be installed across each filter bank, mounted where directed. One gage may serve immediately adjacent pre-filter/final filter banks.
- E. Temporary Prefilters for Construction
 - 1. Protect all 40% or higher efficient filters upstream of air handling units during construction with temporary Panel filters meeting a minimum efficiency of MERV 8. Filters to be polyester media 2 in. disposable panel filters, U.L. 900 Class 2 listed. Flanders type 325.
 - 2. Remove after air balancing and prior to acceptance.
 - 3. Provide a spare set of these temporary pre-filters or media and install them during construction if required in accordance with Section 3.03B.

3.3 SPARE FILTERS

- A. Furnish one new complete spare set of cartridges for each filter bank listed below on completion and acceptance of the work:
 - 1. Medium and high efficiency bag filters.
 - 2. Medium and high efficiency rigid filters.
- B. Install spare set in A. above only if and when directed. If not installed, deliver to owner in sealed cartons.
- C. Replace all panel filters which are not temporary pre-filters with a new set at job completion and furnish owner with an additional set in sealed cartons.

- D. Furnish owner with one set of spare trays loaded with carbon, if carbon housings or adsorbers are specified on this project.

3.4 FIELD QUALITY CONTROL

- A. Filter cartridges shall be capable of being loaded and unloaded easily through access doors in the housings or access sections.

3.5 START-UP PROCEDURE

- A. No fan shall be operated unless temporary particulate filters as specified are installed.
- B. When the pressure drop of the temporary media reaches 1.0 in. w.g. during construction, replace it with the spare set. If not used, deliver the spare set to the owner at job completion.

3.6 SCHEDULE

- A. See air filter schedule on drawings for filter model numbers, CFM and sizing data.

END OF SECTION 23 40 00

SECTION 23 65 00

COOLING TOWERS

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

- A. This Section is coordinated with and complementary to the General Conditions and Supplementary General Conditions of the Work, wherever applicable to Mechanical Work.
- B. Section 01 31 46 - Special Requirements for Mechanical and Electrical Work shall apply.

1.2 DESCRIPTION OF WORK

- A. The Work includes providing all labor, materials, equipment, accessories, services and tests necessary to complete and make ready for operation by the Owner, all cooling towers as shown on the Drawings and hereinafter specified.

1.3 QUALITY ASSURANCE

- A. Manufacturing firms regularly engaged in manufacture of this equipment with characteristics and capacities required, whose products have been in satisfactory use in similar service for not less than ten (10) years.
- B. Provide products produced by the manufacturers which are listed in Section 23 05 12 "Approved Manufacturers List".
- C. Provide equipment whose performance under specified conditions is certified by the manufacturer.

1.4 SUBMITTALS

- A. Refer to Section 01 31 46 - Special Requirements for Mechanical and Electrical Work and submit shop drawings.

1.5 COORDINATION

- A. Refer to Section 01 31 46 - Special Requirements for Mechanical and Electrical Work.

1.6 GUARANTEE

- A. Refer to Section 01 31 46 - Special Requirements for Mechanical and Electrical Work.

PART 2 - PRODUCTS

2.1 DESCRIPTION

- A. Furnish and install an induced draft, vertical discharge, packaged, cross-flow type, closed circuit fluid cooler, non-combustible cooling tower. Total horsepower requirements shall not exceed 3 HP. Tower furnished shall be similar and equal to Marley Model MHF7101HAADN.
- B. The tower shall be guaranteed to cool 100 gpm of 40% PG, from 105 degrees F to 95 degrees F, at 78 degrees F. wet bulb temperature. Coil pressure drop on fluid side shall not exceed 2.97. The thermal performance rating shall be certified by the Cooling Technology Institute.
- C. The closed circuit cooling fluid cooler shall be capable of a minimum of True efficiency per ASHRAE Standard 90.1.
- D. The closed circuit fluid cooler shall be designed for quiet operation and shall produce an overall level of sound not higher than 64 dB(A) measured at a distance of 50 ft from Air Inlet Face. Sound levels shall be measured with a Type 1 (precision) system and in full conformance with ATC-128 test code published by the Cooling Technology Institute (CTI). The measurement system shall have a real-time frequency analyzer and separate microphones with an overall tolerance +/- 3 dB. All low sound options shall be CTI Certified for thermal performance.
- E. Casing and Louvers: Casing shall be hot dip galvanized steel with lapped joints; louvers shall be integral with fill. Louvers are to be sight-tight to horizontal view.
- F. Framework: All framework shall be 3" thick hot dip galvanized steel.
- G. Distribution Basin: Open gravity type distribution basins shall be 304 Stainless steel. All components of this basin, with the exception of the nozzles, shall be stainless steel. Tap screws shall not be allowed. Pump head shall not exceed 30 feet from the base of the tower columns to the centerline of the inlet piping. Flow control valves furnished by the cooling tower manufacturer at the center of each distribution basin shall be provided with a suitable flange for connection of Contractor's piping. Valves to have cast iron body with stainless steel screw and shall be provided with locking and turning bar. Valve to be designed to have positive shut-off up to 25 psi. Valve to be provided with grease fitting for lubrication.
- H. Fan motor(s) shall be 1 maximum, NEMA Premium Efficiency TEFC, 1.15 service factor, variable torque, inverter duty and specially insulated for cooling fluid cooler duty (Class F). Speed and electrical characteristics shall be 1800, single winding, 3 phase, 60 hertz, 208 volts. Motors shall operate in the shaft-vertical position for belt-drive fluid coolers and in the shaft-horizontal position for gear drive fluid coolers. Nameplate power shall not be exceeded at design operation. TEAO motors shall not be acceptable.
- I. The fan and fan drive assembly for each cell shall be supported by a rigid, galvanized steel structural support that resists misalignment. The mechanical equipment assembly shall be warranted against any failure caused by defects in materials and workmanship for no less than five (5) years following the date of fluid cooler shipment. This warranty shall cover the fan(s), premium efficiency motor(s), geared speed reducer(s), drive shaft(s) and couplings, and the mechanical equipment support. Bearing assemblies and V-belts shall be warranted for 18 months.

- J. Winterization: (Electric) Each cold water basin shall be provided with electric heater components consisting of one 3 KW electric heater, stainless steel electric float switch, aquastat and contractor/circuit breaker to maintain 50 degree F. in cold water basin at 7 degree F. ambient and wired for 208V/1/60 hertz provided by cooling tower manufacturer, including control transformer for 120V.
- K. Collection Basin: Cold water basins shall be bolted design. The collection basin shall be G-235 heavy-gauge galvanized steel assembled with bolted connections. Tap screws shall not be allowed. Suction connections shall be equipped with galvanized debris screens. A factory-installed, float-operated, mechanical makeup valve and wastewater blowdown line shall be included. An overflow and drain connection shall be provided in each cell of the fluid cooler. The basin shall include a depressed section into which accumulated particle debris can be flushed to permit cleaning. The basin floor adjacent to the depressed section shall slope toward the depressed section to prevent buildup of debris under the coil area.
- L. Recirculation pump(s) shall be mounted to the collection basin in conjunction with a suction assembly. Recirculation piping shall be schedule 40 galvanized steel. A blowdown line with metering valve shall be connected directly to the fluid cooler overflow. Connecting flume shall be galvanized steel including all hardware.
- M. Access and Safety: Access panels shall be 16 gauge galvanized steel and be provided on both end walls for access to the eliminator and plenum area by a sliding access door. A heavy duty galvanized steel wire grille-type fan guard shall be provided over each fan cylinder. Provide an aluminum ladder from a point 1'-0" above the (roof/grade) to the top of the handrail. 13" diameter galvanized steel pipe handrails shall be provided around the top of the cooling deck to ensure the safety of operating personnel. Tower safety features shall meet OSHA requirements.
- N. Weights and Dimensions: Total installed size of the cooling tower shall not exceed 6.05 ft L x 8.34 ft W x 12.89 ft H to top of the fan guard from the base of the tower. Total operating weight when circulating the maximum recommended fluid flow shall not exceed 7,950 lbs.
- O. Finish: All steel including all hardware shall be hot dip galvanized steel 22 oz. per square foot.
- P. All cooling towers, regardless of manufacture, must comply with O.S.H.A. requirements which affect the ladder and handrail. Also, if any fan check level is 20'-0" or more above roof at grade level, it must be provided with a safety cage on the ladder. The safety cage must start 7'0" above grade or roof level and be carried to top of handrail.
- Q. All cooling tower(s) are to comply with all O.S.H.A. regulations.

PART 3 - EXECUTION

3.1 INSPECTION

- A. The contractor shall examine location where his equipment is to be installed, determine space conditions and notify Architect, in writing, of conditions detrimental to proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install equipment where shown in accordance with manufacturer's written instructions and with recognized industry practices, to ensure that equipment complies with requirements and serves intended purposes.
- B. Coordinate with other work as necessary to interface installation of equipment with other components and systems.
- C. Check alignment and, where necessary (and possible), realign shafts of motors and equipment within tolerances recommended by manufacturer.

3.3 FIELD QUALITY CONTROL

- A. Upon completion of the installation of equipment and after motor has been energized with normal power source, test equipment to demonstrate compliance with requirements. When possible, field correct malfunctioning units, then retest to demonstrate compliance. Replace units which cannot be satisfactorily corrected. Refer to Section 23 05 93 - Testing and Balancing.

END OF SECTION 23 65 00

SECTION 23 73 01

AIR HANDLING UNITS

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

- A. This Section is coordinate with and complementary to the General Conditions and Supplementary General Conditions of the Work, wherever applicable to Mechanical Work.
- B. Section 01 31 46 - Special Requirements for Mechanical and Electrical Work shall apply.

1.2 DESCRIPTION OF WORK

- A. The work includes the providing of all labor, materials, equipment, accessories, services and tests necessary to complete and made ready for operation by the Owner, all air handling units as shown on the drawings and hereinafter specified.

1.3 QUALITY ASSURANCE

- A. Manufacturing firms regularly engaged in manufacture of this material with characteristics and capacities required, whose products have been in satisfactory use in similar service for not less than 10 years.
- B. Provide product produced by the manufacturers, which are listed in Section 23 05 12 "Approved Manufacturer's List".
- C. Provide equipment whose performance, under specified conditions, is certified by the manufacturer.

1.4 SUBMITTALS

- A. Refer to Section 01 31 46 - Special Requirements for Mechanical and Electrical Work and submit shop drawings.

1.5 COORDINATION

- A. Refer to Section 01 31 46 - Special Requirements for Mechanical and Electrical Work.

1.6 GUARANTEE

- A. Refer to Section 01 31 46 - Special Requirements for Mechanical and Electrical Work.

PART 2 - PRODUCTS

2.1 AIR HANDLING UNIT AC-2E

- A. Furnish and install new air handling units as scheduled on the Drawings. Units shall be arranged as shown on the Drawings and are to perform as set forth in the equipment schedule.
- B. Provide AHUs with unit splits and shall be disassembled as required for shipping or installation requirements. As shipped from the AHU Manufacturer, AHUs shall meet the performance requirements shown on the equipment schedule. Units shall have all components and options as indicated on the schedule or drawings. Furthermore, units shall be constructed as detailed hereinafter.
- C. Provide AHUs disassembled on shrink-wrapped pallets for field assembly in the mechanical room by the installing contractor. The units shall be fully factory-assembled to test each panel and component for proper fit-up prior to shipment. Each unit shall be shipped with labeled drawings, assembly instructions, and detailed pictures of the actual unit as it is being assembled. This information may be provided digitally.
- D. Provide a factory-authorized service representative employed by the AHU Manufacturer to supervise installation and start-up of the units as herein described and to certify that AHU as installed and assembled comply with manufacturer requirements.
- E. The framework of the units shall be heavy gauge structural steel shapes which shall be formed to provide a natural recess for flush-mounted casing panels. The design of the units shall be such that the entire casing is removable in panels for service or inspection of any portion of the unit interior. The casing panels are to be secured with thread-cutting sheet metal screws, and all those over 72 square feet in area are to be not less than 16-gauge steel. Inspection and service access doors are to be provided on entering sides of the cooling and heating coil section and filter section, and as indicated on the drawings, and shall extend to the full height of the unit and are to be fitted with cast aluminum quick-opening handles and hinges. No unit casing panel shall exceed 15 square feet in area.
- F. Unit air leakage shall not exceed 1.0% of design cfm at +10.0" w.g. in all positive-pressure sections and -10.0" w.g. in all negative-pressure sections. Leakage shall be calculated by totaling all leakage either in or out of the unit.
- G. Base shall be constructed from welded structural steel channels around the perimeter and welded structural steel cross members. Formed steel channels are not acceptable. The structural steel base shall be shot blasted, fully welded, and then painted. The maximum cross-member spacing shall be 24" on center with members located adequately to support fans, coils, and other large components. The height of each base channel shall be no less than the height indicated in the drawings. Each shipping section shall be provided with removable lifting lugs. The structural framework shall fully support the unit casing and all components during installation such that no section deflects more than $L/1000$ during rigging of that section, where L is defined as the distance between lifting lugs.
- H. Floor shall be double-wall construction with galvanized steel solid exterior and galvanized steel interior. The floor surface shall be welded and all spaces and joints completely sealed with dams around all bottom penetrations. Floor deflection shall not exceed $L/200$ under a point load of 200

pounds, where L is defined as the floor span. All drain pans shall have a rigid 12" wide safety tread plate walk bridge stretched across the unit width. Walk bridge shall be of the same material type and thickness as the unit floor. The walk bridge and support system shall be suspended above the drain pan (not in contact with the drain pan bottom) and shall be easily removable for drain pan cleaning. A galvanized steel liner shall be attached to the underside of the unit base and cross members, ensuring that the floor insulation is completely encapsulated.

- I. Insulation that meets a minimum R-value of 13 shall be provided between inner and outer floor construction for the entire unit floor. Insulation shall be closed-cell foam to prevent wicking of moisture. If fiberglass insulation is provided, it shall be completely wrapped with long-strand fiberglass cloth to limit the entrainment of moisture into the insulation. The long-strand fiberglass cloth shall also incorporate an anti-microbial coating to suppress microbial growth. Insulation shall completely fill the panel cavity in all directions so that no voids exist. Base assemblies shall comply with NFPA 90 A. The inner floor shall be constructed of galvanized 16 GA G90. The outer floor construction shall be constructed of galvanized 18GA G90.

J. Walls

1. Wall assemblies shall be double-wall construction with galvanized steel solid exterior and galvanized steel interior. The entire unit shall have a solid wall liner on the interior. All spaces and joints of wall assemblies shall be completely sealed. Wall shall meet the casing deflection limits contained herein.
2. A thermal break shall be provided throughout the entire wall assembly that ensures no member on the exterior of the unit, including fasteners, has through metal contact with any member on the interior of the unit, including fasteners.
3. Insulation that meets a minimum R-value of 13 shall be provided throughout all unit wall assemblies. Insulation shall be injected foam. Foam shall be closed cell to prevent wicking of moisture. If fiberglass insulation is provided, it shall be completely wrapped with long-strand fiberglass cloth to limit the entrainment of moisture into the insulation. The long-strand fiberglass cloth shall also incorporate an anti-microbial coating to suppress microbial growth. Insulation shall completely fill the panel cavity in all directions so that no voids exist and settling of insulation is prevented. Wall assemblies shall comply with NFPA 90 A. The inner wall shall be constructed of galvanized 20 GA G90. The outer wall construction shall be constructed of galvanized 18GA G90.
4. Removable wall access panels shall be provided in coils, condenser, compressors, and fan sections for service removal of components. A thermal break shall be provided throughout all removal wall access panels that ensures no member on the exterior of the unit, including fasteners, has through metal contact with any member on the interior of the unit, including fasteners.

K. Access Doors

1. Access doors shall be provided throughout units as indicated on the schedules and drawings. Access doors shall be double wall construction. Interior and exterior door panels shall be of the same construction as the interior and exterior wall panels, respectively.
2. A thermal break shall be provided on all door assemblies downstream of the cooling coil that ensures no member on the exterior of the unit, including fasteners, has through metal contact with any member on the interior of the unit, including fasteners.
3. Insulation that meets a minimum R-value of 13 shall be provided throughout all door assemblies. Insulation shall be injected foam. Foam shall be closed cell to prevent wicking of moisture. Insulation shall completely fill the panel cavity in all directions so that no

voids exist and settling of insulation is prevented. Door assemblies shall comply with NFPA 90 A.

4. All doors shall be a minimum of 60" high if sufficient height is available, or the maximum height allowed by the unit height.
5. Door test ports shall be provided by the AHU Manufacturer at all access doors. Test ports shall be designed to allow the test and balance contractor to validate pressure losses using a handheld instrument. Test ports shall have a removable cover that completely seals the door penetration when testing and balancing is not being conducted.
6. Door hinges shall be stainless steel type. Door handles shall be Allegis design for minimized leakage and to provide a thermal break that ensures no member on the exterior of the unit has through metal contact with any member on the interior of the unit. Handles shall fasten against the door frame with a roller cam to eliminate wear of the door frame. On indoor units, if Allegis handles are not provided, Ventlok 310 handles shall be provided on all doors to ensure positive seal of the door and to avoid wear of the door frame. Door handles on units approved to comply with the High Velocity Hurricane Zone of the Florida Building Code shall be provided as detailed in the approved NOA submittal package for the product. All door handles shall be operable from both the unit exterior and interior. Doors that gain access to unprotected fan wheels, belts, or sheaves shall be provided with a key-locking handle.

L. Shipping Splits

1. Shipping splits shall be provided as required for rigging and installation of the units in the existing locations. The contractor shall provide for existing access to the location for the units. Heavy-gage gussets shall be provided in the corners of each split on the unit interior to minimize the opportunity for racking of the section during shipping and rigging. Structural members shall be provided at the base of the unit exterior to enable together of each shipping split. The unit shall be shipped for field installation and to allow the rigging through a 34" door located in the subcellar.

M. Unit Paint

1. External surfaces of all unit casings shall be prepared and painted. Paint shall be able to withstand a salt spray test in accordance with ASTM b117 for a minimum of 700 consecutive hours. Paint shall be AHU manufacturer's standard color, unless otherwise indicated in the schedule and drawings. All casing panels shall be gasketed and the entire unit shall be given an external finish coat of air dry enamel.

N. Dampers

1. Ultra low-leak modulating dampers shall be provided, sized, and located as indicated on the schedule and drawings. Blade arrangement shall be opposed and orientation horizontal blades unless indicated otherwise. Damper blades shall be Aluminum double-skin airfoil design for minimal pressure drop. Leakage rate shall not exceed 3 cfm/square foot at 1" w.g. All leakage testing and pressure ratings shall be based on AMCA Standard 500-D.
2. Mixing box sections shall have parallel blades interconnected outside air and return air dampers oriented to promote mixing.
3. Damper blades shall have parallel bends for stiffness and are welded to 2 in. diameter steel rods rotating in nylon bushings and mounted in rigid galvanized steel damper frames. Dampers are sectionalized to limit blade length to not more than 50 inches in order to prevent excess blade warping and to assure tight closure for a maximum air leakage of 2% at 4 in. tps and 2000 fpm velocity. Damper motors by A.T.C. Contractor

- O. Fan ratings shall be certified as per ARI. 410-72.
- P. All fans shall be statically and dynamically balanced and tested at rated speed after being installed in the factory-assembled units.
- Q. Bearings are to be connected through aluminum tubing to external lubrication fittings located at the drive end of the fan section. The bearings are to be mounted on heavy gauge channel reinforced steel panels which shall form an integral part of the fan section frame. Fan wheels and scrolls are to be protected against corrosion by a two-coat baked-on epoxy enamel finish. Bearings shall be self-aligning, grease-lubricated ball bearings sized to provide minimum average bearing life of 200,000 hours. Lubrication fittings shall be provided on exterior of cabinet. Fan shaft shall be continuous diameter, cold finished steel, ground and polished to ensure trouble-free operation and tolerances within the recommendations of bearing manufacturers. Fan motors shall be mounted on an adjustable pivot base in positions external to the unit. Adjustable pitch shall be furnished with all motors. Fan belt guards shall be furnished by the unit manufacturer, easily removable, and made of solid steel with tachometer openings.
 - 1. All motors shall conform to ANSI/NEMA MG1 Part 31.4.4.2 as well as all applicable requirements of NEC and shall be UL Listed. Motors shall be inverter ready, TEFC and of the voltage, phase, frequency, and Hp indicated on the schedule and drawings. Motors shall be IEF5 efficient, exceeding the EPCa efficiency requirements. The motor shall be provided with a heavy duty, adjustable, steel base.
 - 2. Nameplate motor horsepower for all fans, including dual fans and fan arrays, shall be at least 15% greater than design brake horsepower of each fan.
 - 3. Motors for fan arrays shall each have an independent overload and an independent ground connection.
 - 4. Motors shall be NEMA Design B, with Class F insulation.
 - 5. Motor to have 1.5 service factor.
 - 6. Provide shaft grounding.
- R. The entire unit cabinet, framework and panels, shall be subjected to a phosphatizing treatment after fabrication. Following this, all exposed steel surfaces on the unit interior are to be spray coated with an asphalt non-asbestos fiber compound, whereas the entire exterior is to be finished with an alkyd phenolic paint primer.
- S. All coils shall be of the cartridge type removable from coil connection side of casing and supported in tracks over the entire length of the coil. Coils shall be a product of the unit manufacturer. Coils shall be of the type as specified under "Coils" section of this Specification. There shall be a minimum of 24" spacer sections with access doors on both sides between heating and cooling coils for control bulb installation.
- T. Filter section shall be capable of accepting standard 2" inch thick prefilters and a combination of 12 inch x 24 inch and 24 inch x 24 inch (nominal) pleated filters up to 22 inch in depth. Pleated filter section to have hinged access doors on both sides for filter replacement. Provide 2" space between prefilter and pleated filter for filter gauge probe installation. Pleated filter shall be installed on a 2" metal frame.
- U. Air filters shall be of the type as specified under paragraph 234000 "Air Filters". Provide air filter gages as specified under paragraph 234000 "Air Filter".
- V. The unit(s) shall be arranged for field assembly of sections. All joints between sections shall be sealed with a suitable sealing compound supplied by the manufacturer.

- W. All units shall be direct driven. Drive service factor shall be 1.5 times motor nameplate horsepower.
- X. In the judgement of the Engineer, the CFM and TSP specified in the schedule for a particular unit exceeds the range of an approved manufacturer published catalog data for his standard medium pressure unit, then that manufacturer shall be required to supply his high-pressure model at no extra cost.
- Y. Mixing box for the units only, shall have parallel blades interconnected inside and return air dampers. Damper blades have parallel bends for stiffness and are welded to 2 in. diameter steel rods rotating in nylon bushings and mounted in rigid galvanized steel damper frames. Dampers are sectionalized to limit blade length to not more than 50 inches in order to prevent excess blade warping and to assure tight closure for a maximum outside air leakage of 2% at 4 in. t.s.p. and 2000 fpm velocity. Damper motors shall be BELIMO.
- Z. Modular unit components are to be constructed of sectionalized heavy gauge mill galvanized steel formed panels, rigidly reinforced with externally located hot channels. Casing panels shall be removable for easy access to the unit.
- AA. Coil, fan and all accessory section panels shall be insulated with 0.6 inch thick, foam foil sandwich (isocyanate) insulation. Insulation shall be secured to the casing with waterproof adhesive and permanent fasteners. Casing insulation shall meet NFPA-90A flame spread and smoke generation requirements.
- BB. The condensate drain pan shall have double floor construction with threaded drain connections on both sides. The drain pan shall extend under the complete fan and coil sections on draw thru units and coil section of flow thru units, and shall pitch, for positive drainage, toward side drain connections.
- CC. Condensate drain pan to be insulated with 0.6 inch thick isocyanate foam faced with an additional aluminum foil vapor barrier and cemented between the steel outer pan and the heavy gauge steel inner pan. The pans are to be fabricated of not less than 20 gauge stainless steel. Insulation, adhesive and inner coating to comply with NFPA-90A flame spread and smoke generation requirements.
- DD. Coil sections shall have heavy-duty coil tracks extending the full width of the unit to provide slip-in, slip-out coils for ease of service and maintenance. Where cooling coils are stacked, they are to have intermediate drain pans with drop tubes at either end to drain condensate to the main drain pan without flooding the lower coil.
- EE. Fan section shall be constructed of heavy galvanized steel and formed channel base for integral mounting of fan, motor and casing panels. Fan scroll and bearings are to be mounted on an "A" or "H" frame structure rigidly secured to the channel base. Internally mounted motor to be factory installed on slide rails having two adjusting screws. Access to the motor and drive is to be provided by a removable panel located on the drive side of the unit and of adequate size to permit removal of the fan wheel, motor and drive.
- FF. Provide gravity backdraft damper on each fan.
- GG. Marine Lights
 - 1. Marine lights shall be provided throughout AHUs. Provide lights in each section with an

access door. Light lamps shall be LED-type to minimize amperage draw and shall produce minimum of 800 lumens equivalent to a standard 60w bulb. LED-type lamps shall have a minimum of 25,000 hour life. Light fixtures shall be constructed of die cast aluminum with a glass globe and die cast guard. Fixtures shall be vaporproof and suitable for wet locations.

HH. Marine Light Switches

1. All lights on a unit shall be wired in the factory to a single on-off switch. On outdoor units, the light switch shall be mounted on the exterior of the unit casing with an outdoor rated flip cover. On indoor units, the light switch shall be mounted on the casing exterior. Lighting circuit(s) shall be wired by the AHU manufacturer to a common junction box separate from the fan power so the lights can remain on when the main disconnect to the unit is on or off.

II. Convenience Outlets

1. A 20 amp, 120V GFCI convenience outlet shall be provided by the AHU manufacturer for outdoor units. The outlet shall be mounted on the exterior casing of the unit. The outlet shall be wired by the AHU manufacturer to the same circuit as the lights.

JJ. Control Panel Power and sensors

1. The AC unit shall include all air temperature sensors as shown on the control drawings. The DX air discharge temperature setpoints shall be set by the BMS using analog input at the unit controller and the AC unit controller shall modulate the refrigerating system to maintain the DX air setpoint.
2. All the refrigeration points, pressures, temperatures shall be available as BACNET variables. Unit shall include programable controller with LCD user interface.

KK. Refrigeration system

1. The units shall be provided with two separate refrigeration circuits.
2. The compressors shall be digital scroll type with electronic thermostatic expansion valve.
3. The compressors shall operate on a lead lag configuration and shall alternate on a 4 week schedule. The lead lag schedule shall be adjustable at the user interface.

LL. AC unit Power

1. Power for the AC unit shall be a single point of connection for the AHU.

PART 3 - EXECUTION

3.1 INSPECTION

- A. The contractor shall examine location where this equipment is to be installed and determine space conditions and notify architect in writing of conditions detrimental to proper and timely completion of the work.
- B. Do not proceed with the work until unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install equipment where shown, in accordance with manufacturer's written instructions, and with recognized industry practices, to ensure that equipment comply with requirements and serve intended purposes.
- B. Coordinate with other work as necessary to interface installation of equipment with other components of systems.
- C. Check alignment and, where necessary (and possible), realign shafts of motors and equipment within tolerances recommended by manufacturer.

3.3 CONDENSATE DISPOSAL

- A. See Special Requirements for Mechanical and Electrical Work section of the specification.
- B. Provide drain pan overflow control as required per this section.

3.4 FIELD QUALITY CONTROL

- A. Upon completion of installation of equipment, energized with normal power source, test equipment to demonstrate compliance with requirement. When possible, field correct malfunctioning units, then retest to demonstrate compliance. Replace units which cannot be satisfactorily corrected. Refer to Section 23 05 93 - Testing and Balancing.

END OF SECTION 23 73 01

SECTION 23 82 13

VARIABLE FREQUENCY DRIVES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. This Section is coordinated with and complementary to the General Conditions and Supplementary General Conditions of the Work, wherever applicable to Mechanical Work.
- B. Section 01 31 46 - Special Requirements for Mechanical and Electrical Work shall apply.

1.2 SUMMARY OF WORK IN THIS SECTION

- A. The work includes the providing of all labor, materials, equipment, accessories, services and tests necessary to complete and made ready for operation by the Owner, all variable frequency drives as shown on the drawings and as specified elsewhere in this specification.
- B. Provide a separate variable frequency drive, VFD, for each motor drive. For air handling units with two fans operating in parallel, a separate VFD shall be provided for each fan.
- C. Each pump shall be provided with a VFD.

1.3 QUALITY ASSURANCE

- A. Manufacturing firms regularly engaged in manufacture of this material with characteristics and capacities required, whose products have been in satisfactory use in similar service for not less than 10 years.
- B. Variable frequency drive (VFD) shall be produced by Yaskawa, ABB or approved equal. All VFD's for the project shall be the product of a single manufacturer.
- C. Provide equipment whose performance, under specified conditions, is certified by the manufacturer.
- D. Start-up services and customer training shall be provided by a factory trained and authorized representative. Provide a minimum of 4 hours of training for VFD's.
- E. VFD shall be UL listed and shall have NYC approvals (BSA number) for NYC projects. Submit proof of approval.
- F. Control of fan VFD's shall be provided under Section (23 09 00).

1.4 SUBMITTALS

- A. Refer to Section 01 31 46 - Special Requirements for Mechanical and Electrical Work and submit shop drawings.

1.5 DELIVERY STORAGE AND HANDLING

- A. Refer to Section 01 31 46 - Special Requirements for Mechanical and Electrical Work.

1.6 GUARANTEE

- A. Refer to Section 01 31 46 - Special Requirements for Mechanical and Electrical Work.
- B. In addition to the requirements of Section 01 31 46 regarding Guarantee, the manufacturer and/or supplier of variable frequency drives shall provide a 36-month warranty from the date of certified start-up and shall include all parts, labor, travel time and expenses. Any repairs of variable frequency drives shall be done on an emergency basis during the warranty period.
- C. The manufacturer shall be listed by Underwriter's Laboratories.

1.7 REFERENCES

- A. NEMA ICS 3.1 - Safety Standards for Construction and Guide for Selection,
- B. Installation and Operation of Variable Frequency Drive Systems
- C. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).
- D. IEEE Standard 519
- E. UL 508C (Power Conversion) and UL 508A (Industrial Control Panel)
- F. CSA 22.2 No. 14-95 (Industrial Control Equipment)
- G. CE mark 2006/95/EC LVD and CE mark 2004/108/EC

PART 2 - PRODUCTS

2.1 VARIABLE FREQUENCY DRIVE

- A. The variable frequency drive(s) (VFD) shall be pulse width modulation (PWM) type, microprocessor controlled design. Provide one VFD per fan motor for each fan in the array. Each VFD shall have an active front end AC to DC rectifier having a current distortion level at the individual drive terminals not exceeding 3% at full output.
- B. The VFD, including all factory installed options, shall have UL approval.
- C. Enclosure shall be NEMA 12 ventilated for installation as a wall-mounted or free-standing unit, depending on the amp rating. The drive shall be equipped with an input disconnect switch and fuses to protect against ground faults. A hand- off-automatic switch and speed potentiometer shall be mounted on the front of the enclosure.
- D. VFD shall utilize a diode bridge rectifier to convert three phase AC to a fixed DC voltage or a phase controlled rectifier. Drives utilizing a phased controlled rectifier shall employ a three phase line reactor on the line side of the rectifier.

- E. PWM type drives shall use Insulated gate bipolar transistors (IGBTs) shall be used in the inverter section to convert the fixed DC voltage to a three phase, adjustable frequency, AC output. A DC line reactor shall be provided to minimize harmonic and current distortion of the input power line.
- F. The following customer modifiable adjustments shall be provided:
 - 1. Acceleration time: 0.1 to 1800 seconds
 - 2. Deceleration time: 0.1 to 1800 seconds
 - 3. Minimum frequency: 0 Hz
 - 4. Maximum frequency 66 Hz
- G. Speed reference signal shall be customer selectable for 0-10 VDC or 4-20 mA.
- H. The VFD shall be suitable for elevations to 3300 feet above sea level without derating. Maximum operating ambient temperature shall not be less than 104EF. VFD shall be suitable for operation in environments up to 95% non-condensing humidity. PWM type drives shall be capable of operating at carrier frequencies of 12000 Hz without derating.
- I. The VFD shall be capable of displaying the following information via the display:
 - 1. % speed
 - 2. Voltage
 - 3. % load
 - 4. Fault identification
- J. All VFDs shall be equipped with a bypass switch to allow the fan or pump to operate at constant speed while the drive is being serviced. The bypasses for motors 100 HP and greater shall be solid state reduced voltage.
- K. The following communication features shall be provided to the BAS:
 - 1. Remote start/stop
 - 2. Failure of any system component
 - 3. VFD speed
- L. VFD's shall meet the requirements as outlined in the latest edition of IEEE-519 for total harmonic voltage and current distortion. Individual or simultaneous operation of the VFD's shall not add more than 5% total harmonic voltage distortion to the normal bus, nor more than 10% while operating from standby generator.

The step-up transformers shall be the point of common coupling, as indicated on the project electrical drawings. The short circuit current at point of common coupling under utility operation shall be provided by the Engineer. Standby generator rating shall be as indicated on the electrical drawings. The minimum subtransient reactance shall be provided by the Engineer. The maximum number of VFD's which will operate simultaneously from the generator are indicated on the equipment schedule as having emergency power (E.P.) Maximum allowable total and individual harmonic current distortion limits for each VFD shall not exceed limits as set forth by IEEE 519 latest edition. If harmonic filters are required to meet these requirements, it is the responsibility of the VFD manufacturer to provide filter. It is the responsibility of the VFD manufacturer to design and manufacture any required filters. A preliminary detailed harmonic analysis must be submitted by the VFD manufacturer at bid time, which includes all harmonics to the 99th. Compliance shall be verified by the VFD manufacturer with field measurements of the harmonic distortion difference at the point of common coupling with and without VFD's operating.

The variable frequency control shall include transient voltage suppression to allow reliable operation on a typical industrial or commercial power distribution system.

- M. When the VFD is in fault mode and the fan in smoke purge mode, the VFD shall automatically switch to bypass mode. A signal shall be provided under Section 23 09 00 from the VFD indicating that the fan is in smoke purge mode.

2.2 ACCEPTABLE MANUFACTURERS:

- A. See approved manufacturer Section.
- B. NEMA 3R enclosure with heated enclosure for outdoor installation.
- C. NEMA 12 for all others.

2.3 DESCRIPTION

- A. Provide enclosed variable frequency drives suitable for operation at the current, voltage, and horsepower indicated on the schedule. Conform to requirements of NEMA ICS 3.1.
- B. Motors should be inverter duty rated, per NEMA MG1 parts 30 and 31, for motor-drive compatibility.

2.4 RATINGS

- A. VFD must operate, without fault or failure, when voltage varies plus 10% or minus 15% from rating, and frequency varies plus or minus 5% from rating.
- B. VFD shall be _208_volts, _60_Hz, 3 Phase, as shown on schedules.
- C. Displacement Power Factor: 0.98 over entire range of operating speed and load.
- D. Service factor: 1.0
- E. Operating Ambient Temperature: -10°C to 50°C (14°F to 122°F)
- F. Humidity: 0% to 95% non-condensing.
- G. Minimum Efficiency: 96% at half speed; 98% at full speed.
- H. Starting Torque: 100% starting torque shall be available from 0.5 Hz. to 60 Hz.
- I. Overload capability: 110% of rated FLA (Full Load Amps) for 60 seconds; 150% of rated FLA peak.
- J. Controlled speed range of 40:1
- K. VFDs must be suitable for use on a circuit capable of delivering not more than 100,000 RMS symmetrical amperes.

2.5 DESIGN

- A. VFD shall employ a PWM (Pulse Width Modulated) power electronic system, consisting of:

1. Intermediate Section:
 - a. DC bus shall be interfaced with the VFD diagnostic logic circuit, for continuous monitoring and protection of the power components.
 2. Output Section
 - a. Insulated Gate Bipolar Transistors (IGBTs) shall convert DC bus voltage to variable frequency and voltage.
- B. The VFD must be rated for operation at a carrier frequency of 5 kHz to satisfy the conditions for current, voltage, and horsepower as indicated on the equipment schedule.
- C. VFD shall have an adjustable carrier frequency, from 1 kHz to 12.5 kHz
- D. (Above 250 HP from 1 kHz to 5 kHz)
- E. VFD Must include an adjustable dynamic noise control for quiet motor operation
- F. VFD shall have embedded Building Automation System (BAS) protocols for network communications BACNET/MSTP. These protocols shall be accessible via a RS-422/485 communication port.
- G. VFD shall include at least two independent analog input. Selectable for either 0-10 VDC or 4-20 MA.
- H. VFD shall include two selectable 0-10 VDC or 4-20 MA analog outputs for monitoring, or "speed tracking" the VFD. The analog output signal will be proportional to output frequency, output current, output power, PI (Proportional & Integral control) feedback or DC bus voltage.
- I. VFD shall provide terminals for remote input contact closure, to allow starting in the automatic mode.
- J. VFD shall include at least one external fault input, which shall be programmable for a normally open or normally closed contact. These terminals can be used for connection of firestats, freeze stats, high pressure limits or similar safety devices.
- K. VFD shall include a power loss ride through capable of 2 seconds.
- L. VFD shall have DC injection braking capability, to prevent fan "wind milling" at start or stop, adjustable, current limited.
- M. VFD shall have a motor preheat function to prevent moisture accumulation in an idle motor.
- N. VFD shall include diagnostic fault indication, time and date stamped faults storage and heatsink cooling fan operating hours.
- O. VFD shall have a digital operator with program copy and storage functions to simplify set up of multiple drives. The digital operator shall be interchangeable for all drive ratings.
- P. VFD shall include a front mounted, sealed keypad operator, with an English language illuminated LCD display. The operator will provide complete programming, program copying, operating, monitoring, real time clock and diagnostic capability. Keys provided shall include industry standard commands for Hand, Off, and Auto functions.

- Q. VFD plain language display shall provide readouts of; output frequency in hertz, PI feedback in percent, output voltage in volts, output current in amps, output power in kilowatts, D.C. bus voltage in volts, interface terminal status, heatsink temperature and fault conditions. All displays shall be viewed in an easy-to-read illuminated LCD.
- R. VFD unit shall include the following meters to estimate use of energy:
1. Elapsed Time Meter
 2. Kilowatt Meter
 3. Kilowatt Hour Meter
- S. VFD shall include a user selectable PI control loop, to provide closed loop set point control capability, from a feedback signal, eliminating the need for closed loop output signals from a building automation system. The PI controller shall have a differential feedback capability for closed loop control of fans and pumps for pressure, flow or temperature regulation in response to dual feedback signals.
- T. The VFD shall include HVAC specific application macros. The macros can be used to help facilitate start-up. The macros will provide initialization to program all parameters and customer interfaces for a particular application (Fans, Pumps and Cooling Towers) to reduce programming time
- U. The VFD shall have VLP Sensorless technology. VFD's that require a separate pressure transducer shall not be accepted.
- V. VFD shall include loss of input signal protection, with a selectable response strategy including speed default to a percent of the most recent speed.
- W. VFD shall include electronic thermal overload protection for both the drive and motor. The electronic thermal motor overload shall be approved by UL.
- X. VFD shall include the following program functions:
1. Critical frequency rejection capability: 3 selectable, adjustable dead bands.
 2. Auto restart capability: 0 to 10 attempts with adjustable delay between attempts.
 3. Ability to close fault contact after the completion of all fault restart attempts.
 4. Stall prevention capability.
 5. Bi-directional "Speed search" capability, in order to start a rotating load.
 6. 14 preset and 1 custom volts per hertz pattern.
 7. Heatsink over temperature speed fold back capability
 8. Terminal status indication.
 9. Programmable security code
 10. Current limit adjustment capability, from 30% to 200% of rated full load current of the VFD.
 11. Motor pre-heat capability
 12. Input signal or serial communication loss detection and response strategy.
 13. Anti "wind-milling" function capability.
 14. Automatic energy saving function.
 15. Undertorque / Overtorque Detection.
 16. Fan failure detection and selectable drive action
 17. Bumpless transfer between Hand and Auto modes
 18. Seven preset speeds

19. VFD shall include user parameter initialization capability to re-establish project specific parameters.

2.6 PRODUCT OPTIONS

- A. Three Contactor Manual Bypass shall be provided when indicated by the schedule. VFD and bypass package shall be NEMA 12 rated, fully pre-wired and ready for installation as a single UL listed device. Selectable energy savings and harmonic reduction mode. Drive automatically switches to Bypass (Across-the-line) when motor is running 60 Hz for a set time and automatically switches back when frequency reference changes.
- B. Bypass shall include the following:
 1. Drive, output, and bypass contactors to isolate the VFD from the motor, when the motor is running in the bypass mode. These contactors shall be electrically and software interlocked to ensure safe operation. Two Contactors with Service Switch will not be accepted.
 2. 120 VAC control transformer, with fused primary.
 3. Bypass shall include an Electronic motor overload relay, to display motor amps and protect the motor while operating in the bypass mode.
 4. Control and safety circuit terminal strip.
 5. Door mounted control panel with; Drive/Bypass selector keys, Hand/Off/Auto selector keys, Normal/Test selector keys.
 6. Door mounted control keypad with LCD display for "Control Power", "Drive Ready", "Drive Run", "Drive Selected", "Drive Fault", "Drive Test", "Bypass Selected", "Bypass Run", "Motor OL", "Safety Open", "BAS Interlock", "Auto Run", "Auto Transfer", "Emergency Override", "Hand Mode", "Off Mode", and "Auto Mode".
 7. Drive/Bypass selector keys, to allow switching between the Drive and Bypass mode.
 8. Hand/Off/Auto selector keys shall provide the following operation and be programmed to operate in any of these modes upon power-up:
 9. Normal/Test selector keys, to allow VFD trouble shooting while operating in bypass mode. This option is only available with the 3 contactor style bypass.
 10. Hand Position - The drive is given a start command, operation is via the local speed input (digital operator/keypad). If in bypass mode, the motor is running.
 11. Off Position - The start command is removed, all speed inputs are ignored, power is still applied to the drive. If in bypass mode, the motor is stopped.
 12. Auto Position - The drive is enabled to receive a start command and speed input from a building automation system. If in bypass mode, the motor start/stop is controlled by the building automation system
 13. Eight Programmable digital inputs (24Vdc, 8mA) shall be provided for Auto Transfer to bypass, Safety Interlock, BAS Interlock, and numerous other bypass specific functions.
 14. Four Programmable form C relays (24Vdc/120 VAC, 2 Amp) for: "Motor Run", "Damper Actuator", "Auto Transfer", "Drive Run", "Hand Mode", "Auto Mode", "System Fault", "Bypass Run" or "Serial Com Run".
 15. Damper control circuit with end of travel feedback capability. This circuit shall also include two adjustable wait time functions. One is a run delay time where the drive will operate at a preset speed before the damper opens to pressurize the system. The other time function is an interlock wait time, so if the damper has not fully opened within the specified time, a fault will be declared.
 16. Line voltage sensors on all phases to monitor for brownout, blackout and single phase conditions. Fault levels for each condition must be adjustable to ensure the proper settings pursuant to each application.

- C. Main input circuit breaker with a pad-lockable through-the-door handle mechanism, making the whole bypass package 100KAIC.

2.7 FABRICATION

- A. All standard and optional features shall be included in a NEMA12 rated enclosure with a UL certification label as shown on the schedule.

PART 3 - EXECUTION

3.1 INSPECTION

- A. The contractor shall examine location where this equipment is to be installed and determine space conditions and notify construction manager in writing of conditions detrimental to proper and timely completion of the work.
- B. Do not proceed with the work until unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install equipment where shown, in accordance with manufacturer's written instructions, and with recognized industry practices, to ensure that equipment comply with requirements and serve intended purposes.
- B. Coordinate with other work as necessary to interface installation of equipment with other components of systems.
- C. Check alignment and, where necessary (and possible), realign shafts of motors and equipment within tolerances recommended by manufacturer.

3.3 FIELD QUALITY CONTROL

- A. Upon completion of installation of equipment, energized with normal power source, test equipment to demonstrate compliance with requirement. When possible, field correct malfunctioning units, then retest to demonstrate compliance. Replace units which cannot be satisfactory corrected. Refer to Section 23 05 93 - Testing and Balancing.

END OF SECTION 23 82 13

SECTION 23 82 17

COILS

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

- A. This Section is coordinated with and complementary to the General Conditions and Supplementary General Conditions of the Work, wherever applicable to Mechanical Work.
- B. Section 01 31 46 - Special Requirements for Mechanical and Electrical Work shall apply.

1.2 DESCRIPTION OF WORK

- A. The work includes the providing of all labor, materials, equipment, accessories, services and tests necessary to complete and made ready for operation by the Owner, all coils as shown on the drawings and hereinafter specified.

1.3 QUALITY ASSURANCE

- A. Manufacturing firms regularly engaged in manufacture of this material with characteristics and capacities required, whose products have been in satisfactory use in similar service for not less than 10 years.
- B. Provide product produced by the manufacturers, which are listed in Section 23 05 12 "Approved Manufacturer's List".
- C. Provide equipment whose performance, under specified conditions, is certified by the manufacturer.

1.4 SUBMITTALS

- A. Refer to Section 01 31 46 - Special Requirements for Mechanical and Electrical Work and submit shop drawings.

1.5 COORDINATION

- A. Refer to Section 01 31 46 - Special Requirements for Mechanical and Electrical Work.

1.6 GUARANTEE

- A. Refer to Section 01 31 46 - Special Requirements for Mechanical and Electrical Work.

PART 2 - PRODUCTS

2.1 GLYCOL/WATER COILS

- A. All water coils shall be of the continuous flat plate fin type for minimum resistance to air flow. Fins shall be fabricated with drawn collars and shall be bonded to the tubes by a hydraulic

expansion process. Openings in unit casing for coil connections to be sealed against leakage. Coil casings shall be not less than 16 gauge galvanized steel.

- B. Water coils shall be of the continuous tube type and circuited so as to be completely drainable by gravity through the supply header. Headers and tubes are to be fabricated of a seamless .035 inch thick wall copper tubing. Fins are to be .005 inch thick copper for cooling coils. Supply and return headers shall be complete enclosed within the unit casing or external where called for on the drawing, and shall be equipped with steel nipples of extra length equipped with drain and vent plugs outside unit casing. Coils shall have capacities as called for and shall have the minimum number of rows as shown on the schedule.
- C. Cooling coils shall have ARI Certification.

2.2 DIRECT EXPANSION COOLING COILS

- A. Tubes - Round, seamless copper grooves, arranged in parallel pattern with respect to airflow with 0.035 inch thick wall copper tubing.
- B. Fins - Plat-Tube, Sigma-Flo II configured, copper fins producing identical capacities. Fins continuous across entire coil width and die-formed in multiple stages for accurate tube fit, fin bonding and spacing. Fins mechanically bonded to tubes for lasting reliability.
- C. Casing - Continuous coated galvanized steel, 16 gauge formed end supports and top and bottom channels. 3/8" holes on 3" centers in channels for mounting or fastening coils together. One 16 gauge continuous coated, galvanized steel center tube support on ordering lengths over 42". Two or more supports on lengths over 96".
- D. Test and Working Pressure - Proof tested at 450 psig and leak tested at 300 psig air pressure under water, cleaned, dehydrated and sealed with dry nitrogen charge. Suitable for working pressures up to 250 psig.
- E. U-Bends - Round, seamless copper tubes, 5/8" O.D., machine die-formed on each end to provide accurate fit for silver brazed joints.
- F. Distributor - Venture type refrigerant distributors or low pressure drop design, arranged for down feed. Male sweat connections. Maximum of twelve circuits per single distributor. Split evaporator.
- G. Air Bypass and Water Carryover Arrestor - Foam sealing strip located between casing channels and fins along top and bottom.

PART 3 - EXECUTION

3.1 INSPECTION

- A. The contractor shall examine location where this equipment is to be installed and determine space conditions and notify architect in writing of conditions detrimental to proper and timely completion of the work.
- B. Do not proceed with the work until unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install coils where shown, in accordance with manufacturer's written instructions, and with recognized industry practices, to ensure that coils comply with requirements and serve intended purposes.
- B. Coordinate with other work as necessary to interface installation of coils with other components of systems.
- C. Check alignment and, where necessary (and possible), realign shafts of motors and coils within tolerances recommended by manufacturer.

3.3 FIELD QUALITY CONTROL

- A. Upon completion of installation of coils, test coils to demonstrate compliance with requirement. When possible, field correct malfunctioning units, then retest to demonstrate compliance. Replace units which cannot be satisfactorily corrected. Refer to Section 23 05 93 - Testing and Balancing.

END OF SECTION 23 82 17

SECTION 26 05 00

GENERAL PROVISIONS FOR ELECTRICAL WORK

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. This Section is to coordinate with and be complementary to the General Conditions and Supplementary General Conditions of the work, and Division 01 Specification Sections wherever applicable to Mechanical and Electrical Work.
- B. Section 01 31 46 – Special Requirements for Mechanical and Electrical Work shall apply.
- C. "The General Conditions of the Contract for Construction" is hereby made a part of the specifications for the Electrical, Fire Signal, Security, information technology to the same extent as if written out in full. Where any article of the General Conditions is supplemented by the specifications, the provisions of such articles shall remain in effect and all the supplemental provisions shall be considered as added thereto. When any such article is amended, voided or superseded by the specifications the provisions not specifically amended, voided or superseded shall remain in effect.
- D. Apply provisions of this division equally and specifically to Sections supplying labor and/or equipment and/or materials as required under Electrical Sections of Specifications.
- E. Drawings are diagrammatic and are a graphic representation of contract requirements to the best available standards at the scale required.
- F. Light and power and miscellaneous systems riser diagrams, as well as schematic diagrams, generally indicate connections to be used for various systems and equipment. Systems conduit and wiring shall be as required for the actual systems installed on this Project. Provide all work shown on diagrams whether or not it is duplicated on the plans.

1.2 SCOPE OF WORK

- A. The Specifications and the accompanying drawings are intended to secure the provisions of all material, labor, equipment, and services necessary to install complete, tested, and ready for operation the Electrical Systems in accordance with the Specifications and Drawings. All systems shall be complete with all necessary appurtenances and minor auxiliaries, including pull boxes, offsets to clear interferences, and supports which are not shown but are needed to make each system complete in every respect. All work described in the Specifications and not shown on the Drawings, or vice versa, shall be furnished in complete working order. If mention has been omitted of any item of work or material necessary for completion of the system, then such items must be and are hereby included.
 - 1. Power and light distribution system (system characteristics, equipment).
 - 2. Panelboards lighting, power and distribution.
 - 3. Fuses and/or circuit breakers.

4. Installation and wiring of individual controllers including starters and VFDs. Erecting starter racks where required.
5. Installation and wiring of motor control centers.
6. Control devices, only where specifically called for.
7. Safety and disconnect switches, unless furnished with starters or on equipment. Weatherproof devices for outdoor equipment. Six (6) pole switches for two speed, three phase motors.
8. Motor power wiring.
9. Raceways and installation components.
10. Wire and Cable.
11. Electrical work in connection with equipment specified and furnished under other Sections of the Specifications or furnished by the Owner under separate contracts or direct purchase.
12. Grounding system in conformance with applicable codes.
13. Wiring devices.
14. Lighting fixtures, interior and exterior, including lamps, as described in these Specifications, and in accordance with Schedule on Drawings.
15. Furnishing, installing and connecting of electric heater cables for pipe tracing and snow melting, including controls.
16. Furnishing, installing and connecting of electric radiant panels/electric space heaters.
17. Power wiring for fan coil, incremental units.
18. 120 Volt supply to EP switches and temperature control and/or data gathering panels.
19. Hardware, such as inserts, bolts, etc., associated with concrete pads.
20. Cutting and core drilling associated with electrical work.
21. Prime painting, where required for electrical equipment and installation.
22. Removal of existing electrical work in accordance with Architectural Demolition Scheme or as directed and required. Restoration of electrical service in affected adjoining areas which are to continue to function.
23. Interconnections and interfacing with pertinent existing systems shall be as required to achieve fully integrated operation of systems, as described in these Specifications and/or shown on Drawings.
24. Provision for temporary light and power.
25. Paying all fees as required by governing agency and performing all testing as required by governing agency and adjusting and furnishing all certificates of approval, and those of Underwriters.
 - a. All fan shutdown wiring and furnishing, installing and connecting equipment required for fan shutdown.
 - b. Wiring and Fire Alarm equipment associated with elevator recall feature.
 - c. Empty conduit system and low voltage wiring, including terminal cabinets and plywood backboards.
 - d. Empty conduit system for low voltage wiring supplied and installed under other sections, including terminal cabinets and plywood backboards.
 - e. Public address (paging) system.
 - f. Intercommunicating system.
 - g. Closed circuit television system (security and/or media).
 - h. Door security alarm system.
 - i. Electrical provision for building automation system.
 - j. Water detection system.

1.3 QUALITY ASSURANCE AND STANDARDS

- A. The complete installation shall be in accordance with the applicable requirements and standards of National Electrical Manufacturers Association (NEMA), National Fire Protection Association (NFPA), New York City Electrical Code (NYCEC), National Electrical Code (NEC), Institute of Electrical and Electronic Engineers (IEEE), American National Standard Institute (ANSI), Occupational Safety and Health Administration (OSHA), National Electrical Safety Code, Insulated Cable Engineers Association (ICEA), Underwriters' Laboratories (UL), Factory Mutual (FM), Factory Insurance Association (FIA), National Electrical Contractors Association (NECA) "Standard of Installation", Local Inspection Agency, Local Power Company, Local Telephone Company, along with state and local municipal codes and all applicable codes and authorities having jurisdiction. Any items or requirements noted in the Specifications or on Drawings, which conflict with these shall be referred to the Architect for decision. All work necessary to comply with these requirements shall be performed by the Contractor at no extra cost to the Owner.
- B. Where reference is made to the National Electrical Code only, without mention of the New York City Electrical Code, the requirements of the latter, where they differ from the former, shall take precedence, where applicable.
- C. All electrical equipment, materials and appliances shall have the listing of the Underwriters' Laboratories, Inc., and shall bear labels attesting to UL listing, and types approved by Municipal Departments having jurisdiction.
- D. NYC DEPARTMENT OF BUILDINGS ELECTRICAL DIVISION
 - 1. Drawings and Specifications
 - a. The Contract Drawings and Specifications shall be submitted by the Contractor to the Department of Building's Electrical Division to facilitate any inspections that may be made by that agency.
 - b. It is the intent of these Specifications that all electric work shall be done in strict accordance with the rules of the Electrical Division and with the 2011 NYC Electrical Code (NYC amendments to the 2008 National Electrical Code - NFPA 70-08). Where the requirement of the Drawings or Specifications exceeds the requirements of the Electrical Code, the requirements of the Drawings and Specifications shall be binding upon the Contractor.
 - c. Should the Electrical Division inspect the work and issue a violation, the Contractor shall correct the Work and eliminate the violation as part of the Contract.
 - 2. Interpretation
 - a. The electric work detailed in these Specifications and shown on Drawings shall be under the jurisdiction of the Authority, subject to the approval of the Electrical Division.
 - b. The Authority shall be the sole source for interpretation of the Contract Documents. Any discrepancies or conflicts shall be brought to the attention of the Authority for clarification.
 - 3. Materials and Appliance: All materials and appliance shall be approved by the Authority's Representative and installed in accordance with the rules and regulations of the Building Department, Electrical Division; certificates of approval including the temporary light and power wiring, shall be obtained by the Contractor and delivered to the Authority's Representative before the Work is finally accepted.

1.4 REMOVAL AND RELOCATION OF EXISTING WORK

- A. Disconnect, remove and/or relocate electrical material, equipment, devices, components, and other work noted and required by demolition or alterations in existing construction.
- B. Provide new material and equipment required for relocated equipment.
- C. Remove conductors from existing raceways to be rewired. Clean raceways as required prior to rewiring.
- D. Tape both ends of abandoned conductors, and cap outlets and abandoned raceways.
- E. Cut and cap abandoned floor raceways flush with concrete floor or behind walls and ceilings.
- F. Dispose of removed raceways and wiring.
- G. Dispose of removed electrical equipment as directed.
- H. All electrical work in adjoining areas which is indicated on the Drawings to continue to function but is affected by demolition work shall be reconnected and restored to present function as part of the electrical system of the buildings.
- I. Connect new work to existing work in a neat and acceptable manner, with minimum interference to existing facilities.
- J. Maintain continuous operation of existing facilities affected by the work.
- K. Alarm and emergency systems are to be interrupted only with the written consent of the Owner.
- L. Temporary shutdowns when required, to be made only with written consent of Owner at times not to interfere with normal operations.
- M. Where indicated on the Drawings or required by the alteration scheme, the Contractor shall remove all electrical outlets, switches, and other devices, complete with associated wiring, conduit, etc., from partitions, walls, and floors that are to be removed. When the removal of these makes dead electrical wiring that is to remain, Contractor shall install junction boxes or other devices necessary to make the circuits affected continuous and ready for operation. Otherwise, wiring shall be removed back to the nearest electrical outlet box that is to remain, or to the panelboard.
- N. All raceways which become exposed beyond finished surfaces because of the alteration work shall be removed and rerouted behind finished surfaces.
- O. Wiring that is to be removed as a result of demolition work, but is required to continue to function, shall be interrupted at convenient locations, rerouted (new wiring and conduits) and reconnected for continuation of their original function. New wiring extensions shall match existing ones in all respects, conductor ampacity, conduit size, etc.
- P. Representative in order to be included under the bypass connections allowance.

1.5 SUBMITTALS

- A. Product Data and installation requirements: see Section 01 31 46.

1.6 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. Connecting raceways, cables, wireways, cable trays, and busways must be clear of obstructions and of the 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.
- D. Coordinate sleeve selection and application with selection and application of firestopping specified in Division 07.

1.7 ROUGH-IN

- A. Verify final locations for rough-ins with field measurements and with the requirements of the actual equipment to be connected.
- B. Ceiling Markers:
 - 1. Provide color-coded ceiling markers indicating the location of all electrical equipment located above hung ceilings. Markers shall be provided for, but not limited to the following:
 - 2. All pull or junction boxes, (excluding branch circuits), smoke detectors and other alarm or signal initiating devices, disconnected switches and starters where not identified by other trades.

1.8 CHANGES IN CONDUITS AND EQUIPMENT

- A. Wherever field conditions are such that for proper execution of the work reasonable changes in location of conduits and equipment are necessary and required, the Contractor shall make such changes as directed and approved, without extra cost.

1.9 INSPECTION AND TESTS

- A. Prior to commencing the testing procedure, the contractor shall submit the following information;

1. Describe methods utilized.
 2. Submit information for each electrical system to be tested.
 3. Advise Owner and Engineer of schedule.
- B. At the time of the final inspection and tests, all connections at the panels and all splices, etc., must have been completed. All fuses must be in place and the circuits continuous from service switches to all receptacles, outlets, motors, etc. Each entire wiring system must test free from short circuits and grounds. When wiring systems are "megger" tested, the insulation resistance between conductors and between conductors and grounds, based on maximum load, shall not be less than that required by National Electrical Code and local authorities having jurisdiction. A written record of all test data shall be supplied to the Architect (five copies). The tests shall cover but not be limited to the following:
1. Fire alarm, smoke detection and sprinkler alarm systems.
 2. All communications, signaling and alarm systems.
 3. Power installations and motor controls.
 4. Any part of the work called for in the Specifications, or Drawings and as designated by the Architect or Engineers.
 5. Test equipment for rated output as indicated on drawings. Adjust as required.
- C. Provide all necessary testing equipment, instruments, and skilled personnel for the tests. If in the opinion of the Architect, the results of such tests show that the work has not complied with the requirements of the Specifications or Drawings, the Contractor shall make all additions or changes necessary to put the system in proper working condition and shall pay for all the expenses and for all subsequent tests which are necessary to determine whether the work is satisfactory. Any additional work or subsequent tests shall be carried out at the convenience of the Owner, prior to final payment.
- D. Upon completion of the testing procedures contractor to submit a report for all systems tested and include all testing data.

1.10 TEMPORARY LIGHT AND POWER

- A. Electric services for temporary light and power shall be obtained from the nearest existing switchboard and extended as required. Consult the Owner prior to making any connections to existing services.
- B. The Electrical Contractor shall furnish, install and maintain the temporary lighting and power system for all Contractors. The use of electricity shall be kept to a minimum.
- C. The Owner or Owner's Representative will pay for all energy required by the temporary lighting and power system.
- D. Provide all wiring, supports, lamp sockets, receptacle sockets and any other materials, supplies or equipment necessary for temporary light and power system.
- E. Ground fault protection required by OSHA for temporary receptacle circuits shall be accomplished by providing branch circuit panels containing ground fault protection branch circuit breakers.

- F. Provide a grounding conductor connection to each receptacle grounding terminal. Minimum size branch circuit and grounding conductors shall be No. 12 AWG.
- G. Install separate stringer circuits for lighting and receptacles. Provide one lamp socket and one duplex receptacle (or two single receptacles) for every 400 square feet of new general construction area. (Approximately 20 feet on centers). Furthermore, provide one lamp socket and one duplex receptacle every 20 feet along the peripheral walls of the construction areas for temporary conditions. Each lamp socket shall be provided with a 100 watt lamp. Replace burned out lamps as required as long as the temporary lighting system is maintained in operation.
- H. Provide sufficient supplementary temporary lighting to permit proper execution of the work. This supplementary lighting shall consist of but not be limited to the following:
 - 1. Construction hoist landings.
 - 2. Stairways and stairway landings where existing illumination is inadequate due to alterations or construction.
 - 3. Interior rooms not covered with general construction area lighting.
- I. Provide power wiring to operate construction hoist. Provide fused disconnect switch at hoist location. Fuse size, wiring size and disconnect shall be as required.
- J. Provide 50 trailer extension cords, each 25 feet long.
 - 1. 25 of the trailer cord sets shall be receptacle type
 - 2. 25 of the trailer cord sets shall be trouble light type with receptacle
 - 3. Distribution of these cord sets to Mechanical and other contractors shall be as directed by the Owner's Representative.
- K. Keep the temporary lighting and power system operational commencing fifteen (15) minutes before the established starting time of that trade which starts work earliest in the morning and ending fifteen (15) minutes after the established quitting time of that trade which stops work latest in the evening. This applies to all weekdays, Monday through Friday inclusive, which are established as regular working days for any trade engaged in the work, and shall continue until Final Acceptance of the work or until these services are ordered terminated by the Owner or the Owner's Representative.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 COMMON REQUIREMENTS FOR ELECTRICAL INSTALLATION

- A. Comply with NECA1.
- 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 as to facilitate future disconnecting with minimum interference with other items in the vicinity.
- E. Right of Way: Give to piping systems installed at a required slope.

END OF SECTION 26 05 00

SECTION 26 05 19

LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. This Section is to coordinate with and be complementary to the General Conditions and Supplementary General Conditions of the work, and Division 01 Specification Sections wherever applicable to Mechanical and Electrical Work.
- B. Section 01 31 46 – Special Requirements for Mechanical and Electrical Work shall apply.
- C. Section 26 05 00 – General Provisions for Electrical Work shall apply

1.2 SUMMARY

- A. Section Includes:
 - 1. Copper building wire rated 600V or less.
 - 2. Metal-clad cable, Type MC, rated 600V or less.
 - 3. Armored cable, Type AC, rated 600V or less.
 - 4. Connectors, splices, and terminations rated 600V and less.

1.3 CLICK DEFINITIONS

- A. VFC(S): Variable-frequency controller. (System)
- B. EPDM: Ethylene-propylene-diene terpolymer rubber.
- C. NBR: Acrylonitrile-butadiene rubber.

1.4 ACTION SUBMITTALS

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

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For testing agency or manufacturer's authorized service representative.
- B. Field quality-control reports.

1.6 QUALITY ASSURANCE

- A. Testing Agency's Field Supervisor:
- B. Testing Agency Qualifications: Member company of NETA.

1. An independent agency, with the experience and capability to conduct the testing indicated 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.
- C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- D. Comply with NFPA 70.

PART 2 - PRODUCTS

2.1 COPPER BUILDING WIRE

- A. Description: Flexible, insulated and uninsulated, drawn copper current-carrying conductor with an overall insulation layer or jacket, or both, rated 600 V or less.
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 1. Alpha Wire Company
 2. American Bare Conductor
 3. Belden Inc
 4. Cerro Wire LLC
 5. Encore Wire Corporation
 6. Okonite Company
 7. Service wire Co
 8. Southwire Company
 9. Wesco
- C. Standards:
 1. Listed and labeled as defined in NFPA70, by a qualified testing agency, and marked for intended location and use.
 2. RoHS compliant.
 3. Conductor and Cable Marking: Comply with wire and cable marking according to UL's "Wire and Cable Marking and Application Guide."
- D. Conductors: Copper, complying with ASTM B3 for bare annealed copper and with ASTM B496 for stranded conductors.
- E. Conductor Insulation:
 1. Type NM: Comply with UL83 and UL719.
 2. Type RHH and Type RHW-2: Comply with UL44.
 3. Type USE-2 and Type SE: Comply with UL854.
 4. Type TC-ER: Comply with NEMA WC 0/ICEA S-95-658 and UL 1277.
 5. Type THHN and Type THWN-2: Comply with UL 83.
 6. Type THW and Type THW-2: Comply with NEMA WC-70/ICEA S-95-658 and UL 83.
 7. Type UF: Comply with UL 83 and UL 493.
 8. Type XHHW-2: Comply with UL 44.
- F. Shield:

1. Type TC-ER: Cable designed for use with VFCs, with oversized crosslinked polyethylene insulation, spiral-wrapped foil plus 85 percent coverage braided shields and insulated full-size ground wire.

2.2 METAL-CLAD CABLE, TYPE MC

- A. Description: A factory assembly of one or more current-carrying insulated conductors in an overall metallic sheath.
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 1. Alpha Wire Company
 2. American Bare Conductor
 3. Belden Inc
 4. Cerro Wire LLC
 5. Encore Wire Corporation
 6. Okonite Company
 7. Service wire Co
 8. Southwire Company
 9. Wesco
- C. Standards:
 1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.
 2. Comply with UL 1569.
 3. RoHS compliant.
 4. Conductor and Cable Marking: Comply with wire and cable marking according to UL's "Wire and Cable Marking and Application Guide."
- D. Circuits:
 1. Single circuit and multicircuit with color-coded conductors.
 2. Power-Limited Fire-Alarm Circuits: Comply with UL 1424.
- E. Conductors:
 1. Copper, complying with ASTM B3 for bare annealed copper and with ASTM B8 for stranded conductors
- F. Ground Conductor: Insulated.
- G. Conductor Insulation:
 1. Type TFN/THHN/THWN-2: Comply with UL 83.
 2. Type XHHW-2: Comply with UL 44.
- H. Armor: Aluminum, interlocked.
- I. Jacket: PVC applied over armor.

2.3 ARMORED CABLE, TYPE AC

- A. Description: A factory assembly of insulated current-carrying conductors with or without an equipment grounding conductor in an overall metallic sheath.

- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Alpha Wire Company
 - 2. American Bare Conductor
 - 3. Belden Inc
 - 4. Cerro Wire LLC
 - 5. Encore Wire Corporation
 - 6. Okonite Company
 - 7. Service wire Co
 - 8. Southwire Company
 - 9. Wesco

 - C. Standards:
 - 1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.
 - 2. RoHS compliant.
 - 3. Comply with UL4.
 - 4. Conductor and Cable Marking: Comply with wire and cable marking according to UL's "Wire and Cable Marking and Application Guide."

 - D. Circuits:
 - 1. Single circuit and multicircuit with color-coded conductors.
 - 2. Power-Limited Fire-Alarm Circuits: Comply with UL 1424.

 - E. Conductors:
 - 1. Copper, complying with ASTM B3 for bare annealed copper and with ASTM B8 for stranded conductors

 - F. Ground Conductor: Insulated.

 - G. Conductor Insulation:
 - 1. Type TFN/THHN/THWN-2: Comply with UL 83.
 - 2. Type XHHW-2: Comply with UL 44.

 - H. Conductor Insulation: Type THHN/THWN-2. Comply with UL 83.

 - I. Armor Aluminum, interlocked.
- 2.4 MINERAL-INSULATED CABLE, TYPE MI
- A. Description: Solid copper conductors encased in compressed metal oxide with an outer metallic sheath, rated 600V or less.

 - B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. KME America, Inc
 - 2. Pentair

 - C. Standards:

1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.
2. UL 2196 for fire resistance.
3. Conductor and Cable Marking: Comply with wire and cable marking according to UL's "Wire and Cable Marking and Application Guide."

D. Conductors:

1. Copper, complying with ASTM B3 for bare annealed copper.

E. Insulation: Compressed magnesium oxide

F. Sheath: Copper.

2.5 CONNECTORS AND SPLICES

- A. Description: Factory-fabricated connectors, splices, and lugs of size, ampacity rating, material, type, and class for application and service indicated; listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.

Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. 3M Electrical Products
2. AFC Cable systems
3. Gardnes Bender
4. Hubblee Power systems
5. ILSCO
6. O-Z/Gedney
7. Service wire Co.
8. TE Connectivity
9. Thomas & Betts Corp.

- B. Jacketed Cable Connectors: For steel and aluminum jacketed cables, zinc die-cast with set screws, designed to connect conductors specified in this Section.

- C. Lugs: One piece, seamless, designed to terminate conductors specified in this Section.

1. Material: Aluminum
2. Type: One hole with long barrels.
3. Termination: Compression.

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.
- C. VFC Output Circuits Cable: Extra-flexible stranded for all sizes.
- D. Power-Limited Fire Alarm and Control: Solid for No. 12 AWG and smaller.

3.2 CONDUCTOR INSULATION AND MULTICONDUCTOR CABLE APPLICATIONS AND WIRING METHODS

- A. Exposed Feeders: Type THHN/THWN-2, single conductors in raceway.
- B. Feeders Concealed in Ceilings, Walls, Partitions, and Crawlspace: Type THHN/THWN-2, single conductors in raceway,
 - 1. Type THHN/THWN-2, single conductors in raceway
 - 2. Armored cable, Type AC,
 - 3. Metal-clad cable,
 - 4. Type MC, Mineral-insulated, metal-sheathed cable, Type MI
- C. Feeders Concealed in Concrete, below Slabs-on-Grade, and Underground: Type THHN/THWN-2, single conductors in raceway.
- D. Exposed Branch Circuits, Including in Crawlspace:
 - 1. Type THHN/THWN-2, single conductors in raceway
 - 2. Armored cable, Type AC,
 - 3. Metal-clad cable,
 - 4. Type MC, Mineral-insulated, metal-sheathed cable, Type MI
- E. Branch Circuits Concealed in Ceilings, Walls, and Partitions:
 - 1. Type THHN/THWN-2, single conductors in raceway
 - 2. Armored cable, Type AC,
 - 3. Metal-clad cable,
 - 4. Type MC, Mineral-insulated, metal-sheathed cable, Type MI
- F. Branch Circuits Concealed in Concrete, below Slabs-on-Grade, and Underground: Type THHN/THWN-2, single conductors in raceway
- G. Branch Circuits Installed below Raised Flooring:
 - 1. Type THHN/THWN-2, single conductors in raceway
 - 2. Armored cable, Type AC,
 - 3. Metal-clad cable,
 - 4. Type MC, Mineral-insulated, metal-sheathed cable, Type MI
- H. VFC Output Circuits:
 - 1. Type XHHW-2 in metal conduit
 - 2. Type TC-ER cable with braided shield
 - 3. Type TC-ER cable with dual tape shield.

3.3 INSTALLATION OF CONDUCTORS AND CABLES

- A. Conceal cables in finished walls, ceilings, and floors unless otherwise indicated.
- B. Complete raceway installation between conductor and cable termination points according to Section 260533 "Raceway and Boxes for Electrical Systems" prior to pulling conductors and cables.

- C. 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.
- D. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips that will not damage cables or raceway.
- E. Install exposed cables parallel and perpendicular to surfaces of exposed structural members, and follow surface contours where possible.
- F. Support cables according to Section 260529 "Hangers and Supports for Electrical Systems."

3.4 CONNECTIONS

- A. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A-486B.
- B. Make splices, terminations, and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than unspliced conductors.
 - 1. Use oxide inhibitor in each splice, termination, and tap for aluminum conductors.
- C. Wiring at Outlets: Install conductor at each outlet, with at least 6 inches (150 mm) of slack.

3.5 IDENTIFICATION

- A. Identify and color-code conductors and cables according to Section 260553 "Identification for Electrical Systems."
- B. Identify each spare conductor at each end with identity number and location of other end of the conductor, and identify as spare conductor.

3.6 SLEEVE AND SLEEVE-SEAL INSTALLATION FOR ELECTRICAL PENETRATIONS

- A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies. Comply with requirements in Section 260544 "Sleeves and Sleeve Seals for Electrical Raceways and Cabling."

3.7 FIRESTOPPING

- A. Apply firestopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly according to Section 078400 "Firestops and Smoke Seals."

3.8 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.

- B. Perform tests and inspections with the assistance of a factory-authorized service representative.
 - 1. After installing conductors and cables and before electrical circuitry has been energized, test feeder conductors for compliance with requirements.
 - 2. After installing conductors and cables and before electrical circuitry has been energized, test feeder conductors and conductors feeding the following critical equipment and services for compliance with requirements:
 - a. Newly installed feeders from existing motor control centers.
 - b. Feeders from new and existing panelboards to new motors.
 - c. Fire Alarm Control and associated panels
 - 3. Perform each of the following visual and electrical tests:
 - a. Inspect exposed sections of conductor and cable for physical damage and correct connection according to the single-line diagram.
 - b. Test bolted connections for high resistance using one of the following:
 - 1) A low-resistance ohmmeter.
 - 2) Calibrated torque wrench.
 - 3) Thermographic survey.
 - c. Inspect compression-applied connectors for correct cable match and indentation.
 - d. Inspect for correct identification.
 - e. Inspect cable jacket and condition.
 - f. Insulation-resistance test on each conductor for ground and adjacent conductors. Apply a potential of 500-Vdc for 300-V rated cable and 1000-Vdc for 600-V rated cable for a one-minute duration.
 - g. Continuity test on each conductor and cable.
 - h. Uniform resistance of parallel conductors.
 - 4. Initial Infrared Scanning: After Substantial Completion, but before Final Acceptance, perform an infrared scan of each splice in conductors No. 3 AWG and larger. Remove box and equipment covers so splices are accessible to portable scanner. Correct deficiencies determined during the scan.
 - a. Instrument: Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.
 - b. Record of Infrared Scanning: Prepare a certified report that identifies switches checked and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.
- C. Cables will be considered defective if they do not pass tests and inspections.
- D. Prepare test and inspection reports to record the following:
 - 1. Procedures used.
 - 2. Results that comply with requirements.
 - 3. Results that do not comply with requirements, and corrective action taken to achieve compliance with requirements.

END OF SECTION 26 05 19

SECTION 26 05 26

GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. This Section is to coordinate with and be complementary to the General Conditions and Supplementary General Conditions of the work, and Division 01 Specification Sections wherever applicable to Mechanical and Electrical Work.
- B. Section 01 31 46 – Special Requirements for Mechanical and Electrical Work shall apply.
- C. Section 26 05 00 – General Provisions for Electrical Work shall apply

1.2 SUMMARY

- A. Section includes grounding and bonding systems and equipment, plus the following special applications:
 - 1. Underground distribution grounding.

1.3 DESCRIPTION OF WORK

- A. The work includes the providing of all labor, materials, equipment, accessories, services and tests necessary to complete and make ready for operation by the Owner, all grounding in accordance with Drawings and Specifications and as required for a complete system.

1.4 ACTION SUBMITTALS

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

1.5 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Plans showing dimensioned locations of grounding features specified in "Field Quality Control" Article, including the following:
 - 1. Grounding for sensitive electronic equipment.
- B. Field quality-control reports.

1.6 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For grounding to include in emergency, operation, and maintenance manuals.
- B. "Manufacturers" - Firms regularly engaged in manufacture of the type of equipment required for the application, whose products have been in satisfactory use in similar service for not less than 10 years. Refer to Approved Manufacturers in this Section.

- C. Provide equipment whose performance under specified conditions is certified by the manufacturer and comply with applicable publications of NFPA and UL.
- D. Grounding shall comply with New York City Electrical Code (NYCEC) for construction and installation.

PART 2 - PRODUCTS

2.1 SYSTEM DESCRIPTION

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Comply with UL 467 for grounding and bonding materials and equipment.

2.2 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 1. ERICO International Corporation
 2. O-Z/Gedney
 3. Thomas and Betts Corporation
 4. Burndy
 5. Galvan Industries

2.3 CONDUCTORS

- A. Insulated Conductors: Copper or tinned-copper wire or cable insulated for 600 V unless otherwise required by applicable Code or authorities having jurisdiction.
- B. Bare Copper Conductors:
 1. Solid Conductors: ASTM B 3.
 2. Stranded Conductors: ASTM B 8.
 3. Tinned Conductors: ASTM B 33.
 4. Bonding Conductor: No. 4 or No. 6 AWG, stranded conductor.
 5. Tinned Bonding Jumper: Tinned-copper tape, braided conductors terminated with copper
- C. Grounding Bus: Predrilled rectangular bars of annealed copper, 1/4 by 24 inches (6.3 by 100 mm) in cross section, with 9/32-inch (7.14-mm) holes spaced 1-1/8 inches (28 mm) apart. Stand-off insulators for mounting shall comply with UL 891 for use in switchboards, 600 V and shall be Lexan or PVC, impulse tested at 5000 V.

2.4 CONNECTORS

- A. Listed and labeled by an NRTL acceptable to authorities having jurisdiction for applications in which used and for specific types, sizes, and combinations of conductors and other items connected.

- B. Welded Connectors: Exothermic-welding kits of types recommended by kit manufacturer for materials being joined and installation conditions.
- C. Bus-Bar Connectors: Mechanical type, cast silicon bronze, solderless compression wire terminals, and long-barrel, two-bolt connection to ground bus bar.
- D. Bus-Bar Connectors: Compression type, copper or copper alloy, with two wire terminals.
- E. Beam Clamps: Mechanical type, terminal, ground wire access from four directions, with dual, tin-plated or silicon bronze bolts.
- F. Cable-to-Cable Connectors: Compression type, copper or copper alloy.
- G. Conduit Hubs: Mechanical type, terminal with threaded hub.
- H. Ground Rod Clamps: Mechanical type, copper or copper alloy, terminal with socket set screw.
- I. Lay-in Lug Connector: Mechanical type, copper rated for direct burial terminal with set screw.
- J. Straps: Solid copper, copper lugs. Rated for 600 A.
- K. U-Bolt Clamps: Mechanical type, copper or copper alloy, terminal listed for direct burial.
- L. Water Pipe Clamps:
 - 1. Mechanical type, two pieces with zinc-plated bolts.
 - a. Material: Die-cast zinc alloy.
 - b. Listed for direct burial.
 - 2. U-bolt type with malleable-iron clamp and copper ground connector rated for direct burial.

PART 3 - EXECUTION

3.1 APPLICATIONS

- A. Conductors: Install solid conductor for No. 8 AWG and smaller, and stranded conductors for No. 6 AWG and larger unless otherwise indicated.
- B. Grounding Bus: Install in electrical equipment rooms, in rooms housing service equipment, and elsewhere as indicated.
 - 1. Install bus horizontally, on insulated spacers 2 inches (50 mm) minimum from wall, 6 inches (150 mm) above finished floor unless otherwise indicated.
 - 2. Where indicated on both sides of doorways, route bus up to top of door frame, across top of doorway, and down; connect to horizontal bus.
- C. Conductor Terminations and Connections:
 - 1. Pipe and Equipment Grounding Conductor Terminations: Bolted connectors.
 - 2. Underground Connections: Welded connectors except at test wells and as otherwise indicated.
 - 3. Connections to Ground Rods at Test Wells: Bolted connectors.

4. Connections to Structural Steel: Welded connectors.

3.2 GROUNDING AT THE SERVICE

- A. Equipment grounding conductors and grounding electrode conductors shall be connected to the ground bus. Install a main bonding jumper between the neutral and ground buses.

3.3 EQUIPMENT GROUNDING

- A. Install insulated equipment grounding conductors with all feeders and branch circuits.
- B. Install insulated equipment grounding conductors with the following items, in addition to those required by NFPA 70:
 1. Feeders and branch circuits.
 2. Lighting circuits.
 3. Receptacle circuits.
 4. Single-phase motor and appliance branch circuits.
 5. Three-phase motor and appliance branch circuits.
 6. Flexible raceway runs.
 7. Armored and metal-clad cable runs.
- C. Insulated equipment grounding conductor to duct-mounted electrical devices operating at 120 V and more, including air cleaners, heaters, dampers, humidifiers, and other duct electrical equipment. Bond conductor to each unit and to air duct and connected metallic piping.
- D. Heat-Tracing, and Antifrost Heating Cables: Install a separate insulated equipment grounding conductor to each electric water heater and heat-tracing cable. Bond conductor to heater units, piping, connected equipment, and components.

3.4 INSTALLATION

- A. Grounding Conductors: Route along shortest and straightest paths possible unless otherwise indicated or required by Code. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.
- B. Ground Rods: Drive rods until tops are 2 inches (50 mm) below finished floor or final grade unless otherwise indicated.
 1. Interconnect ground rods with grounding electrode conductor below grade and as otherwise indicated. Make connections without exposing steel or damaging coating if any.
 2. Use exothermic welds for all below-grade connections.
- C. Bonding Straps and Jumpers: Install in locations accessible for inspection and maintenance except where routed through short lengths of conduit.
 1. Bonding to Structure: Bond straps directly to basic structure, taking care not to penetrate any adjacent parts.
 2. Bonding to Equipment Mounted on Vibration Isolation Hangers and Supports: Install bonding so vibration is not transmitted to rigidly mounted equipment.
 3. Use exothermic-welded connectors for outdoor locations; if a disconnect-type connection is required, use a bolted clamp.

- D. Grounding and Bonding for Piping:
 - 1. Metal Water Service Pipe: Install insulated copper grounding conductors, in conduit, from building's main service equipment, or grounding bus, to main metal water service entrances to building. Connect grounding conductors to main metal water service pipes; use a bolted clamp connector or bolt a lug-type connector to a pipe flange by using one of the lug bolts of the flange. Where a dielectric main water fitting is installed, connect grounding conductor on street side of fitting. Bond metal grounding conductor conduit or sleeve to conductor at each end.
 - 2. Water Meter Piping: Use braided-type bonding jumpers to electrically bypass water meters. Connect to pipe with a bolted connector.
 - 3. Bond each aboveground portion of gas piping system downstream from equipment shutoff valve.

- E. Bonding Interior Metal Ducts: Bond metal air ducts to equipment grounding conductors of associated fans, blowers, electric heaters, and air cleaners. Install tinned bonding jumper to bond across flexible duct connections to achieve continuity.

- F. Grounding for Steel Building Structure: Install a driven ground rod at base of each corner column and at intermediate exterior columns at distances not more than 60 feet (18 m) apart.

- G. Select connectors, connection hardware, conductors, and connection methods so metals in direct contact are galvanically compatible.
 - 1. Use electroplated or hot-tin-coated materials to ensure high conductivity and to make contact points closer in order of galvanic series.
 - 2. Make connections with clean, bare metal at points of contact.
 - 3. Make aluminum-to-steel connections with stainless-steel separators and mechanical clamps.
 - 4. Make aluminum-to-galvanized-steel connections with tin-plated copper jumpers and mechanical clamps.
 - 5. Coat and seal connections having dissimilar metals with inert material to prevent future penetration of moisture to contact surfaces.

3.5 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

- B. Tests and Inspections:
 - 1. After installing grounding system but before permanent electrical circuits have been energized, test for compliance with requirements.
 - 2. Inspect physical and mechanical condition. Verify tightness of accessible, bolted, electrical connections with a calibrated torque wrench according to manufacturer's written instructions.
 - 3. Test completed grounding system at each location where a maximum ground-resistance level is specified, at service disconnect enclosure grounding terminal, at ground test wells, and at individual ground rods. Make tests at ground rods before any conductors are connected.
 - a. Measure ground resistance no fewer than two full days after last trace of precipitation and without soil being moistened by any means other than natural drainage or seepage and without chemical treatment or other artificial means of reducing natural ground resistance.

- b. Perform tests by fall-of-potential method according to IEEE 81.
 4. Prepare dimensioned Drawings locating each test well, ground rod and ground-rod assembly, and other grounding electrodes. Identify each by letter in alphabetical order, and key to the record of tests and observations. Include the number of rods driven and their depth at each location and include observations of weather and other phenomena that may affect test results. Describe measures taken to improve test results.
- C. Grounding system will be considered defective if it does not pass tests and inspections.
- D. Prepare test and inspection reports.
- E. Report measured ground resistances that exceed the following values:
 1. Power and Lighting Equipment or System with Capacity of 500 kVA and Less: 10 ohms.
 2. Power and Lighting Equipment or System with Capacity of 500 to 1000 kVA: 5 ohms.
- F. Excessive Ground Resistance: If resistance to ground exceeds specified values, notify Architect promptly and include recommendations to reduce ground resistance.

END OF SECTION 26 05 26

SECTION 26 05 29

HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. This Section is to coordinate with and be complementary to the General Conditions and Supplementary General Conditions of the work, and Division 01 Specification Sections wherever applicable to Mechanical and Electrical Work.
- B. Section 01 31 46 – Special Requirements for Mechanical and Electrical Work shall apply.
- C. Section 26 05 00 – General Provisions for Electrical Work shall apply

1.2 SUMMARY

- A. Section Includes:
 - 1. Steel slotted support systems.
 - 2. Aluminum slotted support systems.
 - 3. Nonmetallic slotted support systems.
 - 4. Conduit and cable support devices.
 - 5. Support for conductors in vertical conduit.
 - 6. Structural steel for fabricated supports and restraints.
 - 7. Mounting, anchoring, and attachment components, including powder-actuated fasteners, mechanical expansion anchors, concrete inserts, clamps, through bolts, toggle bolts, and hanger rods.
 - 8. Fabricated metal equipment support assemblies.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for the following:
 - a. Slotted support systems, hardware, and accessories.
 - b. Clamps.
 - c. Hangers.
 - d. Sockets.
 - e. Eye nuts.
 - f. Fasteners.
 - g. Anchors.
 - h. Saddles.
 - i. Brackets.
 - 2. Include rated capacities and furnished specialties and accessories.
- B. Shop Drawings: Signed and sealed by a qualified professional engineer. For fabrication and installation details for electrical hangers and support systems.

1. Hangers. Include product data for components.
2. Slotted support systems.
3. Equipment supports.
4. Vibration Isolation Base Details: Detail fabrication including anchorages and attachments to structure and to supported equipment. Include adjustable motor bases, rails, and frames for equipment mounting.

1.4 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. Suspended ceiling components.
 2. Ductwork, piping, fittings, and supports.
 3. Structural members to which hangers and supports will be attached.
 4. Size and location of initial access modules for acoustical tile.
 5. Items penetrating finished ceiling, including the following:
 - a. Luminaires.
 - b. Air outlets and inlets.
 - c. Speakers.
 - d. Sprinklers.
 - e. Access panels.
 - f. Projectors.
- B. Seismic Qualification Data: Certificates, for hangers and supports for electrical equipment and systems, accessories, and components, from manufacturer.
1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
 2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
 3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
- C. Welding certificates.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Engage a qualified professional engineer, as defined in "Quality Requirements," to design hanger and support system.
1. Design supports for multiple raceways, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
 2. Design supports for multiple raceways capable of supporting combined weight of supported systems and its contents.
 3. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.

4. Rated Strength: Adequate in tension, shear, and pullout force to resist maximum loads calculated or imposed for this Project, with a minimum structural safety factor of five times the applied force.

2.2 SUPPORT, ANCHORAGE, AND ATTACHMENT COMPONENTS

- A. Steel Slotted Support Systems: Preformed steel channels and angles with minimum 13/32-inch- (10-mm-) diameter holes at a maximum of 8 inches (200 mm) o.c. in at least one surface.
 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. Standard: Comply with MFMA-4 factory-fabricated components for field assembly.
 3. Material for Channel, Fittings, and Accessories: Stainless steel, Type 316.
 4. Channel Width: 13/16 inches (20.64 mm)
 5. Metallic Coatings: Hot-dip galvanized after fabrication and applied according to MFMA-4.
 6. Nonmetallic Coatings: Manufacturer's standard PVC, polyurethane, or polyester coating applied according to MFMA-4.
 7. Painted Coatings: Manufacturer's standard painted coating applied according to MFMA-4.
 8. Protect finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- B. Aluminum Slotted Support Systems: Extruded-aluminum channels and angles with minimum 13/32-inch- (10-mm-) diameter holes at a maximum of 8 inches (200 mm) o.c. in at least one surface.
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Cooper B-Line, Inc.; a division of Cooper Industries.
 - b. Thomas & Betts Corporation.
 - c. Unistrut; Tyco International, Ltd.
 - d. MKT Metal Manufacturing
 - e. Flex-Strut Inc.
 2. Standard: Comply with MFMA-4 factory-fabricated components for field assembly.
 3. Channel Material: 6063-T5 aluminum alloy.
 4. Fittings and Accessories Material: 5052-H32 aluminum alloy.
 5. Channel Width: 1-5/8 inches (41.25 mm)
 6. Applied according to MFMA-4.
 7. Painted Coatings: Manufacturer's standard painted coating applied according to MFMA-4.
 8. Protect finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

- C. Nonmetallic Slotted Support Systems: Structural-grade, factory-formed, glass-fiber-resin channels and angles with minimum 13/32-inch- (10-mm-) diameter holes at a maximum of 8 inches (200 mm) o.c., in at least one surface.
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. Haydon Corporation
 - d. G-Strut
 2. Standard: Comply with MFMA-4 factory-fabricated components for field assembly.
 3. Channel Width: 1-5/8 inches (41.25 mm).
 4. Fittings and Accessories: Products provided by channel and angle manufacturer and designed for use with those items.
 5. Fitting and Accessory Materials: Same as those for channels and angles, except metal items may be stainless steel.
 6. Rated Strength: Selected to suit applicable load criteria.
 7. Protect finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- D. Conduit and Cable Support Devices: Stainless-steel hangers, clamps, and associated fittings, designed for types and sizes of raceway or cable to be supported.
- E. Support for Conductors in Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug or plugs for nonarmored electrical conductors or cables in riser conduits. Plugs shall have number, size, and shape of conductor gripping pieces as required to suit individual conductors or cables supported. Body shall be made of malleable iron.
- F. Structural Steel for Fabricated Supports and Restraints: ASTM A 36/A 36M steel plates, shapes, and bars; black and galvanized.
- G. Mounting, Anchoring, and Attachment Components: Items for fastening electrical items or their supports to building surfaces include the following:
1. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete, steel, or wood, with tension, shear, and pullout capacities appropriate for supported loads and building materials where used.
 - a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1) Hilti, Inc
 - 2) ITW Ramset/Red Head
 - 3) MKT Fastening, LLC
 - 4) Simpson Strong-Tie Co.
 2. Mechanical-Expansion Anchors: Insert-wedge-type, **zinc-coated or stainless** steel, for use in hardened portland cement concrete, 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) B-line
 - 2) Hilti, Inc

- 3) ITW Ramset/Red Head
- 4) MKT Fastening, LLC
3. Concrete Inserts: Steel or malleable-iron, slotted support system units are similar to MSS Type 18 units and comply with MFMA-4 or MSS SP-58.
4. Clamps for Attachment to Steel Structural Elements: MSS SP-58 units are suitable for attached structural element.
5. Through Bolts: Structural type, hex head, and high strength. Comply with ASTM A 325.
6. Toggle Bolts: Stainless-steel springhead type.
7. Hanger Rods: Threaded steel.

2.3 FABRICATED METAL EQUIPMENT SUPPORT ASSEMBLIES

PART 3 - EXECUTION

3.1 APPLICATION

- A. Comply with the following standards for application and installation requirements of hangers and supports, except where requirements on Drawings or in this Section are stricter:
 1. NECA 1.
 2. NECA 101
 3. NECA 102.
 4. NECA 105.
 5. NECA 111.
- B. Comply with requirements in Section 078400 "Firestops and Smoke Seals" for firestopping materials and installation for penetrations through fire-rated walls, ceilings, and assemblies.
- C. Comply with requirements for raceways and boxes specified in Section 260533 "Raceway and Boxes for Electrical Systems."
- D. EMT, IMC, and RMC as scheduled in NECA 1, where its Table 1 lists maximum spacings that are less than those stated in NFPA 70. Minimum rod size shall be 1/4 inch (6 mm) in diameter.
- E. Multiple Raceways or Cables: Install trapeze-type supports fabricated with steel slotted or other support system, sized so capacity can be increased by at least 25 percent in future without exceeding specified design load limits.
 1. Secure raceways and cables to these supports with two-bolt conduit clamps.
- F. Spring-steel clamps designed for supporting single conduits without bolts may be used for 1-1/2-inch (38-mm) 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.
- B. Raceway Support Methods: In addition to methods described in NECA 1, EMT IMC and RMC may be supported by openings through structure members, according to 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 (90 kg).
- D. Mounting and Anchorage of Surface-Mounted Equipment and Components: Anchor and fasten electrical items and their supports to building structural elements by the following methods unless otherwise indicated by code:
 - 1. To Wood: Fasten with lag screws or through bolts.
 - 2. To New Concrete: Bolt to concrete inserts.
 - 3. To Masonry: Approved toggle-type bolts on hollow masonry units and expansion anchor fasteners on solid masonry units.
 - 4. To Existing Concrete: Expansion anchor fasteners.
 - 5. To Steel: Welded threaded studs complying with AWS D1.1/D1.1M, with lock washers and nuts.
 - 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.
- E. Drill holes for expansion anchors in concrete at locations and to depths that avoid the need for reinforcing bars.

3.3 INSTALLATION OF FABRICATED METAL SUPPORTS

- A. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor electrical materials and equipment.
- B. Field Welding: Comply with AWS D1.1/D1.1M.

3.4 PAINTING

- A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use the 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 a minimum dry film thickness of 2.0 mils (0.05 mm).
- B. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

END OF SECTION 26 05 29

SECTION 26 05 33

RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. This Section is to coordinate with and be complementary to the General Conditions and Supplementary General Conditions of the work, and Division 01 Specification Sections wherever applicable to Mechanical and Electrical Work.
- B. Section 01 31 46 – Special Requirements for Mechanical and Electrical Work shall apply.
- C. Section 26 05 00 – General Provisions for Electrical Work shall apply

1.2 SUMMARY

- A. This Section includes raceways, fittings, boxes, enclosures, and cabinets for electrical wiring.
 - 1. Section 26 05 44 – Sleeves and Sleeve Seals for Electrical Raceways and Cabling
- B. The requirements of this section apply to raceway work required for the protection of electrical conductors. Raceways are required for all wiring unless otherwise specified.
- C. The work includes the furnishing and installation of completely coordinated, effectively grounded raceway systems complete with boxes, fittings, flexible connections to vibrating equipment and other accessories, as required. Conduit or tubing sizes referred to in the Specifications and on the Drawings are nominal trade sizes.

1.3 DEFINITIONS

- A. EMT: Electrical metallic tubing.
- B. FMC: Flexible metal conduit.
- C. IMC: Intermediate metal conduit.
- D. LFMC: Liquidtight flexible metal conduit.
- E. LFNC: Liquidtight flexible nonmetallic 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: For wireways, nonmetallic 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. Source quality-control test reports.
- 1.5 QUALITY ASSURANCE
- A. Comply with NFPA 70.
 - B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article by a testing agency acceptable to authorities having jurisdiction and marked for intended use.
 - C. Comply with New York City electrical Code (NYCEC).
 - a. Electrical Components, Devices, and Accessories: Listed and labeled as defined in, NYCEC Article 100 by a testing agency acceptable to authorities having jurisdiction and marked for intended use.

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. Rigid Steel Conduit: ANSI C80.1.
- C. Aluminum Rigid Conduit: ANSI C80.5.
- D. IMC: ANSI C80.6.
- E. PVC-Coated Steel Conduit: PVC-coated rigid steel conduit.

1. Comply with NEMA RN 1.
 2. Coating Thickness: 0.040 inch minimum.
- F. EMT: ANSI C80.3.
- G. FMC: Zinc-coated steel or aluminum where magnetic interference is indicated
- H. LFMC: Flexible steel conduit with PVC jacket.
- I. 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.
1. Conduit Fittings for Hazardous (Classified) Locations: Comply with UL 886.
 2. Fittings for EMT: Steel, compression type.
 3. Coating for Fittings for PVC-Coated Conduit: Minimum thickness, 0.040 inch with overlapping sleeves protecting threaded joints.
- J. Joint Compound for Rigid Steel Conduit or IMC: 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 NONMETALLIC CONDUIT, TUBING AND FITTINGS

A. Nonmetallic Conduit

1. Listing and Labeling: Nonmetallic conduit shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Petroflex
 - b. AFC Cable Systems, Inc.
 - c. Anamet Electrical, Inc.; Anaconda Metal Hose.
 - d. Arcco Corporation.
 - e. CANTEX Inc.
 - f. CertainTeed Corp.; Pipe & Plastics Group.
 - g. Condux International, Inc.
 - h. ElecSYS, Inc.
 - i. Electri-Flex Co.
 - j. Lamson & Sessions; Carlon Electrical Products.
 - k. Manhattan/CDT/Cole-Flex.
 - l. RACO; a Hubbell Company.
 - m. Thomas & Betts Corporation.
3. ENT: NEMA TC 13.
4. RNC: NEMA TC 2, Type EPC-80-PVC, unless otherwise indicated.
5. LFNC: UL 1660.
6. Continuous HDPE: Comply with UL 651A.
7. Coilable HDPE: Preassembled with conductors or cables and complying with ASTM D 3485.
8. RTRC: Comply with UL 2515A and NEMA TC 14.

B. Nonmetallic Fittings

1. Fittings, General: Listed and labeled for type of conduit, location, and use.

2. Fittings for ENT and RNC: NEMA TC 3; match to conduit or tubing type and material.
 - a. Fittings for LFNC: UL 514B.
3. Solvents and Adhesives: As recommended by conduit manufacturer.

2.3 OPTICAL FIBER/COMMUNICATIONS CABLE RACEWAY AND FITTINGS

- A. Manufacturers: Where permitted and subject to compliance with requirements, provide products by one of the following:
 1. Arco Corporation.
 2. Endot Industries Inc.
 3. IPEX Inc.
 4. Lamson & Sessions; Carlon Electrical Products.
- B. Description: Comply with UL 2024; flexible type, approved for plenum and riser installation.

2.4 METAL WIREWAYS AND AUXILIARY GUTTERS

- 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.
 4. Legrand Wiremold
- B. Description: Sheet metal sized and shaped as indicated, NEMA 250, Type 1, 4, 12, or 3R, unless otherwise indicated and sized according to NFPA 70
 1. Metal wireways installed outdoors shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- C. Fittings and Accessories: Include couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for complete system.
- D. Wireway Covers: Screw-cover type.
- E. Finish: Manufacturer's standard enamel finish.

2.5 SURFACE RACEWAYS

- A. Surface Metal Raceways: Galvanized steel with snap-on covers. Manufacturer's standard enamel finish in color selected by Architect.
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Thomas & Betts Corporation.
 - b. Legrand Walker Systems, Inc.;
 - c. Legrand Wiremold.
- B. Listing and Labeling: Surface raceways and tele-power poles shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

- C. Surface Nonmetallic Raceways: Two-piece construction, manufactured of rigid PVC with texture and color selected by Architect from manufacturer's standard colors.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Butler Manufacturing Company; Walker Division.
 - b. Enduro Systems, Inc.; Composite Products Division.
 - c. Hubbell Incorporated; Wiring Device-Kellems Division.
 - d. Lamson & Sessions; Carlon Electrical Products.
 - e. Panduit Corp.
 - f. Legrand Walker Systems, Inc.;
 - g. Legrand Wiremold.
 - a. Tele-Power Poles:
 - a. Butler Manufacturing Company; Walker Division.
 - b. Enduro Systems, Inc.; Composite Products Division.
 - c. Hubbell Incorporated; Wiring Device-Kellems Division.
 - d. Lamson & Sessions; Carlon Electrical Products.
 - e. Panduit Corp.
 - f. Legrand Walker Systems, Inc.;
 - g. Legrand Wiremold.
 - 2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Butler Manufacturing Company; Walker Division.
 - b. Enduro Systems, Inc.; Composite Products Division.
 - c. Hubbell Incorporated; Wiring Device-Kellems Division.
 - d. Lamson & Sessions; Carlon Electrical Products.
 - e. Panduit Corp.
 - f. Legrand Walker Systems, Inc.;
 - g. Legrand Wiremold.
 - 3. Material: Aluminum with clear anodized finish.
 - 4. Fittings and Accessories: Dividers, end caps, covers, cutouts, wiring harnesses, devices, mounting materials, and other fittings shall match and mate with tele-power pole as required for complete system.

2.6 BOXES, ENCLOSURES, AND CABINETS

- A. Listing and Labeling: boxes shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application
- B. 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. Legrand Walker Systems, Inc.;
 - 13. Woodhead, Daniel Company; Woodhead Industries, Inc. Subsidiary.
- C. General Requirements for Boxes, Enclosures, and Cabinets: Boxes, enclosures, and cabinets installed in wet locations shall be listed for use in wet locations.

- 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. Nonmetallic Outlet and Device Boxes: NEMA OS 2.
- G. Metal Floor Boxes: Cast or sheet metal, fully adjustable, rectangular.
- H. Nonmetallic Floor Boxes: Nonadjustable, round.
- I. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.
- J. Luminaire Outlet Boxes: Nonadjustable, designed for attachment of luminaire weighing 50 lb. Outlet boxes designed for attachment of luminaires weighing more than 50 lb. shall be listed and marked for the maximum allowable weight.
- K. Paddle Fan Outlet Boxes: Nonadjustable, designed for attachment of paddle fan weighing 70 lb.
 - 1. Listing and Labeling: Paddle fan outlet boxes shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- L. Box extensions used to accommodate building finishes shall be of same material as recessed box.
- M. Device Box Dimensions: 4 inches square by 2-1/8 inches deep for quad and telecommunication installations, and 4 inches by 2-1/8 inches by 2-1/8 inches deep for single device installations.
- N. Gangable boxes are prohibited.
- O. Cast-Metal Access, Pull, and Junction Boxes: NEMA FB 1 and UL 1773, galvanized, cast iron, or cast aluminum for high frequency applications, with gasketed cover.
- P. Hinged-Cover Enclosures: NEMA 250, Type 1, with continuous-hinge cover with flush latch for general use, or NEMA 250, Type 12, for dusty environments.
 - 1. Metal Enclosures: Steel, finished inside and out with manufacturer's standard enamel.
 - 2. Nonmetallic Enclosures: Plastic, finished inside with radio-frequency-resistant paint.
- Q. Cabinets:
 - 1. NEMA 250, Type 1, or NEMA 250, Type 12 as required, 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.

PART 3 - EXECUTION

3.1 RACEWAY APPLICATION

- A. Outdoors: Apply raceway products as specified below, unless otherwise indicated:

1. Exposed Conduit: Rigid steel conduit, RNC.
 2. Concealed Conduit, Aboveground: Rigid steel conduit RNC.
 3. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFMC.
 4. 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: Rigid steel conduit. Includes raceways in the following locations:
 - a. Loading dock.
 - b. Corridors used for traffic of mechanized carts, forklifts, and pallet-handling units.
 - c. Mechanical rooms/floors.
 3. Concealed in Ceilings and Interior Walls and Partitions: EMT
 4. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): FMC, except use LFMC in damp or wet locations.
 5. Damp or Wet Locations: Rigid steel conduit.
 6. Boxes and Enclosures: NEMA 250, Type 1, except use
 - a. NEMA 250, Type 4, stainless steel in corrosive locations, or
 - b. NEMA 250, Type 4, nonmetallic in damp or wet locations.
- C. Minimum Raceway Size: 3/4-inch (21-mm) trade size.
- D. Raceway Fittings: Compatible with raceways and suitable for use and location.
1. Rigid and Intermediate Steel Conduit: Use threaded rigid steel conduit fittings, unless otherwise indicated.
 2. Rigid Steel Conduits: Use only fittings listed for use with that material. Use sealant recommended by fitting manufacturer.
- E. Do not install aluminum conduits in contact with concrete.
- F. Install surface raceways only where indicated on Drawings.

3.2 INSTALLATION

- A. Comply with NECA1 and NECA101 for installation requirements except where requirements on Drawings or in this article are stricter. Comply with NECA102 for aluminum conduits. Comply with NFPA70 limitations for types of raceways allowed in specific occupancies and number of floors.
- B. Do not install raceways or electrical items on any "explosion-relief" walls or rotating equipment.
- C. Do not fasten conduits onto the bottom side of a metal deck roof.
- D. Keep raceways at least 6 inches (150 mm) away from parallel runs of flues and steam or hot-water pipes. Install horizontal raceway runs above water and steam piping.
- E. Complete raceway installation before starting conductor installation.

- F. Support raceways as specified in Section 260529 – Hangers and Supports for Electrical Systems.
- G. Arrange stub-ups so curved portions of bends are not visible above the finished slab.
- H. 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. Coordinate specific requirements for conduit routing with telecommunication system installer.
- I. Make bends in raceway using large-radius preformed ells. Field bending shall be according to NFPA70 minimum radii requirements. Use only equipment specifically designed for material and size involved.
- J. Conceal conduit and EMT within finished walls, ceilings, and floors, unless otherwise indicated.
- K. Stub-Ups to Above Recessed Ceilings:
 - 1. Use EMT, IMC, or RMC for raceways.
 - 2. Use a conduit bushing or insulated fitting to terminate stub-ups not terminated in hubs or in an enclosure.
- L. 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.
- M. Coat field-cut threads on PVC-coated raceway with a corrosion-preventing conductive compound prior to assembly.
- N. Terminate threaded conduits into threaded hubs or with locknuts on inside and outside of boxes or cabinets. Install bushings on conduits up to 1-1/4-inch trade size and insulated throat metal bushings on 1-1/2-inch trade size and larger conduits terminated with locknuts. Install insulated throat metal grounding bushings on service conduits.
- O. Install raceways square to the enclosure and terminate at enclosures with locknuts. Install locknuts hand tight plus 1/4 turn more.
- P. Do not rely on locknuts to penetrate nonconductive coatings on enclosures. Remove coatings in the locknut area prior to assembling conduit to enclosure to assure a continuous ground path.
- Q. Cut conduit perpendicular to the length. For conduits 2-inch trade size and larger, use roll cutter or a guide to make cut straight and perpendicular to the length.
- R. Install pull wires in empty raceways. Use polypropylene or monofilament plastic line with not less than 200-lb tensile strength. Leave at least 12 inches of slack at each end of pull wire.
- S. Raceways for Optical Fiber and Communications Cable: Install raceways, metallic and nonmetallic, rigid and flexible, 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.

- T. Surface Raceways:
 - 1. Install surface raceway with a minimum 2-inch radius control at bend points.
 - 2. Secure surface raceway with screws or other anchor-type devices at intervals not exceeding 48 inches and with no less than two supports per straight raceway section. Support surface raceway according to manufacturer's written instructions. Tape and glue are not acceptable support methods.
- U. Install raceway sealing fittings at accessible locations according to NFPA70 and fill them with listed sealing compound. For concealed raceways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces. Install raceway sealing fittings according to NFPA70.
- V. Install devices to seal raceway interiors at accessible locations. Locate seals so no fittings or boxes are between the seal and the following changes of environments. Seal the interior of all raceways at the following points:
 - 1. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.
 - 2. Where an underground service raceway enters a building or structure.
 - 3. Conduit extending from interior to exterior of building.
 - 4. Conduit extending into pressurized duct and equipment.
 - 5. Conduit extending into pressurized zones that are automatically controlled to maintain different pressure set points.
 - 6. Where otherwise required by NFPA70.
- W. Comply with manufacturer's written instructions for solvent welding RNC and fittings.
 - a. Expansion-Joint Fittings:
 - 2. Install in each run of aboveground RNC that is located where environmental temperature change may exceed 30 deg F and that has straight-run length that exceeds 25 feet. Install in each run of aboveground RMC and EMT conduit that is located where environmental temperature change may exceed 100 deg F and that has straight-run length that exceeds 100 feet.
 - 3. Install type and quantity of fittings that accommodate temperature change listed for each of the following locations:
 - a. Outdoor Locations Not Exposed to Direct Sunlight: 125 deg F
 - b. Outdoor Locations Exposed to Direct Sunlight: 155 deg F temperature change.
 - c. Indoor Spaces Connected with Outdoors without Physical Separation: 125 deg F temperature change.
 - d. Attics: 135 deg F temperature change.
 - 4. Install fitting(s) that provide expansion and contraction for at least 0.00041 inch per foot of length of straight run per deg F of temperature change.
 - 5. Install each expansion-joint fitting with position, mounting, and piston setting selected according to manufacturer's written instructions for conditions at specific location at the time of installation.
 - 6. Install expansion fittings at all locations where conduits cross building or structure expansion joints.
 - a. Flexible Conduit Connections: Comply with NEMA RV3. Use a maximum of 36 inches of flexible conduit for recessed and semi-recessed luminaires, equipment

- subject to vibration, noise transmission, or movement; and for transformers and motors.
- 7. Use LFMC in damp or wet locations subject to severe physical damage.
 - 8. Use LFMC or LFNC in damp or wet locations not subject to severe physical damage.
- X. Mount boxes at heights indicated on Drawings. If mounting heights of boxes are not individually indicated, give priority to ADA requirements. Install boxes with height measured to center of box unless otherwise indicated.
 - Y. Recessed Boxes in Masonry Walls: Saw-cut opening for box in center of cell of masonry block, and install box flush with surface of wall. Prepare block surfaces to provide a flat surface for a raintight connection between box and cover plate or supported equipment and box.
 - Z. Horizontally separate boxes mounted on opposite sides of walls so they are not in the same vertical channel.
 - AA. Locate boxes so that cover or plate will not span different building finishes.
 - BB. Support boxes of three gangs or more from more than one side by spanning two framing members or mounting on brackets specifically designed for the purpose.
 - CC. Fasten junction and pull boxes to or support from building structure. Do not support boxes by conduits.
 - DD. Set metal floor boxes level and flush with finished floor surface.
- 3.3 SLEEVE INSTALLATION FOR ELECTRICAL PENETRATIONS
- A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies. Comply with requirements in Section 260544 "Sleeves and Sleeve Seals for Electrical Raceways and Cabling."
- 3.4 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 078400 "Firestops and Smoke Seals."
- 3.5 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 26 05 33

SECTION 26 05 44

SLEEVES AND SLEEVE SEALS FOR ELECTRICAL RACEWAYS AND CABLING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. This Section is to coordinate with and be complementary to the General Conditions and Supplementary General Conditions of the work, and Division 01 Specification Sections wherever applicable to Mechanical and Electrical Work.
- B. Section 01 31 46 – Special Requirements for Mechanical and Electrical Work shall apply.
- C. Section 26 05 00 – General Provisions for Electrical Work shall apply

1.2 SUMMARY

- A. Section Includes:
 - 1. Sleeves for raceway and cable penetration of non-fire-rated construction walls and floors.
 - 2. Sleeve-seal systems.
 - 3. Sleeve-seal fittings.
 - 4. Grout.
 - 5. Silicone sealants.
- B. Related Requirements:
 - 1. Penetration Firestopping for penetration firestopping installed in fire-resistance-rated walls, horizontal assemblies, and smoke barriers, with and without penetrating items.

1.3 ACTION SUBMITTALS

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

PART 2 - PRODUCTS

2.1 SLEEVES

- A. Wall Sleeves:
 - 1. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, zinc coated, plain ends.
 - 2. Cast-Iron Pipe Sleeves: Cast or fabricated "wall pipe," equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop unless otherwise indicated.
- B. Sleeves for Conduits Penetrating Non-Fire-Rated Gypsum Board Assemblies: Galvanized-steel sheet; 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint, with tabs for screw-fastening the sleeve to the board.
- C. Sleeves for Rectangular Openings:
 - 1. Material: Galvanized sheet steel.

2. Minimum Metal Thickness:
 - a. For sleeve cross-section rectangle perimeter less than 50 inches and with no side larger than 16 inches, thickness shall be 0.052 inch.
 - b. For sleeve cross-section rectangle perimeter 50 inches or more and one or more sides larger than 16 inches, thickness shall be 0.138 inch.

2.2 SLEEVE-SEAL SYSTEMS

- A. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and raceway or cable.
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Advance Products & systems
 - b. CALPICO, Inc
 - c. Metraflex Company
 - d. Pipeline Seal and Insulator
 - e. Proco Products
 2. Sealing Elements: Nitrile (Buna N) rubber interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
 3. Pressure Plates: Stainless steel.
 4. Connecting Bolts and Nuts: Stainless steel of length required to secure pressure plates to sealing elements.

2.3 SLEEVE-SEAL FITTINGS

- A. Description: Manufactured plastic, sleeve-type, waterstop assembly made for embedding in concrete slab or wall. Unit shall have plastic or rubber waterstop collar with center opening to match piping OD.
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. HOLDRITE
 - b. Presealed Systems

2.4 GROUT

- A. Description: Nonshrink; recommended for interior and exterior sealing openings in non-fire-rated walls or floors.
- B. Standard: ASTM C 1107/C 1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.
- C. Design Mix: 5000-psi, 28-day compressive strength.
- D. Packaging: Premixed and factory packaged.

2.5 SILICONE SEALANTS

- A. Silicone Sealants: Single-component, silicone-based, neutral-curing elastomeric sealants of grade indicated below.
 1. Grade: Pourable (self-leveling) formulation for openings in floors and other horizontal surfaces that are not fire rated.

- B. Silicone Foams: Multicomponent, silicone-based liquid elastomers that, when mixed, expand and cure in place to produce a flexible, nonshrinking foam.

PART 3 - EXECUTION

3.1 SLEEVE INSTALLATION FOR NON-FIRE-RATED ELECTRICAL PENETRATIONS

- A. Comply with NECA 1.
- B. Comply with NEMA VE 2 for cable penetrations.
- C. Sleeves for Conduits Penetrating Above-Grade Non-Fire-Rated Concrete and Masonry-Unit Floors and Walls:
 - 1. Interior Penetrations of Non-Fire-Rated Walls and Floors:
 - a. Seal annular space between sleeve and raceway or cable, using joint sealant appropriate for size, depth, and location of joint.
 - b. Seal space outside of sleeves with mortar or grout. Pack sealing material solidly between sleeve and wall so no voids remain. Tool exposed surfaces smooth; protect material while curing.
 - 2. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.
 - 3. Size pipe sleeves to provide 1/4-inch annular clear space between sleeve and raceway or cable unless sleeve seal is to be installed [or unless seismic criteria require different clearance].
 - 4. Install sleeves for wall penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of walls. Cut sleeves to length for mounting flush with both surfaces of walls. Deburr after cutting.
 - 5. Install sleeves for floor penetrations. Extend sleeves installed in floors 2 inches (50 mm) above finished floor level. Install sleeves during erection of floors.
- D. Sleeves for Conduits Penetrating Non-Fire-Rated Gypsum Board Assemblies:
 - 1. Use circular metal sleeves unless penetration arrangement requires rectangular sleeved opening.
 - 2. Seal space outside of sleeves with approved joint compound for gypsum board assemblies.
- E. Roof-Penetration Sleeves: Seal penetration of individual raceways and cables with flexible boot-type flashing units applied in coordination with roofing work.
- F. Aboveground, Exterior-Wall Penetrations: Seal penetrations using steel pipe sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.
- G. Underground, Exterior-Wall and Floor Penetrations: Install cast-iron pipe sleeves. Size sleeves to allow for 1-inch annular clear space between raceway or cable and sleeve for installing sleeve-seal system.

3.2 SLEEVE-SEAL-SYSTEM INSTALLATION

- A. Install sleeve-seal systems in sleeves in exterior concrete walls and slabs-on-grade at raceway entries into building.
- B. Install type and number of sealing elements recommended by manufacturer for raceway or cable material and size. Position raceway or cable in center of sleeve. Assemble mechanical sleeve seals and install in annular space between raceway or cable and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

3.3 SLEEVE-SEAL-FITTING INSTALLATION

- A. Install sleeve-seal fittings in new walls and slabs as they are constructed.
- B. Assemble fitting components of length to be flush with both surfaces of concrete slabs and walls. Position waterstop flange to be centered in concrete slab or wall.
- C. Secure nailing flanges to concrete forms.
- D. Using grout, seal the space around outside of sleeve-seal fittings.

END OF SECTION 26 05 44

SECTION 26 05 53

IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. This Section is to coordinate with and be complementary to the General Conditions and Supplementary General Conditions of the work, and Division 01 Specification Sections wherever applicable to Mechanical and Electrical Work.
- B. Section 01 31 46 – Special Requirements for Mechanical and Electrical Work shall apply.
- C. Section 26 05 00 – General Provisions for Electrical Work shall apply.

1.2 SUMMARY

- A. Section Includes:
 - 1. Color and legend requirements for raceways, conductors, and warning labels and signs.
 - 2. Labels.
 - 3. Bands and tubes.
 - 4. Tapes and stencils.
 - 5. Tags.
 - 6. Signs.
 - 7. Cable ties.
 - 8. Paint for identification.
 - 9. Fasteners for labels and signs.
 - 10. Identification for raceways.
 - 11. Identification of power and control cables.
 - 12. Identification for conductors.
 - 13. Underground-line warning tape.
 - 14. Warning labels and signs.
 - 15. Instruction signs.
 - 16. Equipment identification labels.
 - 17. Miscellaneous identification products.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for electrical identification products.
- B. Samples: For each type of label and sign to illustrate composition, size, colors, lettering style, mounting provisions, and graphic features of identification products.
- C. Identification Schedule: For each piece of electrical equipment and electrical system components to be an index of nomenclature for electrical equipment and system components used in identification signs and labels. Use same designations indicated on Drawings.

- D. Submittal: Design of labeling for arc-flash hazard study.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Comply with ASME A13.1
- B. Comply with NFPA 70.
- C. Comply with 29 CFR 1910.144 and 29 CFR 1910.145.
- D. Comply with ANSI Z535.4 for safety signs and labels.
- E. Comply with NFPA 70E and Section 260573 "Arc-Flash Hazard Analysis" requirements for arc-flash warning labels.
- F. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.
 - 1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces

2.2 COLOR AND LEGEND REQUIREMENTS

- A. Raceways and Cables Carrying Circuits at 600 V or Less:
 - 1. Black letters on a white field.
 - 2. Legend: Indicate voltage and system or service type.
- B. Warning Label Colors:
 - 1. Identify system voltage with black letters on an orange background.
- C. Warning labels and signs 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."
- D. Equipment Identification Labels:
 - 1. Black letters on a white field.

2.3 LABELS

- A. Vinyl Wraparound Labels: Preprinted, flexible labels laminated with a clear, weather- and chemical-resistant coating and matching wraparound clear adhesive tape for securing label ends.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Brady corporation
 - b. Champion America
 - c. Emedco
 - d. Grafoplast Wire Markers
 - e. LEM Products
 - f. Marking Services, Inc.

- g. Hellermann Tyton
 - h. Panduit Corp.
 - i. Seton Edentification Products

- B. Snap-around Labels: Slit, pretensioned, flexible, preprinted, color-coded acrylic sleeves, with diameters sized to suit diameters and that stay in place by gripping action.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Brady corporation
 - b. Champion America
 - c. Marking Services, Inc.
 - d. Hellermann Tyton
 - e. Panduit Corp.
 - f. Seton Edentification Products

- C. Self-Adhesive Wraparound Labels: Write-on, 3-mil thick, vinyl flexible label with acrylic pressure-sensitive adhesive.
 - 1. Self-Lamination: Clear; UV-, weather- and chemical-resistant; self-laminating, protective shield over the legend. Labels sized such that the clear shield overlaps the entire printed legend.
 - 2. Marker for Labels: Permanent, waterproof, black ink marker recommended by tag manufacturer.

- D. Self-Adhesive Labels: Vinyl, thermal, transfer-printed, 3-mil thick, multicolor, weather- and UV-resistant, pressure-sensitive adhesive labels, configured for intended use and location.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Brady corporation
 - b. Emedco
 - c. Grafoplast Wire Markers
 - d. LEM Products
 - e. Marking Services, Inc.
 - f. Hellermann Tyton
 - g. Panduit Corp.
 - h. Seton Edentification Products
 - 2. Minimum Nominal Size:
 - a. 1-1/2 by 6 inches for raceway and conductors.
 - b. 3-1/2 by 5 inches for equipment.
 - c. As required by authorities having jurisdiction.

2.4 BANDS AND TUBES

- A. Snap-around, Color-Coding Bands: Slit, pretensioned, flexible, solid-colored acrylic sleeves, 2 inches long, with diameters sized to suit diameters and that stay in place by gripping action.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Brady corporation
 - b. Hellermann Tyton
 - c. Marking Services, Inc.
 - d. Panduit Corp.

- B. Heat-Shrink Preprinted Tubes: Flame-retardant polyolefin tubes with machine-printed identification labels, sized to suit diameter and shrunk to fit firmly. Full shrink recovery occurs at a maximum of 200 deg F. Comply with UL 224.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Brady corporation
 - b. Panduit Corp.

2.5 TAPES AND STENCILS

- A. Marker Tapes: Vinyl or vinyl-cloth, self-adhesive wraparound type, with circuit identification legend machine printed by thermal transfer or equivalent process.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Carlton Industries, LP
 - b. Champion America
 - c. Marking Services, Inc.
 - d. Hellermann Tyton
 - e. Panduit Corp.
- B. Tape and Stencil: 4-inch wide black stripes on 10-inch centers placed diagonally over orange background and are 12 inches wide. Stop stripes at legends.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. LEM Products
 - b. Marking Services, Inc.
 - c. Hellermann Tyton
 - d. Seton Edentification Products
- C. Floor Marking Tape: 2-inch wide, 5-mil pressure-sensitive vinyl tape, with **yellow and black** stripes and clear vinyl overlay.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Carlton Industries, LP
 - b. Seton Edentification Products

2.6 TAGS

- A. Metal Tags: Brass or aluminum, 2 by 2 by 0.05 inch, with stamped legend, punched for use with self-locking cable tie fastener.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Brady corporation
 - b. Emedco
 - c. Marking Services, Inc.
 - d. Seton Edentification Products
- B. Nonmetallic Preprinted Tags: Polyethylene tags, 0.015 inch thick, color-coded for phase and voltage level, with factory screened permanent designations; punched for use with self-locking cable tie fastener.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Brady corporation
 - b. Emedco
 - c. Grafoplast Wire Markers
 - d. LEM Products
 - e. Marking Services, Inc.
 - f. Hellermann Tyton
 - g. Panduit Corp.
 - h. Seton Edentification Products

C. Write-on Tags:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Carlton Industries, LP
 - b. LEM Products
 - c. Seton Edentification Products
2. Polyester Tags: 0.010 inch thick, with corrosion-resistant grommet and cable tie for attachment.

2.7 SIGNS

A. Baked-Enamel Signs:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Carlton Industries, LP
 - b. Emedco
 - c. Marking Services, Inc.
2. Preprinted aluminum signs, high-intensity reflective, punched or drilled for fasteners, with colors, legend, and size required for application.
3. 1/4-inch grommets in corners for mounting.
4. Nominal Size: 7 by 10 inches.

B. Metal-Backed Butyrate Signs:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Brady corporation
 - b. Emedco
 - c. Marking Services, Inc.
2. Weather-resistant, nonfading, preprinted, cellulose-acetate butyrate signs, with 0.0396-inch galvanized-steel backing, punched and drilled for fasteners, and with colors, legend, and size required for application.
3. 1/4-inch grommets in corners for mounting.
4. Nominal Size: 10 by 14 inches.

C. Laminated Acrylic or Melamine Plastic Signs:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Brady corporation
 - b. Emedco
 - c. Marking Services, Inc.

2. Engraved legend.
3. Thickness:
 - a. For signs up to 20 sq. in., minimum 1/16 inch thick.
 - b. For signs larger than 20 sq. in., 1/8 inch thick.
 - c. Engraved legend with black letters on white
 - d. Punched or drilled for mechanical fasteners with 1/4-inch grommets in corners for mounting or Self-adhesive as required by project conditions.
 - e. Framed with mitered acrylic molding and arranged for attachment at applicable equipment.

2.8 CABLE TIES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 1. Marking Services, Inc.
 2. Hellermann Tyton
 3. Panduit Corp.
- B. General-Purpose Cable Ties: Fungus inert, self-extinguishing, one piece, self-locking, and Type 6/6 nylon.
 1. Minimum Width: 3/16 inch.
 2. Tensile Strength at 73 Deg F according to ASTM D 638: 12,000 psi.
 3. Temperature Range: Minus 40 to plus 185 deg F.
 4. Color: Black, except where used for color-coding.
- C. UV-Stabilized Cable Ties: Fungus inert, designed for continuous exposure to exterior sunlight, self-extinguishing, one piece, self-locking, and Type 6/6 nylon.
 1. Minimum Width: 3/16 inch.
 2. Tensile Strength at 73 Deg F according to ASTM D 638: 12,000 psi.
 3. Temperature Range: Minus 40 to plus 185 deg F.
 4. Color: Black.
- D. Plenum-Rated Cable Ties: Self-extinguishing, UV stabilized, one piece, and self-locking.
 1. Minimum Width: 3/16 inch.
 2. Tensile Strength at 73 Deg F according to ASTM D 638: 7000 psi.
 3. UL 94 Flame Rating: 94V-0.
 4. Temperature Range: Minus 50 to plus 284 deg F.
 5. Color: Black.

2.9 MISCELLANEOUS IDENTIFICATION PRODUCTS

- A. Paint: Comply with requirements in painting Sections for paint materials and application requirements. Retain paint system applicable for surface material and location (exterior or interior).
- B. Fasteners for Labels and Signs: Self-tapping, stainless-steel screws or stainless-steel machine screws with nuts and flat and lock washers.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Self-Adhesive Identification Products: Before applying electrical identification products, clean substrates of substances that could impair bond, using materials and methods recommended by manufacturer of identification product.

3.2 INSTALLATION

- A. Verify and coordinate identification names, abbreviations, colors, and other features with requirements in other Sections requiring identification applications, Drawings, Shop Drawings, manufacturer's wiring diagrams, and operation and maintenance manual. Use consistent designations throughout Project.
- B. Install identifying devices before installing acoustical ceilings and similar concealment.
- C. Verify identity of each item before installing identification products.
- D. Coordinate identification with Project Drawings, manufacturer's wiring diagrams, and operation and maintenance manual.
- E. Apply identification devices to surfaces that require finish after completing finish work.
- F. Install signs with approved legend to facilitate proper identification, operation, and maintenance of electrical systems and connected items.
- G. System Identification for Raceways and Cables under 600 V: Identification shall completely encircle cable or conduit. Place identification of two-color markings in contact, side by side.
 - 1. Secure tight to surface of conductor, cable, or raceway.
- H. Vinyl Wraparound Labels:
 - 1. Secure tight to surface of raceway or cable at a location with high visibility and accessibility.
 - 2. Attach labels that are not self-adhesive type with clear vinyl tape, with adhesive appropriate to the location and substrate.
- I. Snap-around Labels: Secure tight to surface at a location with high visibility and accessibility.
- J. Self-Adhesive Wraparound Labels: Secure tight to surface at a location with high visibility and accessibility.
- K. Self-Adhesive Labels:
 - 1. On each item, install unique designation label that is consistent with wiring diagrams, schedules, and operation and maintenance manual.
 - 2. Unless otherwise indicated, provide a single line of text with 1/2-inch high letters on 1-1/2-inch high label; where two lines of text are required, use labels 2 inches high.
- L. Snap-around Color-Coding Bands: Secure tight to surface at a location with high visibility and accessibility.

- M. Heat-Shrink, Preprinted Tubes: Secure tight to surface at a location with high visibility and accessibility.
- N. Marker Tapes: Secure tight to surface at a location with high visibility and accessibility.
- O. Self-Adhesive Vinyl Tape: Secure tight to surface at a location with high visibility and accessibility.
 - 1. Field-Applied, Color-Coding Conductor Tape: Apply in half-lapped turns for a minimum distance of 6 inches where splices or taps are made. Apply last two turns of tape with no tension to prevent possible unwinding.
- P. Tape and Stencil: Comply with requirements in painting Sections for surface preparation and paint application.
- Q. Floor Marking Tape: Apply stripes to finished surfaces following manufacturer's written instructions.
- R. Underground Line Warning Tape:
 - 1. During backfilling of trenches, install continuous underground-line warning tape directly above cable or raceway at 6 to 8 inches below finished grade. Use multiple tapes where width of multiple lines installed in a common trench or concrete envelope exceeds 16 inches overall.
 - 2. Limit use of underground-line warning tape to direct-buried cables.
- S. Nonmetallic Preprinted Tags:
 - 1. Place in a location with high visibility and accessibility.
 - 2. Secure using general-purpose cable ties.
- T. Write-on Tags:
 - 1. Place in a location with high visibility and accessibility.
 - 2. Secure using general-purpose cable ties.
- U. Baked-Enamel Signs:
 - 1. Attach signs that are not self-adhesive type with mechanical fasteners appropriate to the location and substrate.
 - 2. Unless otherwise indicated, provide a single line of text with 1/2-inch high letters on minimum 1-1/2-inch high sign; where two lines of text are required, use signs minimum 2 inches high.
- V. Metal-Backed Butyrate Signs:
 - 1. Attach signs that are not self-adhesive type with mechanical fasteners appropriate to the location and substrate.
 - 2. Unless otherwise indicated, provide a single line of text with 1/2-inch high letters on 1-1/2-inch high sign; where two lines of text are required, use labels 2 inches high.
- W. Laminated Acrylic or Melamine Plastic Signs:
 - 1. Attach signs that are not self-adhesive type with mechanical fasteners appropriate to the location and substrate.
 - 2. Unless otherwise indicated, provide a single line of text with 1/2-inch high letters on 1-1/2-inch high sign; where two lines of text are required, use labels 2 inches high.

- X. Cable Ties: General purpose, for attaching tags, except as listed below:
 - 1. Outdoors: UV-stabilized nylon.
 - 2. In Spaces Handling Environmental Air: Plenum rated.

3.3 IDENTIFICATION SCHEDULE

- A. Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment. Install access doors or panels to provide view of identifying devices.
- B. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, pull points, and locations of high visibility. Identify by system and circuit designation.
- C. Instructional Signs: Self-adhesive labels, including the color code for grounded and ungrounded conductors.
- D. Warning Labels for Indoor Cabinets, Boxes, and Enclosures for Power and Lighting: Baked-enamel warning signs.
 - 1. Apply to exterior of door, cover, or other access.
 - 2. For equipment with multiple power or control sources, apply to door or cover of equipment, including, but not limited to, the following:
 - a. Power-transfer switches.
 - b. Controls with external control power connections.
- E. Arc Flash Warning Labeling: Self-adhesive labels.
- F. Operating Instruction Signs: Laminated acrylic or melamine plastic signs.
- G. Equipment Identification Labels:
 - 1. Indoor Equipment: Baked-enamel signs
 - 2. Outdoor Equipment: Stenciled legend 4 inches high.
 - 3. Equipment to Be Labeled:
 - a. Panelboards: Typewritten directory of circuits in the location provided by panelboard manufacturer. Panelboard identification shall be in the form of a engraved, laminated acrylic or melamine label.
 - b. Enclosures and electrical cabinets.
 - c. Access doors and panels for concealed electrical items.
 - d. Existing motor control center switches affected by this scope of work.
 - e. Enclosed switches.
 - f. Enclosed circuit breakers.
 - g. Enclosed controllers.
 - h. Variable-speed controllers.
 - i. Push-button stations.
 - j. Contactors.
 - k. Monitoring and control equipment.

END OF SECTION 26 05 53

SECTION 26 05 72

SHORT-CIRCUIT STUDIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. This Section is to coordinate with and be complementary to the General Conditions and Supplementary General Conditions of the work, and Division 01 Specification Sections wherever applicable to Project Work.
- B. Section 01 31 46 – Special Requirements for Project Work shall apply.
- C. Section 26 05 00 – General Provisions for Electrical Work shall apply.

1.2 SUMMARY

- A. Section includes requirements for the contractor to develop a computer-based, fault-current study to determine the minimum interrupting capacity of circuit protective devices based on equipment proposed to be provided as described herein.
- B. The study shall be produced in two (2) separate submissions.
 - 1. A first preliminary submission based on types and approximation of feeder length for existing and new to be installed feeders and sub-feeders.
 - 2. A second finalized submission based on as build conditions.
 - 3. For additional information see Action Submittals article.
- C. The study is limited to and must include all portions, equipment and feeders, new and existing as shown in the single line electrical diagram included with the project submission.

1.3 DEFINITIONS

- A. Existing to Remain: Existing items of construction that are not to be removed and that are not otherwise indicated to be removed and salvaged, or removed and reinstalled. Existing to remain items shall remain functional throughout the construction period.
- B. Field Adjusting Agency: An independent electrical testing agency with full-time employees and the capability to adjust devices and conduct testing indicated and that is a member company of NETA.
- C. One-Line Diagram: A diagram that shows, by means of single lines and graphic symbols, the course of an electric circuit or system of circuits and the component devices or parts used therein.
- D. Power System Analysis Software Developer: An entity that commercially develops, maintains, and distributes computer software used for power system studies.

- E. Power Systems Analysis Specialist: Professional engineer in charge of performing the study and documenting recommendations, licensed in the state where Project is located.
- F. Protective Device: A device that senses when an abnormal current flow exists and then removes the affected portion of the circuit from the system.
- G. SCCR: Short-circuit current rating.
- H. Service: The conductors and equipment for delivering electric energy from the serving utility to the wiring system of the premises served.
- I. Single-Line Diagram: See "One-Line Diagram."

1.4 ACTION SUBMITTALS

- A. Product Data:
 - 1. For computer software program to be used for studies.
 - 2. Submit the following after the approval of system protective devices submittals. Submittals shall be in digital form.
 - a. Short-circuit study input data, including completed computer program input data sheets.
 - b. Short-circuit study and equipment evaluation report; signed, dated, and sealed by a qualified professional engineer licensed in the state where the project is taking place.
 - 1) Submit study report for action prior to receiving final approval of distribution equipment submittals. If formal completion of studies will cause delay in equipment manufacturing, obtain approval from Owner's Representative for preliminary submittal of sufficient study data to ensure that selection of devices and associated characteristics is satisfactory.
 - 2) Revised one-line diagram, reflecting field investigation results and results of short-circuit study.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data:
 - 1. For Power Systems Analysis Software Developer.
 - 2. For Power System Analysis Specialist.
 - 3. For Field Adjusting Agency.
- B. Product Certificates: For short-circuit study software, certifying compliance with IEEE 399.

1.6 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data:

1. For overcurrent protective devices to include in emergency, operation, and maintenance manuals.
2. The following are from the Short-Circuit Study Report:
 - a. Final one-line diagram.
 - b. Final Short-Circuit Study Report.
 - c. Short-circuit study data files.
 - d. Power system data.

1.7 QUALITY ASSURANCE

- A. Studies shall use computer programs that are distributed nationally and are in wide use. Software algorithms shall comply with the requirements of standards and guides specified in this Section. Manual calculations are unacceptable.
- B. Short-Circuit Study Software Developer Qualifications: An entity that owns and markets computer software used for studies, having performed successful studies of similar magnitude on electrical distribution systems using similar devices.
 1. The computer program shall be developed under the charge of a licensed professional engineer who holds IEEE Computer Society's Certified Software Development Professional certification.
- C. Short-Circuit Study Specialist Qualifications: Professional engineer in charge of performing the study and documenting recommendations, licensed in the state where Project is located. All elements of the study shall be performed under the direct supervision and control of this professional engineer.
- D. Field Adjusting Agency Qualifications: An independent agency, with the experience and capability to adjust overcurrent devices and 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.

PART 2 - PRODUCTS

2.1 POWER SYSTEM ANALYSIS SOFTWARE DEVELOPERS

- A. Computer Software Developers: Subject to compliance with requirements, provide products by one of the following:
 1. Eaton CYME International
 2. ESA Inc.
 3. SKM System Analysis, Inc.
 4. Power Analytics, Corporation
 5. ETAP.
- B. Comply with IEEE 399 and IEEE 551.

1. Analytical features of power systems analysis software program shall have capability to calculate "mandatory," "very desirable," and "desirable" features as listed in IEEE 399.
- C. Computer software program shall be capable of plotting and diagramming time-current-characteristic curves as part of its output.

2.2 SHORT-CIRCUIT STUDY REPORT CONTENTS

- A. Executive summary of study findings.
- B. Study descriptions, purpose, basis, and scope. Include case descriptions, definition of terms, and guide for interpretation of results.
- C. One-line diagram of modeled power system, showing the following:
1. Protective device designations and ampere ratings.
 2. Conductor types, sizes, and lengths.
 3. Transformer kilovolt ampere (kVA) and voltage ratings.
 4. Motor and generator designations and kVA ratings.
 5. Switchgear, switchboard, motor-control center, and panelboard designations and ratings.
 6. Derating factors and environmental conditions.
 7. Any revisions to electrical equipment required by the study.
- D. Comments and recommendations for system improvements or revisions in a written document, separate from one-line diagram.
- E. Protective Device Evaluation:
1. Evaluate equipment and protective devices and compare to available short-circuit currents. Verify that equipment withstand ratings exceed available short-circuit current at equipment installation locations.
 2. Tabulations of circuit breaker, fuse, and other protective device ratings versus calculated short-circuit duties.
 3. For devices and equipment rated for asymmetrical fault current, apply multiplication factors listed in standards to 1/2-cycle symmetrical fault current.
 4. Verify adequacy of phase conductors at maximum three-phase bolted fault currents; verify adequacy of equipment grounding conductors and grounding electrode conductors at maximum ground-fault currents. Ensure that short-circuit withstand ratings are equal to or higher than calculated 1/2-cycle symmetrical fault current.
 5. Contractor is responsible to coordinate levels of over-current protection as per electrical code requirements and to size interrupting rating of boards, panels and over-current devices as per the study results at no additional cost to owner.
- F. Short-Circuit Study Input Data:
1. One-line diagram of system being studied.
 2. Power sources available.
 3. Manufacturer, model, and interrupting rating of protective devices.
 4. Conductors.
 5. Transformer data.

G. Short-Circuit Study Output Reports:

1. Low-Voltage Fault Report: Three-phase and unbalanced fault calculations, showing the following for each overcurrent device location:
 - a. Voltage.
 - b. Calculated fault-current magnitude and angle.
 - c. Fault-point X/R ratio.
 - d. Equivalent impedance.

2. Momentary Duty Report: Three-phase and unbalanced fault calculations, showing the following for each overcurrent device location:
 - a. Voltage.
 - b. Calculated symmetrical fault-current magnitude and angle.
 - c. Fault-point X/R ratio.
 - d. Calculated asymmetrical fault currents:
 - 1) Based on fault-point X/R ratio.

3. Interrupting Duty Report: Three-phase and unbalanced fault calculations, showing the following for each overcurrent device location:
 - a. Voltage.
 - b. Calculated symmetrical fault-current magnitude and angle.
 - c. Fault-point X/R ratio.
 - d. No AC Decrement (NACD) ratio.
 - e. Equivalent impedance.
 - f. Multiplying factors for 2-, 3-, 5-, and 8-cycle circuit breakers rated on a symmetrical basis.
 - g. Multiplying factors for 2-, 3-, 5-, and 8-cycle circuit breakers rated on a total basis.

PART 3 - EXECUTION

3.1 POWER SYSTEM DATA

- A. Obtain all data necessary for conduct of the study.
 1. Verify completeness of data supplied on one-line diagram. Call any discrepancies to Owner's Representative attention.
 2. For equipment included as Work of this Project, use characteristics submitted under provisions of action submittals and information submittals for this Project.
 3. For relocated equipment and that which is existing to remain, obtain required electrical distribution system data by field investigation and surveys, conducted by qualified technicians and engineers. Qualifications of technicians and engineers shall be as defined by NFPA 70E.

- B. Gather and tabulate the required input data to support the short-circuit study. Record circuit protective device characteristics. Record all data on a Record Document copy of one-line

diagram. Comply with recommendations in IEEE 551 as to the amount of detail that is required to be acquired in the field. Field data gathering shall be under direct supervision and control of the Owner's Representative in charge of performing the study and shall be by the Owner's Representative or its representative who holds NETA ETT-Certified Technician Level III or NICET Electrical Power Testing Level III certification. Data include, but are not limited to, the following:

1. Product Data for Project's overcurrent protective devices involved in overcurrent protective device coordination studies. Use equipment designation tags that are consistent with electrical distribution system diagrams, overcurrent protective device submittals, input and output data, and recommended device settings.
2. Obtain electrical power utility impedance at the service.
3. Power sources and ties.
4. For transformers, include actual kVA, primary and secondary voltages, connection type, impedance, X/R ratio, taps measured in percent, and phase shift.
5. For reactors, provide manufacturer and model designation, voltage rating, and impedance.
6. For circuit breakers and fuses, provide manufacturer and model designation. List type of breaker, type of trip, SCCR, current rating, and breaker settings.
7. Generator short-circuit current contribution data, including short-circuit reactance, rated kVA, rated voltage, and X/R ratio.
8. Busway manufacturer and model designation, current rating, impedance, lengths, and conductor material.
9. Motor horsepower and NEMA MG 1 code letter designation.
10. Conductor sizes, lengths, number, conductor material and conduit material (magnetic or nonmagnetic).
11. Derating factors.

3.2 SHORT-CIRCUIT STUDY

- A. Perform study following the general study procedures contained in IEEE 399.
- B. Calculate short-circuit currents according to IEEE 551.
- C. Base study on device characteristics supplied by device manufacturer.
- D. The extent of the electrical power system to be studied is the complete electrical distribution system as indicated in the Summary of Work in this section.
- E. Extent of electrical power system to be studied is indicated on Power Riser and Single Line Diagram that are included in the Drawings.
- F. Begin short-circuit current analysis at the service, extending down to system overcurrent protective devices as follows:
 1. To normal system low-voltage load buses where fault current is 10 kA or less.
 2. Exclude equipment rated 240-V ac or less when supplied by a single transformer rated less than 75 kVA and having impedance of 4.5% or greater.

- G. Study electrical distribution system from normal and alternate power sources throughout electrical distribution system for Project. Study all cases of system-switching configurations and alternate operations that could result in maximum fault conditions.
- H. Include the ac fault-current decay from induction motors, synchronous motors, and asynchronous generators and apply to low- and medium-voltage, three-phase ac systems. Also account for the fault-current dc decrement to address asymmetrical requirements of interrupting equipment.
- I. Calculate short-circuit momentary and interrupting duties for a three-phase bolted fault and a single line-to-ground fault at each equipment indicated on one-line diagram.
 - 1. For grounded systems, provide a bolted line-to-ground fault-current study for areas as defined for the three-phase bolted fault short-circuit study.
- J. Include in the report identification of any protective device applied outside its capacity.

END OF SECTION 26 05 72

SECTION 26 05 73

COORDINATION STUDIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. This Section is to coordinate with and be complementary to the General Conditions and Supplementary General Conditions of the work, and Division 01 Specification Sections wherever applicable to Project Work.
- B. Section 01 31 46 – Special Requirements for Project Work shall apply.
- C. Section 26 05 00 – General Provisions for Electrical Work shall apply.

1.2 SUMMARY

- A. Section includes requirements for the contractor to develop a computer-based, overcurrent protective device coordination studies to determine overcurrent protective devices and to determine overcurrent protective device settings for selective tripping based on equipment proposed to be provided as described herein.
- B. The study shall be produced in two (2) separate submissions.
 - 1. A first preliminary submission based on types and approximation of feeder length for existing to remain and new to be installed feeders and sub-feeders.
 - 2. A second finalized submission based on as build conditions.
 - 3. For additional information see Action Submittals article.

1.3 DEFINITIONS

- A. Coordination (Selective): Localization of an overcurrent condition to restrict outages to the circuit or equipment affected, accomplished by the choice of overcurrent protective devices and their ratings or settings. Two overcurrent protective devices shall be deemed selectively coordinated if their respective time-current characteristic curves do not intersect.
- B. Existing to Remain: Existing items of construction that are not to be removed and that are not otherwise indicated to be removed, removed and salvaged, or removed and reinstalled. Existing to remain items shall remain functional throughout the construction period.
- C. Field Adjusting Agency: An independent electrical testing agency with full-time employees and the capability to adjust devices and conduct testing indicated and that is a member company of NETA.
- D. One-Line Diagram: A diagram that shows, by means of single lines and graphic symbols, the course of an electric circuit or system of circuits and the component devices or parts used therein.

- E. Power System Analysis Software Developer: An entity that commercially develops, maintains, and distributes computer software used for power system studies.
- F. Power System Analysis Specialist: Professional engineer in charge of performing the study and documenting recommendations, licensed in the state where Project is located.
- G. Protective Device: A device that senses when an abnormal current flow exists and then removes the affected portion of the circuit from the system.
- H. SCCR: Short-circuit current rating.
- I. Service: The conductors and equipment for delivering electric energy from the serving utility to the wiring system of the premises served.
- J. Single-Line Diagram: See "One-Line Diagram."

1.4 ACTION SUBMITTALS

- A. Product Data:
 - 1. For computer software program to be used for studies.
 - 2. Submit the following after the approval of system protective devices submittals. Submittals shall be in digital form.
 - a. Coordination-study input data, including completed computer program input data sheets.
 - b. Study and equipment evaluation reports.
 - 3. Overcurrent protective device coordination study report; signed, dated, and sealed by a qualified professional engineer licensed in the state where the project is taking place.
 - a. Submit study report for action prior to receiving final approval of distribution equipment submittals. If formal completion of studies will cause delay in equipment manufacturing, obtain approval from Owner's Representative for preliminary submittal of sufficient study data to ensure that selection of devices and associated characteristics is satisfactory.
 - b. Revised one-line diagram, reflecting field investigation results and results of short-circuit study.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data:
 - 1. For Power System Analysis Software Developer.
 - 2. For Power Systems Analysis Specialist.
 - 3. For Field Adjusting Agency.
- B. Product Certificates: For overcurrent protective device coordination study software, certifying compliance with IEEE 399.

1.6 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data:
 - 1. For overcurrent protective devices to include in emergency, operation, and maintenance manuals.
 - 2. The following are from the Coordination Study Report:
 - a. Final one-line diagram.
 - b. Final protective device coordination study.
 - c. Coordination study data files.
 - d. List of all protective device settings.
 - e. Time-current coordination curves.
 - f. Power system data.

1.7 QUALITY ASSURANCE

- A. Studies shall use computer programs that are distributed nationally and are in wide use. Software algorithms shall comply with requirements of standards and guides specified in this Section. Manual calculations are unacceptable.
- B. Coordination Study Software Developer Qualifications: An entity that owns and markets computer software used for studies, having performed successful studies of similar magnitude on electrical distribution systems using similar devices.
 - 1. The computer program shall be developed under the charge of a licensed professional engineer who holds IEEE Computer Society's Certified Software Development Professional certification.
- C. Coordination Study Specialist Qualifications: Professional engineer in charge of performing the study and documenting recommendations, licensed in the state where Project is located. All elements of the study shall be performed under the direct supervision and control of this professional engineer.
- D. Field Adjusting Agency Qualifications: An independent agency, with the experience and capability to adjust overcurrent devices and 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.

PART 2 - PRODUCTS

2.1 POWER SYSTEM ANALYSIS SOFTWARE DEVELOPERS

- A. Computer Software Developers: Subject to compliance with requirements, provide products by one of the following:
 - 1. SKM System Analysis, Inc.
 - 2. Power Analytics, Corporation

3. Operation Technology, Inc.
 4. ETAP
- B. Comply with IEEE 242 and IEEE 399.
1. Analytical features of device coordination study computer software program shall have the capability to calculate "mandatory," "very desirable," and "desirable" features as listed in IEEE 399.
- C. Computer software program shall be capable of plotting and diagramming time-current-characteristic curves as part of its output. The computer software program shall report device settings and ratings of all overcurrent protective devices and shall demonstrate selective coordination by computer-generated, time-current coordination plots.
1. Optional Features:
 - a. Arcing faults.
 - b. Simultaneous faults.
 - c. Explicit negative sequence.
 - d. Mutual coupling in zero sequence.

2.2 COORDINATION STUDY REPORT CONTENTS

- A. Executive summary of study findings.
- B. Study descriptions, purpose, basis, and scope. Include case descriptions, definition of terms, and guide for interpretation of results.
- C. One-line diagram of modeled power system, showing the following:
1. Protective device designations and ampere ratings.
 2. Conductor types, sizes, and lengths.
 3. Transformer kilovolt ampere (kVA) and voltage ratings.
 4. Motor and generator designations and kVA ratings.
 5. Switchgear, switchboard, motor-control center, and panelboard designations.
 6. Any revisions to electrical equipment required by the study.
 7. Study Input Data: As described in "Power System Data" Article.
 - a. Short-Circuit Study Output: As specified in "Short-Circuit Studies" Section 260572.
- D. Protective Device Coordination Study:
1. Report recommended settings of protective devices, ready to be applied in the field. Use manufacturer's data sheets for recording the recommended setting of overcurrent protective devices when available.
 - a. Phase and Ground Relays:
 - 1) Device tag.

- 2) Relay current transformer ratio and tap, time dial, and instantaneous pickup value.
 - 3) Recommendations on improved relaying systems, if applicable.
 - b. Circuit Breakers:
 - 1) Adjustable pickups and time delays (long time, short time, and ground).
 - 2) Adjustable time-current characteristic.
 - 3) Adjustable instantaneous pickup.
 - 4) Include Recommendations on improved trip systems, if applicable.
 - c. Fuses: Show current rating, voltage, and class.
- E. Time-Current Coordination Curves: Determine settings of overcurrent protective devices to achieve selective coordination. Graphically illustrate that adequate time separation exists between devices installed in series, including power utility company's upstream devices. Prepare separate sets of curves for the switching schemes and for emergency periods where the power source is local generation. Show the following information:
1. Device tag and title, one-line diagram with legend identifying the portion of the system covered.
 2. Terminate device characteristic curves at a point reflecting maximum symmetrical or asymmetrical fault current to which the device is exposed.
 3. Identify the device associated with each curve by manufacturer type, function, and, if applicable, tap, time delay, and instantaneous settings recommended.
 4. Plot the following listed characteristic curves, as applicable:
 - a. Power utility's overcurrent protective device.
 - b. Medium-voltage equipment overcurrent relays.
 - c. Medium- and low-voltage fuses include manufacturer's minimum melt, total clearing, tolerance, and damage bands.
 - d. Low-voltage equipment circuit-breaker trip devices, including manufacturer's tolerance bands.
 - e. Transformer full-load current, magnetizing inrush current, and ANSI through-fault protection curves.
 - f. Cables and conductors damage curves.
 - g. Ground-fault protective devices.
 - h. Motor-starting characteristics and motor damage points.
 - i. Generator short-circuit decrement curve and generator damage point.
 - j. The largest feeder circuit breaker in each motor-control center and panelboard.
 5. Identify series-rated interrupting devices for a condition where the available fault current is greater than the interrupting rating of downstream equipment. Obtain device data details to allow verification that series application of these devices complies with NFPA 70 and UL 489 requirements.
 6. Maintain selectivity for tripping currents caused by overloads.
 7. Maintain maximum achievable selectivity for tripping currents caused by overloads on series-rated devices.
 8. Provide adequate time margins between device characteristics such that selective operation is achieved.
 9. Comments and recommendations for system improvements.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine Project overcurrent protective device submittals for compliance with electrical distribution system coordination requirements and other conditions affecting performance of the Work. Devices to be coordinated are indicated on Drawings.
 - 1. Proceed with coordination study only after relevant equipment submittals have been assembled. Overcurrent protective devices that have not been submitted and approved prior to coordination study may not be used in study.

3.2 POWER SYSTEM DATA

- A. Obtain all data necessary for conduct of the overcurrent protective device study.
 - 1. Verify completeness of data supplied in one-line diagram on Drawings. Call any discrepancies to Owner's Representative attention.
 - 2. For equipment included as Work of this Project, use characteristics submitted under provisions of action submittals and information submittals for this Project.
 - 3. For relocated equipment and that which is existing to remain, obtain required electrical distribution system data by field investigation and surveys, conducted by qualified technicians and engineers. Qualifications of technicians and engineers shall be as defined by NFPA 70E.
- B. Gather and tabulate all required input data to support the coordination study. Comply with recommendations in IEEE 551 for the amount of detail required to be acquired in the field. Field data gathering shall be under direct supervision and control of the Owner's Representative in charge of performing the study and shall be by the Owner's Representative or its representative who holds NETA ETT-Certified Technician Level III or NICET Electrical Power Testing Level III certification. Data include, but are not limited to, the following:
 - 1. Product Data for overcurrent protective devices specified in other Sections and involved in overcurrent protective device coordination studies. Use equipment designation tags that are consistent with electrical distribution system diagrams, overcurrent protective device submittals, input and output data, and recommended device settings.
 - 2. Electrical power utility impedance at the service.
 - 3. Power sources and ties.
 - 4. Short-circuit current at each system bus (three phase and line to ground).
 - 5. Full-load current of all loads.
 - 6. Voltage level at each bus.
 - 7. For transformers, include kVA, primary and secondary voltages, connection type, impedance, X/R ratio, taps measured in percent, and phase shift.
 - 8. For reactors, provide manufacturer and model designation, voltage rating, and impedance.
 - 9. For circuit breakers and fuses, provide manufacturer and model designation. List type of breaker, type of trip and available range of settings, SCCR, current rating, and breaker settings.

10. Generator short-circuit current contribution data, including short-circuit reactance, rated kVA, rated voltage, and X/R ratio.
11. For relays, provide manufacturer and model designation, current transformer ratios, potential transformer ratios, and relay settings.
12. Maximum demands from service meters.
13. Busway manufacturer and model designation, current rating, impedance, lengths, size, and conductor material.
14. Motor horsepower and NEMA MG 1 code letter designation.
15. Low-voltage cable sizes, lengths, number, conductor material, and conduit material (magnetic or nonmagnetic).
16. Medium-voltage cable sizes, lengths, conductor material, cable construction, metallic shield performance parameters, and conduit material (magnetic or nonmagnetic).
17. Data sheets to supplement electrical distribution system one-line diagram, cross-referenced with tag numbers on diagram, showing the following:
 - a. Special load considerations, including starting inrush currents and frequent starting and stopping.
 - b. Transformer characteristics, including primary protective device, magnetic inrush current, and overload capability.
 - c. Motor full-load current, locked rotor current, service factor, starting time, type of start, and thermal-damage curve.
 - d. Generator thermal-damage curve.
 - e. Ratings, types, and settings of utility company's overcurrent protective devices.
 - f. Special overcurrent protective device settings or types stipulated by utility company.
 - g. Time-current-characteristic curves of devices indicated to be coordinated.
 - h. Manufacturer, frame size, interrupting rating in amperes root mean square (rms) symmetrical, ampere or current sensor rating, long-time adjustment range, short-time adjustment range, and instantaneous adjustment range for circuit breakers.
 - i. Manufacturer and type, ampere-tap adjustment range, time-delay adjustment range, instantaneous attachment adjustment range, and current transformer ratio for overcurrent relays.
 - j. Switchgear, switchboards, motor-control centers, and panelboards ampacity, and SCCR in amperes rms symmetrical.
 - k. Identify series-rated interrupting devices for a condition where the available fault current is greater than the interrupting rating of downstream equipment. Obtain device data details to allow verification that series application of these devices complies with NFPA 70 and UL 489 requirements.

3.3 COORDINATION STUDY

- A. Comply with IEEE 242 for calculating short-circuit currents and determining coordination time intervals.
- B. Comply with IEEE 399 for general study procedures.
- C. Base study on device characteristics supplied by device manufacturer.
- D. Extent of electrical power system to be studied is indicated on Drawings.

- E. Begin analysis at the service, extending down to system overcurrent protective devices as follows:
 - 1. To normal system low-voltage load buses where fault current is 10 kA or less.
 - 2. Exclude equipment rated 240 V ac or less when supplied by a single transformer rated less than 125 kVA.

- F. Study electrical distribution system from normal and alternate power sources throughout electrical distribution system for Project. Study all cases of system-switching configurations and alternate operations that could result in maximum fault conditions.

- G. Transformer Primary Overcurrent Protective Devices:
 - 1. Device shall not operate in response to the following:
 - a. Inrush current when first energized.
 - b. Self-cooled, full-load current or forced-air-cooled, full-load current, whichever is specified for that transformer.
 - c. Permissible transformer overloads according to IEEE C57.96 if required by unusual loading or emergency conditions.
 - 2. Device settings shall protect transformers according to IEEE C57.12.00, for fault currents.

- H. Motor Protection:
 - 1. Select protection for low-voltage motors according to IEEE 242 and NFPA 70.
 - 2. Select protection for motors served at voltages more than 600 V according to IEEE 620.

- I. Conductor Protection: Protect cables against damage from fault currents according to ICEA P-32-382, ICEA P-45-482, and protection recommendations in IEEE 242. Demonstrate that equipment withstands the maximum short-circuit current for a time equivalent to the tripping time of the primary relay protection or total clearing time of the fuse. To determine temperatures that damage insulation, use curves from cable manufacturers or from listed standards indicating conductor size and short-circuit current.

- J. Generator Protection: Select protection according to manufacturer's written instructions and to IEEE 242.

- K. Include the ac fault-current decay from induction motors, synchronous motors, and asynchronous generators and apply to low- and medium-voltage, three-phase ac systems. Also account for fault-current dc decrement, to address asymmetrical requirements of interrupting equipment.

- L. Calculate short-circuit momentary and interrupting duties for a three-phase bolted fault and a single line-to-ground fault at each equipment indicated on one-line diagram.
 - 1. For grounded systems, provide a bolted line-to-ground fault-current study for areas as defined for the three-phase bolted fault short-circuit study.

- M. Protective Device Evaluation:

1. Evaluate equipment and protective devices and compare to short-circuit ratings.
2. Adequacy of switchgear, motor-control centers, and panelboard bus bars to withstand short-circuit stresses.
3. Any application of series-rated devices shall be recertified, complying with requirements in NFPA 70.
4. Include in the report identification of any protective device applied outside its capacity.
5. Contractor is responsible to coordinate levels of over-current protection as per electrical code requirements and to size interrupting rating of boards, panels and over-current devices as per the study results at no additional cost to owner.

3.4 LOAD-FLOW AND VOLTAGE-DROP STUDY

- A. Perform a load-flow and voltage-drop study to determine the steady-state loading profile of the system. Analyze power system performance two times as follows:
 1. Determine load flow and voltage drop based on full-load currents obtained in "Power System Data" Article.
 2. Determine load flow and voltage drop based on 80 percent of the design capacity of load buses.
 3. Prepare load-flow and voltage-drop analysis and report to show power system components that are overloaded or might become overloaded; show bus voltages that are less than as prescribed by NFPA 70.

3.5 MOTOR-STARTING STUDY

- A. Perform a motor-starting study to analyze the transient effect of system's voltage profile during motor starting. Calculate significant motor-starting voltage profiles and analyze the effects of motor starting on the power system stability.
- B. Prepare the motor-starting study report, noting light flicker for limits proposed by IEEE 141, and voltage sags so as not to affect operation of other utilization equipment on system supplying the motor.

3.6 FIELD ADJUSTING

- A. Adjust relay and protective device settings according to recommended settings provided by the coordination study. Field adjustments shall be completed by the engineering service division of equipment manufacturer under the "Startup and Acceptance Testing" contract portion.
- B. Make minor modifications to equipment as required to accomplish compliance with short-circuit and protective device coordination studies. Any required major modifications to be reported to the Owner's Representative in writing separate from the actual study specified in this specification manual.
- C. Testing and adjusting shall be by a full-time employee of the Field Adjusting Agency, who holds NETA ETT-Certified Technician Level III or NICET Electrical Power Testing Level III certification.

1. Perform each visual and mechanical inspection and electrical test stated in NETA ATS. Certify compliance with test parameters. Perform NETA tests and inspections for all adjustable overcurrent protective devices.

3.7 DEMONSTRATION

- A. Engage Power Systems Analysis Specialist to train Owner's maintenance personnel in the following:
 1. Acquaint personnel with the fundamentals of operating the power system in normal and emergency modes.
 2. Hand-out and explain the coordination study objectives, study descriptions, purpose, basis, and scope. Include case descriptions, definition of terms, and guide for interpreting time-current coordination curves.
 3. For Owner's maintenance staff certified as NETA ETT-Certified Technicians Level III or NICET Electrical Power Testing Level III Technicians, teach how to adjust, operate, and maintain overcurrent protective device settings.

END OF SECTION 26 05 73

SECTION 26 05 74

ARC-FLASH HAZARD ANALYSIS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. This Section is to coordinate with and be complementary to the General Conditions and Supplementary General Conditions of the work, and Division 01 Specification Sections wherever applicable to Project Work.
- B. Section 01 31 46 – Special Requirements for Project Work shall apply.
- C. Section 26 05 00 – General Provisions for Electrical Work shall apply.

1.2 SUMMARY

- A. Section includes requirements for the contractor to develop a computer-based, arc-flash study to determine the arc-flash hazard distance and the incident energy to which personnel could be exposed during work on or near electrical equipment proposed to be provided as described herein.
- B. The study shall be produced in two (2) separate submissions.
 - 1. A first preliminary submission based on types and approximation of feeder length for existing and new to be installed feeders and sub-feeders.
 - 2. A second finalized submission based on as build conditions.
 - 3. For additional information see Action Submittals article.

1.3 DEFINITIONS

- A. Existing to Remain: Existing items of construction that are not to be removed and that are not otherwise indicated to be removed, removed and salvaged, or removed and reinstalled.
- B. Field Adjusting Agency: An independent electrical testing agency with full-time employees and the capability to adjust devices and conduct testing indicated and that is a member company of NETA.
- C. One-Line Diagram: A diagram that shows, by means of single lines and graphic symbols, the course of an electric circuit or system of circuits and the component devices or parts used therein.
- D. Power System Analysis Software Developer: An entity that commercially develops, maintains, and distributes computer software used for power system studies.
- E. Power Systems Analysis Specialist: Professional engineer in charge of performing the study and documenting recommendations, licensed in the state where Project is located.

- F. Protective Device: A device that senses when an abnormal current flow exists and then removes the affected portion from the system.
- G. SCCR: Short-circuit current rating.
- H. Service: The conductors and equipment for delivering electric energy from the serving utility to the wiring system of the premises served.
- I. Single-Line Diagram: See "One-Line Diagram."

1.4 ACTION SUBMITTALS

- A. Product Data: For computer software programs to be used for studies.
- B. If formal completion of studies will cause delay in equipment manufacturing, obtain approval from Owner's Representative and submit preliminary study report for action prior to receiving final approval of distribution equipment submittals.
 - 1. The report must contain sufficient study data to ensure that selection of devices and associated characteristics is satisfactory.
- C. Study Submittals: Submit the following submittals after the approval of system protective devices submittals. Submittals shall be in digital form:
 - 1. Arc-flash study input data, including completed computer program input data sheets.
 - 2. Arc-flash study report; signed, dated, and sealed by Power Systems Analysis Specialist licensed as professional engineer in the state where the project is taking place.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data:
 - 1. For Power Systems Analysis Software Developer.
 - 2. For Power System Analysis Specialist.
 - 3. For Field Adjusting Agency.
- B. Product Certificates: For arc-flash hazard analysis software, certifying compliance with IEEE 1584 and NFPA 70E.

1.6 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data:
 - 1. Provide maintenance procedures in equipment manuals according to requirements in NFPA 70E.
 - 2. Operation and Maintenance Procedures: Provide maintenance procedures for use by Owner's personnel that comply with requirements in NFPA 70E.

1.7 QUALITY ASSURANCE

- A. Study shall be performed using commercially developed and distributed software designed specifically for power system analysis.
- B. Software algorithms shall comply with the requirements of standards and guides specified in this Section.
- C. Manual calculations are unacceptable.
- D. Power System Analysis Software Qualifications: An entity that owns and markets computer software used for studies, having performed successful studies of similar magnitude on electrical distribution systems using similar devices.
 - 1. Computer programs shall be designed to perform arc-flash analysis or have a function, component, or add-on module designed to perform arc-flash analysis.
 - 2. Computer programs shall be developed under the charge of a licensed professional engineer who holds IEEE Computer Society's Certified Software Development Professional certification.
- E. Power Systems Analysis Specialist Qualifications: Professional engineer in charge of performing the arc-flash study, analyzing the arc flash, and documenting recommendations, licensed in the state where Project is located. All elements of the study shall be performed under the direct supervision and control of this professional engineer.
- F. Arc-Flash Study Certification: Arc-Flash Study Report shall be signed and sealed by Power Systems Analysis Specialist.
- G. Field Adjusting Agency Qualifications:
 - 1. Employer of a NETA ETT-Certified Technician Level III or NICET Electrical Power Testing Level III certification responsible for all field adjusting of the Work.
 - 2. A member company of NETA.
 - 3. Acceptable to authorities having jurisdiction.

PART 2 - PRODUCTS

2.1 COMPUTER SOFTWARE DEVELOPERS

- A. Computer Software Developers: Subject to compliance with requirements, provide products by one of the following:
 - 1. SKM System Analysis, Inc.
 - 2. Power Analytics, Corporation
 - 3. Operation Technology, Inc.
 - 4. ETAP
- B. Comply with IEEE 1584 and NFPA 70E.

1. Analytical features of device coordination study computer software program shall have the capability to calculate "mandatory," "very desirable," and "desirable" features as listed in IEEE 399.

2.2 ARC-FLASH STUDY REPORT CONTENT

- A. Executive summary of study findings.
- B. Study descriptions, purpose, basis, and scope. Include case descriptions, definition of terms, and guide for interpretation of results.
- C. One-line diagram, showing the following:
 1. Protective device designations and ampere ratings.
 2. Conductor types, sizes, and lengths.
 3. Motor and generator designations and kVA ratings.
 4. Panelboard designation and rating.
- D. Study Input Data: As described in "Power System Data" Article.
- E. Short-Circuit Study Output Data: As specified in "Short Circuit Studies" Section 260572.
- F. Protective Device Coordination Study Report Contents: As specified in "Coordination Studies" Section 260573.
- G. Arc-Flash Study Output Reports:
 1. Interrupting Duty Report: Three-phase and unbalanced fault calculations, showing the following for each equipment location included in the report:
 - a. Voltage.
 - b. Calculated symmetrical fault-current magnitude and angle.
 - c. Fault-point X/R ratio.
 - d. No AC Decrement (NACD) ratio.
 - e. Equivalent impedance.
 - f. Multiplying factors for 2-, 3-, 5-, and 8-cycle circuit breakers rated on a symmetrical basis.
 - g. Multiplying factors for 2-, 3-, 5-, and 8-cycle circuit breakers rated on a total basis.
- H. Incident Energy and Flash Protection Boundary Calculations:
 1. Arcing fault magnitude.
 2. Protective device clearing time.
 3. Duration of arc.
 4. Arc-flash boundary.
 5. Restricted approach boundary.
 6. Limited approach boundary.
 7. Working distance.
 8. Incident energy.
 9. Hazard risk category.

10. Recommendations for arc-flash energy reduction.

- I. Fault study input data, case descriptions, and fault-current calculations including a definition of terms and guide for interpretation of computer printout.

2.3 ARC-FLASH WARNING LABELS

- A. Comply with requirements in Section 260553 "Identification for Electrical Systems" for self-adhesive equipment labels. Produce a 3.5-by-5-inch (76-by-127-mm) self-adhesive equipment label for each work location included in the analysis.
- B. Label shall have an orange header with the wording, "WARNING, ARC-FLASH HAZARD," and shall include the following information taken directly from the arc-flash hazard analysis:
 1. Location designation.
 2. Nominal voltage.
 3. Protection boundaries.
 - a. Arc-flash boundary.
 - b. Restricted approach boundary.
 - c. Limited approach boundary.
 4. Arc flash PPE category.
 5. Required minimum arc rating of PPE in Cal/cm squared.
 6. Available incident energy.
 7. Working distance.
 8. Engineering report number, revision number, and issue date.
- C. Labels should be machine printed, with no field-applied markings.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine Project overcurrent protective device submittals. Proceed with arc-flash study only after relevant equipment submittals have been assembled. Overcurrent protective devices that have not been submitted and approved prior to arc-flash study may not be used in study.

3.2 ARC-FLASH HAZARD ANALYSIS

- A. Comply with NFPA 70E and its Annex D for hazard analysis study.
- B. Preparatory Studies: Perform the Short-Circuit and Protective Device Coordination studies prior to starting the Arc-Flash Hazard Analysis.
 1. Short-Circuit Study Output: As specified in "Short-Circuit Studies" Section 260572.
 2. Coordination Study Report Contents: As specified in "Coordination Studies" Section 260573.

- C. Calculate maximum and minimum contributions of fault-current size.
 - 1. Maximum calculation shall assume a maximum contribution from the utility and shall assume motors to be operating under full-load conditions.
 - 2. Calculate arc-flash energy at 38 percent of maximum short-circuit current according to NFPA 70E recommendations.
- D. Calculate the arc-flash protection boundary and incident energy at locations in electrical distribution system where personnel could perform work on energized parts.
- E. Include medium- and low-voltage equipment locations, except equipment rated 240 V ac or less fed from transformers less than 125 kVA.
- F. Calculate the limited, restricted, and prohibited approach boundaries for each location.
- G. Incident energy calculations shall consider the accumulation of energy over time when performing arc-flash calculations on buses with multiple sources. Iterative calculations shall take into account the changing current contributions, as the sources are interrupted or decremented with time. Fault contribution from motors and generators shall be decremented as follows:
 - 1. Fault contribution from induction motors shall not be considered beyond three to five cycles.
 - 2. Fault contribution from synchronous motors and generators shall be decayed to match the actual decrement of each as closely as possible (for example, contributions from permanent magnet generators will typically decay from 10 per unit to three per unit after 10 cycles).
- H. Arc-flash energy shall generally be reported for the maximum of line or load side of a circuit breaker. However, arc-flash computation shall be performed and reported for both line and load side of a circuit breaker as follows:
 - 1. When the circuit breaker is in a separate enclosure.
 - 2. When the line terminals of the circuit breaker are separate from the work location.
- I. Base arc-flash calculations on actual overcurrent protective device clearing time. Cap maximum clearing time at two seconds based on IEEE 1584, Section B.1.2.

3.3 LABELING

- A. Apply arc-flash labels on the front cover of each section of the equipment and on side or rear covers with accessible live parts and hinged doors or removable plates for each equipment included in the study. Base arc-flash label data on highest values calculated at each location.
- B. Each piece of equipment listed below shall have an arc-flash label applied to it:
 - 1. Panelboard and safety switches.
 - 2. Control panel.
 - 3. Contactor.

- C. Note on record Drawings the location of equipment where the personnel could be exposed to arc-flash hazard during their work.
 - 1. Indicate arc-flash energy.
 - 2. Indicate protection level required.

3.4 APPLICATION OF WARNING LABELS

- A. Install arc-flash warning labels under the direct supervision and control of Power System Analysis Specialist.

3.5 DEMONSTRATION

- A. Engage Power Systems Analysis Specialist to train Owner's maintenance personnel in potential arc-flash hazards associated with working on energized equipment and the significance of arc-flash warning labels.

END OF SECTION 26 05 74

SECTION 26 24 16

PANELBOARDS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. This Section is to coordinate with and be complementary to the General Conditions and Supplementary General Conditions of the work, and Division 01 Specification Sections wherever applicable to Mechanical and Electrical Work.
- B. Section 01 31 46 – Special Requirements for Mechanical and Electrical Work shall apply.
- C. Section 26 05 00 – General Provisions for Electrical Work shall apply

1.2 SUMMARY

- A. Section Includes:
 - 1. Lighting and appliance branch-circuit panelboards.

1.3 DEFINITIONS

- A. ATS: Acceptance testing specification.
- B. GFCI: Ground-fault circuit interrupter.
- C. GFEP: Ground-fault equipment protection.
- D. HID: High-intensity discharge.
- E. MCCB: Molded-case circuit breaker.
- F. SPD: Surge protective device.
- G. VPR: Voltage protection rating.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of panelboard.
 - 1. Include materials, switching and overcurrent protective devices, SPDs, accessories, and components indicated.
 - 2. 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.
 - 2. Show tabulations of installed devices with nameplates, conductor termination sizes, equipment features, and ratings.

3. Detail enclosure types including mounting and anchorage, environmental protection, knockouts, corner treatments, covers and doors, gaskets, hinges, and locks.
4. Detail bus configuration, current, and voltage ratings.
5. Short-circuit current rating of panelboards and overcurrent protective devices.
6. Include evidence of NRTL listing for SPD as installed in panelboard.
7. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.
8. Include wiring diagrams for power, signal, and control wiring.
9. Key interlock scheme drawing and sequence of operations.
10. 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. Include an Internet link for electronic access to downloadable PDF of the coordination curves.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For testing agency.
- B. Panelboard Schedules: For installation in panelboards. Submit final versions after load balancing.

1.6 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For panelboards and components to include in emergency, operation, and maintenance manuals. As a minimum 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.

1.7 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. Keys: Two spares for each type of panelboard cabinet lock.
 2. Circuit Breakers Including GFCI and GFEP Types: Equal to 10 percent of quantity installed for each size and type, but no fewer than three of each size and type
 3. Fuses for Fused Switches: Equal to 10 percent of quantity installed for each size and type, but no fewer than three of each size and type.
 4. Fuses for Fused Power-Circuit Devices: Equal to 10 percent of quantity installed for each size and type, but no fewer than three of each size and type.

1.8 QUALITY ASSURANCE

- A. Manufacturer Qualifications: ISO 9001 or 9002 certified.

1.9 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.

- B. Handle and prepare panelboards for installation according to NEMA PB 1.

1.10 FIELD CONDITIONS

A. Environmental Limitations:

1. Interior Locations

- a. 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.
- b. Rate equipment for continuous operation under the following conditions unless otherwise indicated:
- c. Ambient Temperature:
 - 1) For circuit breaker panelboards; Not exceeding minus 22 deg F (minus 30 deg C) to plus 104 deg F (plus 40 deg C).
 - 2) For Switch and fuse panelboards; Not exceeding 23 deg F (minus 5 deg C) to plus 104 deg F (plus 40 deg C).
- d. Altitude: Not exceeding 6600 feet (2000 m).

- B. Interruption of Existing Electric Service: Do not interrupt electric service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary electric service according to requirements indicated:

- 1. Notify Owner no fewer than three days in advance of proposed interruption of electric service.
- 2. Do not proceed with interruption of electric service Owner's written permission.
- 3. Comply with NFPA 70E.

1.11 WARRANTY

- A. Manufacturer's Warranty: Manufacturer agrees to repair or replace panelboards that fail in materials or workmanship within specified warranty period.

- 1. Panelboard Warranty Period: 18 months from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PANELBOARDS REQUIREMENTS

- A. Product Selection for Restricted Space: Drawings indicate maximum dimensions for panelboards including clearances between panelboards and adjacent surfaces and other items. Comply with indicated maximum dimensions.
- 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 PB 1.
- D. City electrical Code (NYCEC).

- E. Electrical Components, Devices, and Accessories: Listed and labeled as defined in, NYCEC Article 100 by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- F. Enclosures: Surface - mounted, dead-front cabinets.
 - 1. Rated for environmental conditions at installed location.
 - a. Indoor Dry and Clean Locations: NEMA 250, Type 1
 - b. Other Wet or Damp Indoor Locations: NEMA 250, Type 4
 - c. Indoor Locations Subject to Dust, Falling Dirt, and Dripping Noncorrosive Liquids: NEMA 250, Type 12.
 - 2. Hinged Front Cover: Entire front trim hinged to box and with standard door within hinged trim cover. Trims shall cover all live parts and shall have no exposed hardware.
 - 3. Gutter Extension and Barrier: Same gage and finish as panelboard enclosure; integral with enclosure body. Arrange to isolate individual panel sections.
 - 4. Finishes:
 - a. Panels and Trim: galvanized 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: Same finish as panels and trim.
- G. Incoming Mains:
 - 1. Location: Top or Bottom as manufactured for a given application. Non-convertible.
 - 2. Main Breaker: The main circuit breaker shall be individually mounted. Branch mounted main circuit breakers are not acceptable.
- H. Phase, Neutral, and Ground Buses:
 - 1. Material; Hard-drawn copper, 98 percent conductivity.
 - a. Plating shall run entire length of bus.
 - b. Bus shall be fully rated the entire length.
 - 2. Interiors shall be factory assembled into a unit. Replacing switching and protective devices shall not disturb adjacent units or require removing the main bus connectors.
 - 3. Equipment Ground Bus: Adequate for feeder and branch-circuit equipment grounding conductors; bonded to box.
 - 4. Isolated Ground Bus: Adequate for branch-circuit isolated ground conductors; insulated from box.
 - 5. Full-Sized Neutral: Equipped with full-capacity bonding strap for service entrance applications. Mount electrically isolated from enclosure. Do not mount neutral bus in gutter.
 - 6. Extra-Capacity Neutral Bus: Neutral bus rated 200 percent of phase bus and listed and labeled by an NRTL acceptable to authority having jurisdiction, as suitable for nonlinear loads in electronic-grade panelboards and others designated on Drawings. Connectors shall be sized for double-sized or parallel conductors as indicated on Drawings. Do not mount neutral bus in gutter.
- I. Conductor Connectors: Suitable for use with conductor material and sizes.
 - 1. Material: Hard-drawn copper, 98 percent conductivity.
 - 2. Terminations shall allow use of 75 deg C rated conductors without derating.
 - 3. Size: Lugs suitable for indicated conductor sizes, with additional gutter space, if required, for larger conductors.

4. Main and Neutral Lugs: Mechanical type, with a lug on the neutral bar for each pole in the panelboard.
 5. Ground Lugs and Bus-Configured Terminators: Mechanical type, with a lug on the bar for each pole in the panelboard.
 6. Feed-Through Lugs: Mechanical type, suitable for use with conductor material. Locate at opposite end of bus from incoming lugs or main device.
 7. Subfeed (Double) Lugs: Mechanical type suitable for use with conductor material. Locate at the same end of bus as incoming lugs or main device.
 8. Gutter-Tap Lugs: Mechanical type suitable for use with conductor material and with matching insulating covers. Locate at the same end of the bus as incoming lugs or main device.
 9. Extra-Capacity Neutral Lugs: Rated 200 percent of phase lugs mounted on extra-capacity neutral bus.
- J. Panelboard Short-Circuit Current Rating: Fully rated to interrupt symmetrical short-circuit current available at terminals. Assembly listed by an NRTL for 100 percent interrupting capacity.
1. Panelboards and overcurrent protective devices rated 240 V or less shall have short-circuit ratings as shown on Drawings, but not less than 10,000 A rms symmetrical.

2.2 PERFORMANCE REQUIREMENTS

- A. Surge Suppression: Factory installed as an integral part of indicated panelboards, complying with UL 1449 SPD Type 1.
1. External Control-Power Source: 120-V branch circuit.

2.3 BRANCH-CIRCUIT PANELBOARDS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Eaton
 2. Square D
 3. General Electric Company
 4. Siemens
- B. Panelboards: NEMA PB 1, lighting and appliance branch-circuit type.
- C. Mains: Circuit breaker lugs only (indicated on plan).
- D. Branch Overcurrent Protective Devices: Bolt-on circuit breakers, replaceable without disturbing adjacent units.
- E. Contactors in Main Bus: NEMA ICS 2, Class A, mechanically held, general-purpose controller, with same short-circuit interrupting rating as panelboard.
1. Internal Control-Power Source: Control-power transformer, with fused primary and secondary terminals, connected to main bus ahead of contactor connection.
 2. External Control-Power Source: 120-V branch circuit
- F. Doors: Door-in-door construction with concealed hinges; secured with multipoint latch with tumbler lock; keyed alike. Outer door shall permit full access to the panel interior. Inner door

shall permit access to breaker operating handles and labeling, but current carrying terminals and bus shall remain concealed.

- G. Column-Type Panelboards: Single row of overcurrent devices with narrow gutter extension and overhead junction box equipped with ground and neutral terminal buses.
 - 1. Doors: Concealed hinges secured with multipoint latch with tumbler lock; keyed alike.

2.4 DISCONNECTING AND OVERCURRENT PROTECTIVE DEVICES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Eaton
 - 2. Square D
 - 3. General Electric Company
 - 4. Siemens

- B. MCCB: Comply with UL 489, with interrupting capacity to meet available fault currents.
 - 1. Thermal-Magnetic Circuit Breakers:
 - a. Inverse time-current element for low-level overloads.
 - b. Instantaneous magnetic trip element for short circuits.
 - c. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.
 - 2. Adjustable Instantaneous-Trip Circuit Breakers: Magnetic trip element with front-mounted, field-adjustable trip setting.
 - 3. Electronic Trip Circuit Breakers:
 - a. RMS sensing.
 - b. Field-replaceable rating plug or electronic trip.
 - c. Digital display of settings, trip targets, and indicated metering displays.
 - d. Multi-button keypad to access programmable functions and monitored data.
 - e. Ten-event, trip-history log. Each trip event shall be recorded with type, phase, and magnitude of fault that caused the trip.
 - f. Integral test jack for connection to portable test set or laptop computer.
 - g. Field-Adjustable Settings:
 - 1) Instantaneous trip.
 - 2) Long- and short-time pickup levels.
 - 3) Long and short time adjustments.
 - 4) Ground-fault pickup level, time delay, and I squared T response.
 - 4. Current-Limiting Circuit Breakers: Frame sizes 400 A and smaller; let-through ratings less than NEMA FU 1, RK-5.
 - 5. GFCI Circuit Breakers: Single- and double-pole configurations with Class A ground-fault protection (6-mA trip).
 - 6. GFEP Circuit Breakers: Class B ground-fault protection (30-mA trip).
 - 7. Arc-Fault Circuit Interrupter Circuit Breakers: Comply with UL 1699; 120/240-V, single-pole configuration.
 - 8. Subfeed Circuit Breakers: Vertically mounted.
 - 9. MCCB Features and Accessories:
 - a. Breaker handle indicates tripped status.
 - b. UL listed for reverse connection without restrictive line or load ratings.
 - c. Lugs: Mechanical style, suitable for number, size, trip ratings, and conductor materials.

- d. Shunt Trip: 120-V trip coil energized from separate circuit, set to trip at 55 percent of rated voltage.
 - e. Auxiliary Contacts: One, SPDT switch with "a" and "b" contacts; "a" contacts mimic circuit-breaker contacts and "b" contacts operate in reverse of circuit-breaker contacts.
 - f. Alarm Switch: Single-pole, normally open contact that actuates only when circuit breaker trips.
 - g. one-Selective Interlocking: Integral with electronic trip unit; for interlocking ground-fault protection function with other upstream or downstream devices.
 - h. Multipole units enclosed in a single housing with a single handle.
- C. Fused Switch: NEMA KS 1, Type HD; clips to accommodate specified fuses; lockable handle.
- 1. Fuses and Spare-Fuse Cabinet: Comply with requirements specified in Section 262813 "Fuses."
 - 2. Fused Switch Features and Accessories:
 - a. Standard ampere ratings and number of poles.
 - b. Mechanical cover interlock with a manual interlock override, to prevent the opening of the cover when the switch is in the on position. The interlock shall prevent the switch from being turned on with the cover open. The operating handle shall have lock-off means with provisions for three padlocks.
 - c. Auxiliary Contacts: One normally open and normally closed contact(s) that operate with switch handle operation.

2.5 IDENTIFICATION

- A. Panelboard Label: Manufacturer's name and trademark, voltage, amperage, number of phases, and number of poles shall be located on the interior of the panelboard door.
- B. Breaker Labels: Faceplate shall list current rating, UL and IEC certification standards, and AIC rating.
- C. Circuit Directory: Computer-generated circuit directory mounted inside panelboard door with transparent plastic protective cover.
 - 1. Circuit directory shall identify specific purpose with detail sufficient to distinguish it from all other circuits.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify actual conditions with field measurements prior to ordering panelboards to verify that equipment fits in allocated space in, and comply with, minimum required clearances specified in NFPA 70.
- B. Receive, inspect, handle, and store panelboards according to NEMA PB 1.1.
- C. Examine panelboards before installation. Reject panelboards that are damaged, rusted, or have been subjected to water saturation.

- D. Examine elements and surfaces to receive panelboards for compliance with installation tolerances and other conditions affecting performance of the Work.
- E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Coordinate layout and installation of panelboards and components with other construction that penetrates walls or is supported by them, including electrical and other types of equipment, raceways, piping, encumbrances to workspace clearance requirements, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.
- B. Comply with NECA 1.
- C. Install panelboards and accessories according to NEMA PB 1.1.
- D. Equipment Mounting:
 - 1. Attach panelboard to the vertical finished or structural surface behind the panelboard.
 - 2. Comply with requirements for seismic control devices and equipment.
- E. Mount top of trim 90 inches (2286 mm) above finished floor unless otherwise indicated.
- F. Mount panelboard cabinet plumb and rigid without distortion of box.
- G. Mount recessed panelboards with fronts uniformly flush with wall finish and mating with back box.
- H. Mount surface-mounted panelboards to steel slotted supports 5/8 inch (16 mm) 1 1/4 inch (32 mm) in depth. Orient steel slotted supports vertically.
- I. Install overcurrent protective devices and controllers not already factory installed.
 - 1. Set field-adjustable, circuit-breaker trip ranges.
 - 2. Tighten bolted connections and circuit breaker connections using calibrated torque wrench or torque screwdriver per manufacturer's written instructions.
- J. Make grounding connections and bond neutral for services and separately derived systems to ground. Make connections to grounding electrodes, separate grounds for isolated ground bars, and connections to separate ground bars.
- K. Install filler plates in unused spaces.
- L. Stub four 1-inch empty conduits from panelboard into accessible ceiling space or space designated to be ceiling space in the future. Stub four 1-inch empty conduits into raised floor space or below slab not on grade.
- M. Arrange conductors in gutters into groups and bundle and wrap with wire ties after completing load balancing.

- N. Mount spare fuse cabinet in an accessible location.

3.3 IDENTIFICATION

- A. Identify field-installed conductors, interconnecting wiring, and components; install warning signs complying with requirements in Section 260553 "Identification for Electrical Systems."
- B. Create a directory to indicate installed circuit loads after balancing panelboard loads; incorporate Owner's final room designations. Obtain approval before installing. Handwritten directories are not acceptable. Install directory inside panelboard door.
- C. Panelboard Nameplates: Label each panelboard with a nameplate complying with requirements for identification specified in Section 260553 "Identification for Electrical Systems."
- D. Device Nameplates: Label each branch circuit device in power panelboards with a nameplate complying with requirements for identification specified in Section 260553 "Identification for Electrical Systems."
- E. Install warning signs complying with requirements in Section 260553 "Identification for Electrical Systems" identifying source of remote circuit.

3.4 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
 - 1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
- B. Acceptance Testing Preparation:
 - 1. Test insulation resistance for each panelboard bus, component, connecting supply, feeder, and control circuit.
 - 2. Test continuity of each circuit.
- C. Tests and Inspections:
 - 1. Perform 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. 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.
- D. Panelboards will be considered defective if they do not pass tests and inspections.
- E. Prepare test and inspection reports, including a certified report that identifies panelboards included and that describes scanning results, with comparisons of the two scans. 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 indicated on plan
- C. Load Balancing: After Substantial Completion, but not more than 60 days after Final Acceptance, measure load balancing and make circuit changes. Change phase color coding to match the adjustments made.
 - 1. Measure loads during period of normal facility operations.
 - 2. Perform circuit changes to achieve load balancing outside normal facility operation schedule or at times directed by the Architect. Avoid disrupting services such as fax machines and on-line data processing, computing, transmitting, and receiving equipment.
 - 3. After changing circuits to achieve load balancing, recheck loads during normal facility operations. Record load readings before and after changing circuits to achieve load balancing.
 - 4. Tolerance: Maximum difference between phase loads, within a panelboard, shall not exceed 20 percent.

3.6 PROTECTION

- A. Temporary Heating: Prior to energizing panelboards, apply temporary heat to maintain temperature according to manufacturer's written instructions.

END OF SECTION 26 24 16

SECTION 26 27 26

WIRING DEVICES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. This Section is to coordinate with and be complementary to the General Conditions and Supplementary General Conditions of the work, and Division 01 Specification Sections wherever applicable to Mechanical and Electrical Work.
- B. Section 01 31 46 – Special Requirements for Mechanical and Electrical Work shall apply.
- C. Section 26 05 00 – General Provisions for Electrical Work shall apply

1.2 SUMMARY

- A. Section Includes:
 - 1. Standard-grade receptacles, 125 V, 20 A.
 - 2. GFCI receptacles, 125 V, 20 A.
 - 3. Wall plates.

1.3 DEFINITIONS

- A. AFCI: Arc-fault circuit interrupter.
- B. BAS: Building automation system.
- C. EMI: Electromagnetic interference.
- D. GFCI: Ground-fault circuit interrupter.
- E. Pigtail: Short lead used to connect a device to a branch-circuit conductor.
- F. RFI: Radio-frequency interference.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: List of legends and description of materials and process used for premarking wall plates.

1.5 INFORMATIONAL SUBMITTALS

- A. Field quality-control reports.

1.6 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For wiring devices to include in all manufacturers' packing-label warnings and instruction manuals that include labeling conditions.

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. Service/Power Poles: One for every 10, but no fewer than one.
 - 2. Floor Service-Outlet Assemblies: One for every 10, but no fewer than one.
 - 3. Poke-Through, Fire-Rated Closure Plugs: One for every 10 floor service outlets installed, but no fewer than two.
 - 4. SPD Receptacles: One for every 10 of each type installed, but no fewer than two of each type.

PART 2 - PRODUCTS

2.1 GENERAL WIRING-DEVICE REQUIREMENTS

- A. Wiring Devices, Components, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.
- B. Comply with NFPA 70.
- C. RoHS compliant.
- D. Comply with NEMA WD 1.
- E. Comply with New York City Electrical Code (NYCEC).
- F. Electrical Components, Devices, and Accessories: Listed and labeled as defined in, NYCEC Article 100 by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- G. Device Color:
 - 1. Wiring Devices Connected to Normal Power System: As selected by Architect unless otherwise indicated or required by NFPA 70 NYCEC or device listing.
- H. Wall Plate Color: For plastic covers, match device color.
- I. Source Limitations: Obtain each type of wiring device and associated wall plate from single source from single manufacturer.

2.2 STANDARD-GRADE RECEPTACLES, 125 V, 20 A

- A. Duplex Receptacles, 125 V, 20 A:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- a. Hubbell Incorporated
- b. Leviton Manufacturing Co.
- c. Arrow Hart
- d. Pass & Seymour
2. Description: Two pole, three wire, and self-grounding.
3. Configuration: NEMA WD 6, Configuration 5-20R.

B. Weather-Resistant Duplex Receptacle, 125 V, 20 A:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Hubbell Incorporated
 - b. Leviton Manufacturing Co.
 - c. Arrow Hart
 - d. Pass & Seymour
2. Description: Two pole, three wire, and self-grounding. Integral shutters that operate only when a plug is inserted in the receptacle. Square face.
3. Configuration: NEMA WD 6, Configuration 5-20R.
4. Standards: Comply with UL 498.

C. Tamper- and Weather-Resistant Duplex Receptacles, 125 V, 20 A:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Hubbell Incorporated
 - b. Leviton Manufacturing Co.
 - c. Arrow Hart
 - d. Pass & Seymour
2. Description: Two pole, three wire, and self-grounding. Integral shutters that operate only when a plug is inserted in the receptacle. Square face.
3. Configuration: NEMA WD 6, Configuration 5-20R.
4. Standards: Comply with UL 498.

2.3 GFCI RECEPTACLES, 125 V, 20 A

A. Duplex GFCI Receptacles, 125 V, 20 A:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Hubbell Incorporated
 - b. Leviton Manufacturing Co.
 - c. Arrow Hart
 - d. Pass & Seymour
2. Description: Integral GFCI with "Test" and "Reset" buttons and LED indicator light. Two pole, three wire, and self-grounding.
3. Configuration: NEMA WD 6, Configuration 5-20R.
4. Type: Feed-through.
5. Standards: Comply with UL 498, UL 943 Class A, and FS W-C-596.
6. Description: Integral GFCI with "Test" and "Reset" buttons and LED indicator light. Two pole, three wire, and self-grounding. Integral shutters that operate only when a plug is inserted in the receptacle. Square face.
7. Configuration: NEMA WD 6, Configuration 5-15R.
8. Type: Feed through.
9. Standards: Comply with UL 498 and UL 943 Class A.

2.4 WALL PLATES

- A. Single Source: Obtain wall plates from same manufacturer of wiring devices.
- B. Single and combination types shall match corresponding wiring devices.
 - 1. Plate-Securing Screws: Metal with head color to match plate finish.
 - 2. Material for Finished Spaces: Steel with white baked enamel, suitable for field painting
 - 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 and damp locations.
- C. Wet-Location, Weatherproof Cover Plates: NEMA 250, complying with Type 3R, weather-resistant, die-cast aluminum with lockable cover.
- D. Antimicrobial Cover Plates:
 - 1. Contact surfaces treated with a coating that kills 99.9 percent of certain common bacteria within two hours when regularly and properly cleaned.
 - 2. Tarnish resistant.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Comply with NECA 1, including mounting heights listed in that standard, unless otherwise indicated on drawings.
- B. Coordination with Other Trades:
 - 1. Protect installed devices and their boxes. Do not place wall finish materials over device boxes, and do not cut holes for boxes with routers that are guided by riding against outside of boxes.
 - 2. Keep outlet boxes free of plaster, drywall joint compound, mortar, cement, concrete, dust, paint, and other material that may contaminate the raceway system, conductors, and cables.
 - 3. Install device boxes in brick or block walls so that the cover plate does not cross a joint unless the joint is troweled flush with the face of the wall.
 - 4. Install wiring devices after all wall preparation, including painting, is complete.
- C. Conductors:
 - 1. Do not strip insulation from conductors until right before they are spliced or terminated on devices.
 - 2. Strip insulation evenly around the conductor using tools designed for the purpose. Avoid scoring or nicking of solid wire or cutting strands from stranded wire.
 - 3. The length of free conductors at outlets for devices shall comply with NFPA 70, NYCEC, Article 300, without pigtails.
 - 4. Existing Conductors:
 - a. Cut back and pigtail, or replace all damaged conductors.
 - b. Straighten conductors that remain and remove corrosion and foreign matter.
 - c. Pigtail existing conductors is permitted, provided the outlet box is large enough.

D. Device Installation:

1. Replace devices that have been in temporary use during construction and that were installed before building finishing operations were complete.
2. Keep each wiring device in its package or otherwise protected until it is time to connect conductors.
3. Do not remove surface protection, such as plastic film and smudge covers, until the last possible moment.
4. Connect devices to branch circuits using pigtails that are not less than 6 inches in length.
5. When there is a choice, use side wiring with binding-head screw terminals. Wrap solid conductor tightly clockwise, two-thirds to three-fourths of the way around terminal screw.
6. Use a torque screwdriver when a torque is recommended or required by manufacturer.
7. When conductors larger than No. 12 AWG are installed on 15- or 20-A circuits, splice No. 12 AWG pigtails for device connections.
8. Tighten unused terminal screws on the device.
9. When mounting into metal boxes, remove the fiber or plastic washers used to hold device-mounting screws in yokes, allowing metal-to-metal contact.

E. Receptacle Orientation:

1. Install ground pin of vertically mounted receptacles down, and on horizontally mounted receptacles to the right.
2. Install hospital-grade receptacles in patient-care areas with the ground pin or neutral blade at the top.

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, multigang wall plates.

H. Adjust locations of floor service outlets and service poles to suit arrangement of partitions and furnishings.

3.2 GFCI RECEPTACLES

A. Install non-feed-through GFCI receptacles where protection of downstream receptacles is not required.

3.3 IDENTIFICATION

A. Comply with Section 260553 "Identification for Electrical Systems."

B. Identify each receptacle with panelboard identification and circuit number. Use hot, stamped, or engraved machine printing with white-filled lettering on face of plate, and durable wire markers or tags inside outlet boxes.

3.4 FIELD QUALITY CONTROL

A. Test Instruments: Use instruments that comply with UL 1436.

- B. Test Instrument for Receptacles: Digital wiring analyzer with digital readout or illuminated digital-display indicators of measurement.
- C. Tests for Receptacles:
 - 1. Line Voltage: Acceptable range is 105 to 132 V.
 - 2. Percent Voltage Drop under 15-A Load: A value of 6 percent or higher is unacceptable.
 - 3. Ground Impedance: Values of up to 2 ohms are acceptable.
 - 4. GFCI Trip: Test for tripping values specified in UL 1436 and UL 943.
 - 5. Using the test plug, verify that the device and its outlet box are securely mounted.
 - 6. Tests shall be diagnostic, indicating damaged conductors, high resistance at the circuit breaker, poor connections, inadequate fault-current path, defective devices, or similar problems. Correct circuit conditions, remove malfunctioning units and replace with new ones, and retest as specified above.
- D. Test straight-blade convenience for the retention force of the grounding blade according to NFPA 99. Retention force shall be not less than 4 oz.
- E. Wiring devices will be considered defective if it does not pass tests and inspections.
- F. Prepare test and inspection reports.

END OF SECTION 26 27 26

SECTION 26 28 13

FUSES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. This Section is to coordinate with and be complementary to the General Conditions and Supplementary General Conditions of the work, and Division 01 Specification Sections wherever applicable to Mechanical and Electrical Work.
- B. Section 01 31 46 – Special Requirements for Mechanical and Electrical Work shall apply.
- C. Section 26 05 00 – General Provisions for Electrical Work shall apply
- D. Section Includes:
 - 1. Cartridge fuses rated 600 V ac and less for use in the following:
 - a. Control circuits.
 - b. Enclosed controllers.
 - c. Enclosed switches.
 - 2. Spare-fuse cabinets.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product. Include construction details, material descriptions, dimensions of individual components and profiles, 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. Coordination charts and tables and related data.

1.3 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For fuses to include in emergency, operation, and maintenance manuals. In addition to items specified in "Closeout Procedures," and "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 used on the Project. Submit in PDF format.
 - 4. Coordination charts and tables and related data.

1.4 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Fuses: Equal to 10 percent of quantity installed for each size and type, but no fewer than three of each size and type.

1.5 FIELD CONDITIONS

- A. Where ambient temperature to which fuses are directly exposed is less than 40 deg F (5 deg C) or more than 100 deg F (38 deg C), apply manufacturer's ambient temperature adjustment factors to fuse ratings.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Bussmann, (Eaton)
 - 2. Edison
 - 3. Littlefuse
 - 4. Mersen USA
- B. Source Limitations: Obtain fuses, for use within a specific product or circuit, from single source from single manufacturer.

2.2 CARTRIDGE FUSES

- A. Characteristics: NEMA FU 1, current-limiting, nonrenewable cartridge fuses with voltage ratings consistent with circuit voltages.
 - 1. Type RK-1: 250V, zero- to 600-A rating, 200 kAIC.
 - 2. Type RK-5: 250 V, zero- to 600-A rating, 200 kAIC
- 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. Coordinate fuse ratings with utilization equipment nameplate limitations of maximum fuse size and with system short-circuit current levels.

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 20 percent spare capacity minimum.
 - 2. Finish: Gray, baked enamel.

3. Identification: "SPARE FUSES" in 1-1/2-inch- (38-mm-) high letters on exterior of door.
4. Fuse Pullers: For each size of fuse, where applicable and available, from fuse manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine fuses before installation. Reject fuses that are moisture damaged or physically damaged.
- B. Examine holders to receive fuses for compliance with installation tolerances and other conditions affecting performance, such as rejection features.
- C. Examine utilization equipment nameplates and installation instructions. Install fuses of sizes and with characteristics appropriate for each piece of equipment.
- D. Evaluate ambient temperatures to determine if fuse rating adjustment factors must be applied to fuse ratings.
- E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 FUSE APPLICATIONS

- A. Cartridge Fuses:
 1. Feeders: Class L, time delay.
 2. Motor Branch Circuits: Class RK1 time delay.
 3. Other Branch Circuits: J, fast acting.
 4. Control Transformer Circuits: Class CC, time delay, control transformer duty.

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) in location shown on the Drawings or as indicated in the field by Engineer

3.4 IDENTIFICATION

- A. Install labels complying with requirements for identification specified in Section 260553 "Identification for Electrical Systems" indicating fuse replacement information inside of door of each fused switch and adjacent to each fuse block, socket, and holder.

END OF SECTION 26 28 13

SECTION 26 28 16

ENCLOSED SWITCHES AND CIRCUIT BREAKERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. This Section is to coordinate with and be complementary to the General Conditions and Supplementary General Conditions of the work, and Division 01 Specification Sections wherever applicable to Mechanical and Electrical Work.
- B. Section 01 31 46 – Special Requirements for Mechanical and Electrical Work shall apply.
- C. Section 26 05 00 – General Provisions for Electrical Work shall apply

1.2 SUMMARY

- A. Section Includes:
 - 1. Fusible switches.
 - 2. Nonfusible switches.
 - 3. Molded-case circuit breakers (MCCBs).
 - 4. Molded-case switches.
 - 5. Enclosures.

1.3 DEFINITIONS

- A. NC: Normally closed.
- B. NO: Normally open.
- C. SPDT: Single pole, double throw.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of enclosed switch, circuit breaker, accessory, and component indicated. Include nameplate ratings, 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 a nationally recognized testing laboratory (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. Provide in PDF electronic format.

- B. Shop Drawings: For enclosed switches and circuit breakers.
 - 1. Include plans, elevations, sections, details, and attachments to other work.
 - 2. Include wiring diagrams for power, signal, and control wiring.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified testing agency.
- B. Manufacturer Seismic Qualification Certification: Submit certification that enclosures and cabinets and their mounting provisions, including those for internal components.
- C. Field quality-control reports.

1.6 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For enclosed switches and circuit breakers to include in emergency, operation, and maintenance manuals.

1.7 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. 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.

1.8 QUALITY ASSURANCE

- A. Testing Qualifications: Accredited by NETA.
 - 1. Testing Contractor's Field Supervisor: to manufacturer specifications

1.9 FIELD 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 (minus 30 deg C) and not exceeding 104 deg F (40 deg C).
 - 2. Altitude: Not exceeding 6600 feet (2010 m).

1.10 WARRANTY

- A. Manufacturer's Warranty: Manufacturer and Installer agree to repair or replace components that fail in materials or workmanship within specified warranty period.
 - 1. Warranty Period: One year (from date of Substantial Completion).

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

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

2.2 GENERAL REQUIREMENTS

- A. Source Limitations: Obtain enclosed switches and circuit breakers, overcurrent protective devices, components, and accessories, within same product category, from single manufacturer.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by an NRTL, and marked for intended location and application.
- C. Comply with NFPA 70.
 - a. Comply with New York City electrical Code (NYCEC).
 - b. Electrical Components, Devices, and Accessories: Listed and labeled as defined in, NYCEC Article 100 by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

2.3 FUSIBLE SWITCHES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. ABB Inc.
 - 2. Eaton
 - 3. General electric Company
 - 4. Siemens Industry, Inc
 - 5. Square D, by Schneider electric
- B. Type HD, Heavy Duty:
 - 1. Single throw.
 - 2. Three pole.
 - 3. 240-V ac.
 - 4. 1200 A and smaller.
 - 5. UL 98 and NEMA KS 1, horsepower rated, with clips or bolt pads to accommodate specified and indicated fuses.
 - 6. Lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.
- C. Accessories:
 - 1. Hookstick Handle: Allows use of a hookstick to operate the handle.
 - 2. Lugs: Mechanical type, suitable for number, size, and conductor material.

2.4 NONFUSIBLE SWITCHES

- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
- 2. ABB Inc.
- 3. Eaton
- 4. General electric Company
- 5. Siemens Industry, Inc
- 6. Square D, by Schneider electric

- B. Type HD, Heavy Duty, Three Pole, Single Throw, 240-V ac, 1200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, lockable handle with capability to accept three
- C. Accessories:
 - 1. Hookstick Handle: Allows use of a hookstick to operate the handle.
 - 2. Lugs: Mechanical type, suitable for number, size, and conductor material.

2.5 MOLDED-CASE CIRCUIT BREAKERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Eaton
 - 2. Square D
 - 3. General Electric Company
 - 4. Siemens
- B. Circuit breakers shown to be installed within existing motor control centers as shown in the drawings must be compatible with the existing motor control centers in which they are intended to be installed. Contractor must become familiar with and coordinate with the existing motor control center manufacturer to determine which MCCBs to purchase for this scope of work.
- C. Circuit breakers shall be constructed using glass-reinforced insulating material. Current carrying components shall be completely isolated from the handle and the accessory mounting area.
- D. Circuit breakers shall have a toggle operating mechanism with common tripping of all poles, which provides quick-make, quick-break contact action. The circuit-breaker handle shall be over center, be trip free, and reside in a tripped position between on and off to provide local trip indication. Circuit-breaker escutcheon shall be clearly marked on and off in addition to providing international I/O markings. Equip circuit breaker with a push-to-trip button, located on the face of the circuit breaker to mechanically operate the circuit-breaker tripping mechanism for maintenance and testing purposes.
- E. MCCBs shall be equipped with a device for locking in the isolated position.
- F. Lugs shall be suitable for 140 deg F (60 deg C) rated wire on 125-A circuit breakers and below rated wire, sized according to the 167 deg F (75 deg C) temperature rating in NYCEC.
- G. Standard: Comply with UL 489 with interrupting capacity to comply with available fault currents.
- H. Thermal-Magnetic Circuit Breakers: Inverse time-current thermal element for low-level overloads and instantaneous magnetic trip element for short circuits.
- I. Adjustable, Instantaneous-Trip Circuit Breakers: Magnetic trip element with front-mounted, field-adjustable trip setting.
- J. Electronic Trip Circuit Breakers: Field-replaceable rating plug, rms sensing, with the following field-adjustable settings:
 - 1. Instantaneous trip.
 - 2. Long- and short-time pickup levels.
 - 3. Long- and short-time time adjustments.

4. Ground-fault pickup level, time delay, and I-squared t response.
- K. Current-Limiting Circuit Breakers: Frame sizes 400 A and smaller, and let-through ratings less than NEMA FU 1, RK-5.
- L. Integrally Fused Circuit Breakers: Thermal-magnetic trip element with integral limiter-style fuse listed for use with circuit breaker and trip activation on fuse opening or on opening of fuse compartment door.
- M. 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.
 4. Ground-Fault Protection: Comply with UL 1053; integrally mounted, self-powered type 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: Trip coil energized from separate circuit, with coil-clearing contact.
 6. Undervoltage Trip: Set to operate at 35 to 75 percent of rated voltage without intentional time delay.
 7. Auxiliary Contacts: One SPDT switch with "a" and "b" contacts; "a" contacts mimic circuit-breaker contacts, "b" contacts operate in reverse of circuit-breaker contacts.
 8. Alarm Switch: One NO contact that operates only when circuit breaker has tripped.
 9. Key Interlock Kit: Externally mounted to prohibit circuit-breaker operation; key shall be

2.6 MOLDED-CASE SWITCHES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 1. Eaton
 2. Square D
 3. General Electric Company
 4. Siemens
- B. Description: MCCB with fixed, high-set instantaneous trip only, and short-circuit withstand rating equal to equivalent breaker frame size interrupting rating.
- C. Standard: Comply with UL 489 with interrupting capacity to comply with available fault currents.
- D. Features and Accessories:
 1. Standard frame sizes and number of poles.
 2. Lugs:
 - a. Mechanical type, suitable for number, size, trip ratings, and conductor material.
 - b. Lugs shall be suitable for deg F (75 deg C) rated wire] [194 deg F (90 deg C) rated wire, sized according to the 167 deg F (75 deg C) temperature rating in NFPA 70.
 3. Ground-Fault Protection: Comply with UL 1053; remote-mounted and powered type 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.
 4. Shunt Trip: Trip coil energized from separate circuit, with coil-clearing contact.

5. Undervoltage Trip: Set to operate at 35 to 75 percent of rated voltage without intentional time delay.
6. Auxiliary Contacts: One SPDT switch with "a" and "b" contacts; "a" contacts mimic switch contacts, "b" contacts operate in reverse of switch contacts.
7. Alarm Switch: One NO contact that operates only when switch has tripped.
8. Key Interlock Kit: Externally mounted to prohibit switch operation; key shall be removable only when switch is in off position.
9. Zone-Selective Interlocking: Integral with ground-fault shunt trip unit; for interlocking ground-fault protection function.

2.7 ENCLOSURES

- A. Enclosed Switches and Circuit Breakers: UL 489, NEMA KS 1, NEMA 250, and UL 50, to comply with environmental conditions at installed location.
- B. Enclosure Finish: The enclosure shall be finished with gray baked enamel paint, electrodeposited on cleaned, phosphatized steel (NEMA 250 Type 1).
- C. Conduit Entry: NEMA 250 Types 4, 4X, and 12 enclosures shall contain no knockouts. NEMA 250 Types 7 and 9 enclosures shall be provided with threaded conduit openings in both endwalls.
- D. Operating Mechanism: The circuit-breaker operating handle shall be externally operable with the operating mechanism being an integral part of the box, not the cover. The cover interlock mechanism shall have an externally operated override. The override shall not permanently disable the interlock mechanism, which shall return to the locked position once the override is released. The tool used to override the cover interlock mechanism shall not be required to enter the enclosure in order to override the interlock.
- E. Enclosures designated as NEMA 250 Type 4, 4X stainless steel, 12, or 12K shall have a dual cover interlock mechanism to prevent unintentional opening of the enclosure cover when the circuit breaker is ON and to prevent turning the circuit breaker ON when the enclosure cover is open.
- F. NEMA 250 Type 7/9 enclosures shall be furnished with a breather and drain kit to allow their use in outdoor and wet location applications.

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.
 1. Commencement of work shall indicate Installer's acceptance of the areas and conditions as satisfactory.

3.2 PREPARATION

- A. Interruption of Existing Electric Service: Do not interrupt electric service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary electric service according to requirements indicated:
 - 1. Notify Owner no fewer than fourteen (14) days in advance of proposed interruption of electric service.
 - 2. Indicate method of providing temporary electric service.
 - 3. Do not proceed with interruption of electric service without Owner's written permission.
 - 4. Comply with NFPA 70E.

3.3 ENCLOSURE ENVIRONMENTAL RATING APPLICATIONS

- A. Enclosed Switches and Circuit Breakers: Provide enclosures at installed locations with the following environmental ratings.
 - 1. Indoor, Dry and Clean Locations: NEMA 250, Type 1.
 - 2. Outdoor Locations: NEMA 250, Type 3R.
 - 3. Other Wet or Damp, Indoor Locations: NEMA 250, Type 4
 - 4. Indoor Locations Subject to Dust, Falling Dirt, and Dripping Noncorrosive Liquids:

3.4 INSTALLATION

- 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.
- B. Comply with mounting and anchoring requirements specified.
- C. Temporary Lifting Provisions: Remove temporary lifting of eyes, channels, and brackets and temporary blocking of moving parts from enclosures and components.
- D. Install fuses in fusible devices.
- E. Comply with NFPA 70 and NECA 1.

3.5 IDENTIFICATION

- A. Comply with requirements in Section 260553 "Identification for Electrical Systems."
 - 1. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs.
 - 2. Label each enclosure with engraved metal or laminated-plastic nameplate.

3.6 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to test and
- B. Perform tests and inspections
- C. Tests and Inspections for Switches:
 - 1. Visual and Mechanical Inspection:
 - a. Inspect physical and mechanical condition.

- b. Inspect anchorage, alignment, grounding, and clearances.
 - c. Verify that the unit is clean.
 - d. Verify blade alignment, blade penetration, travel stops, and mechanical operation.
 - e. Verify that fuse sizes and types match the Specifications and Drawings.
 - f. Verify that each fuse has adequate mechanical support and contact integrity.
 - g. Inspect bolted electrical connections for high resistance using one of the two following methods:
 - 1) Use a low-resistance ohmmeter.
 - a) Compare bolted connection resistance values to values of similar connections. Investigate values that deviate from those of similar bolted connections by more than 50 percent of the lowest value.
 - 2) Verify tightness of accessible bolted electrical connections by calibrated torque-wrench method in accordance with manufacturer's published data or NETA ATS Table 100.12.
 - a) Bolt-torque levels shall be in accordance with manufacturer's published data. In the absence of manufacturer's published data, use NETA ATS Table 100.12.
 - h. Verify that operation and sequencing of interlocking systems is as described in the Specifications and shown on the Drawings.
 - i. Verify correct phase barrier installation.
 - j. Verify lubrication of moving current-carrying parts and moving and sliding surfaces.
2. Electrical Tests:
- a. Perform resistance measurements through bolted connections with a low-resistance ohmmeter. Compare bolted connection resistance values to values of similar connections. Investigate values that deviate from adjacent poles or similar switches by more than 50 percent of the lowest value.
 - b. Measure contact resistance across each switchblade fuseholder. Drop values shall not exceed the high level of the manufacturer's published data. If manufacturer's published data are not available, investigate values that deviate from adjacent poles or similar switches by more than 50 percent of the lowest value.
 - c. Perform insulation-resistance tests for one minute on each pole, phase-to-phase and phase-to-ground with switch closed, and across each open pole. Apply voltage in accordance with manufacturer's published data. In the absence of manufacturer's published data, use Table 100.1 from the NETA ATS. Investigate values of insulation resistance less than those published in Table 100.1 or as recommended in manufacturer's published data.
 - d. Measure fuse resistance. Investigate fuse-resistance values that deviate from each other by more than 15 percent.
 - e. Perform ground fault test according to NETA ATS 7.14 "Ground Fault Protection Systems, Low-Voltage."
- D. Tests and Inspections for Molded Case Circuit Breakers:
- 1. Visual and Mechanical Inspection:
 - a. Verify that equipment nameplate data are as described in the Specifications and shown on the Drawings.
 - b. Inspect physical and mechanical condition.

- c. Inspect anchorage, alignment, grounding, and clearances.
 - d. Verify that the unit is clean.
 - e. Operate the circuit breaker to ensure smooth operation.
 - f. Inspect bolted electrical connections for high resistance using one of the two following methods:
 - 1) Use a low-resistance ohmmeter.
 - a) Compare bolted connection resistance values to values of similar connections. Investigate values that deviate from those of similar bolted connections by more than 50 percent of the lowest value.
 - 2) Verify tightness of accessible bolted electrical connections by calibrated torque-wrench method in accordance with manufacturer's published data or NETA ATS Table 100.12.
 - a) Bolt-torque levels shall be in accordance with manufacturer's published data. In the absence of manufacturer's published data, use NETA ATS Table 100.12.
 - g. Inspect operating mechanism, contacts, and chutes in unsealed units.
 - h. Perform adjustments for final protective device settings in accordance with the coordination study.
2. Electrical Tests:
- a. Perform resistance measurements through bolted connections with a low-resistance ohmmeter. Compare bolted connection resistance values to values of similar connections. Investigate values that deviate from adjacent poles or similar switches by more than 50 percent of the lowest value.
 - b. Perform insulation-resistance tests for one minute on each pole, phase-to-phase and phase-to-ground with circuit breaker closed, and across each open pole. Apply voltage in accordance with manufacturer's published data. In the absence of manufacturer's published data, use Table 100.1 from the NETA ATS. Investigate values of insulation resistance less than those published in Table 100.1 or as recommended in manufacturer's published data.
 - c. Perform a contact/pole resistance test. Drop values shall not exceed the high level of the manufacturer's published data. If manufacturer's published data are not available, investigate values that deviate from adjacent poles or similar switches by more than 50 percent of the lowest value.
 - d. Perform insulation resistance tests on all control wiring with respect to ground. Applied potential shall be 500-V dc for 300-V rated cable and 1000-V dc for 600-V rated cable. Test duration shall be one minute. For units with solid state components, follow manufacturer's recommendation. Insulation resistance values shall be no less than two megohms.
 - e. Determine the following by primary current injection:
 - 1) Long-time pickup and delay. Pickup values shall be as specified. Trip characteristics shall not exceed manufacturer's published time-current characteristic tolerance band, including adjustment factors.
 - 2) Short-time pickup and delay. Short-time pickup values shall be as specified. Trip characteristics shall not exceed manufacturer's published time-current characteristic tolerance band, including adjustment factors.

- 3) Ground-fault pickup and time delay. Ground-fault pickup values shall be as specified. Trip characteristics shall not exceed manufacturer's published time-current characteristic tolerance band, including adjustment factors.
 - 4) Instantaneous pickup. Instantaneous pickup values shall be as specified and within manufacturer's published tolerances.
 - f. Test functionality of the trip unit by means of primary current injection. Pickup values and trip characteristics shall be as specified and within manufacturer's published tolerances.
 - g. Perform minimum pickup voltage tests on shunt trip and close coils in accordance with manufacturer's published data. Minimum pickup voltage of the shunt trip and close coils shall be as indicated by manufacturer.
 - h. Verify correct operation of auxiliary features such as trip and pickup indicators; zone interlocking; electrical close and trip operation; trip-free, anti-pump function; and trip unit battery condition. Reset all trip logs and indicators. Investigate units that do not function as designed.
 - i. Verify operation of charging mechanism. Investigate units that do not function as designed.
 3. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
 4. Perform the following infrared scan tests and inspections and prepare reports:
 - a. Initial Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each enclosed switch and circuit breaker. Remove front panels so joints and connections are accessible to portable scanner.
 - b. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each enclosed switch and circuit breaker 11 months after date of Substantial Completion.
 - c. Instruments and Equipment: Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.
 5. Test and adjust controls, remote monitoring, and safeties. Replace damaged and malfunctioning controls and equipment.
- E. Enclosed switches and circuit breakers will be considered defective if they do not pass tests and inspections.
- F. Prepare test and inspection reports.
1. Test procedures used.
 2. Include identification of each enclosed switch and circuit breaker tested and describe test results.
 3. List deficiencies detected, remedial action taken, and observations after remedial action.

3.7 ADJUSTING

- A. Adjust moving parts and operable components to function smoothly, and lubricate as
- B. Set field-adjustable circuit-breaker trip ranges to values indicated on the Drawings.

END OF SECTION 26 28 16

SECTION 28 31 13

FIRE PROTECTIVE ALARM SYSTEM

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

- A. This Section is to coordinate with and be complementary to the General Conditions and Supplementary General Conditions of the work, wherever applicable to Mechanical and Electrical Work.
- B. Section 01 31 46 - Special Requirements for Mechanical and Electrical Work shall apply.
- C. Section 26 05 00 - General Provisions for Electrical Work shall apply.
- D. Drawings are diagrammatic and are a graphic representation of contract requirements to best available standards at the scale required.

1.2 DESCRIPTION OF WORK

- A. The system shall consist of addressable, intelligent devices, analog detecting, low voltage and modular, with digital communication techniques, in full compliance with all applicable codes and standards. Generic terms such as “sub system”, “the system”, “a system”, “the fire alarm system”, etc. shall be deemed to apply to the complete intelligent analog addressable fire alarm system, unless specifically noted elsewhere.
- B. The features and capacities described in this specification are a requirement for this project and shall be furnished by the successful Contractor. The system as described shall be installed, programmed, tested, and delivered to the Owner in fully operational condition. The system shall include all required hardware, software, raceways and interconnecting wiring to accomplish the requirements of this specification and the contract drawings, whether or not specifically itemized herein. The system shall consist of, but not be limited to, the following:
 - 1. Fire Command Station with Integral Flashing “FIRE” Visible Signal. (FCS)
 - 2. Remote System Panel. (RSP)
 - 3. Remote Annunciator Panel(s) with LCD alphanumeric display. (If required)
 - 4. Fire System Alarm Printer(s).
 - 5. System CRT Terminal with Keyboard.
 - 6. Addressable Analog Duct Smoke Sensors.
 - 7. Addressable Interface Modules.
 - 8. Audible and Visual Notification Devices.
- C. Devices to be controlled by the FCS and/or RSP’s panel programmable relays, duct smoke detector programmable relays, remote system programmable addressable relays and/or intelligent addressable interface module relays:
 - 1. Connections to the appropriate Receiving Agency for smoke alarm, supervisory, and system trouble conditions.
 - 2. Air handling fan systems alarm shutdown operations.
 - 3. Fire/smoke dampers operations. (If required)

1.3 RELATED DOCUMENTS / WORK AND EXISTING CONDITIONS

A. RELATED DOCUMENTS

1. Prior to the commencement of work, the Contractor shall obtain all permits necessary for installation of the work. All permit costs and inspections fees shall be included as part of the required work.
2. Local requirements shall be adhered to with regard to submitting specifications, wiring diagrams, shop drawings and plans. Responsibility for furnishing the quantities of copies on cloth and/or paper, as directed by such requirements, shall be included as part of the work of this Section.
3. Prior to commencement and after completion of work, the Contractor shall notify all authorities having jurisdiction.
4. The Contractor shall submit a letter of approval of the installation, from the local code authority, before requesting final acceptance of the system.

B. RELATED WORK

1. The Contractor shall coordinate work in this Section with all related trades. Work and/or equipment provided in other Sections and related to the fire alarm system shall include, but not be limited to:
2. Duct smoke sensors to be installed by the Mechanical Contractor. See Division 23. They shall be furnished, wired and connected to the fire alarm system by the Contractor.
3. Air handling system, smoke exhaust fan and smoke damper control circuits and fan status contacts to be provided by the fan systems control equipment. See Division 23. They shall be wired and connected to the fire alarm system by the Contractor.
4. Coordinate with all other trade Contractors for the mounting of and/or interfacing with any and all other fire alarm system related devices.
5. The Contractor shall visit the site to determine and verify all existing conditions. Existing conditions that would, in the Contractor's opinion, prohibit or greatly delay construction progress shall be brought to the Architect's and Engineer's attention in writing.
6. No additional compensation shall be permitted for variations due to field conditions that would affect the installation of the fire alarm system.

C. RETROFIT COORDINATION REQUIREMENTS

1. **VERIFICATION TESTING:** The fire protection Contractor shall test and document the operation of existing fire protection system(s) prior to new installation. The purpose of testing is to establish a benchmark of functional reliability prior to altering or removing existing protection. The Contractor shall maintain the condition and integrity of existing life safety equipment as found after verification testing. Interfacing requirements shall be provided for all new installed work during the phasing of this project. Interfacing shall mean that both existing and new work shall operate and/or function as one system during the life cycle of installation.
2. **CRITICAL PATH - INSTALLATION SCHEDULE:** The fire protection Contractor shall prepare, and gain approval by the Owner or owners Engineer, an installation schedule based on owners priorities prior to the start of work. Any deviation from the agreed work schedule, unless requested in writing and approved, shall not be acceptable. Minimizing impact on normal business activities shall be the contractor's responsibility, should "off-hour" work be required outside of the approved installation schedule, the Contractor shall request a change order prior to starting work.
3. **FIRE WATCH RESPONSIBILITIES:** Prior to the start of work the Owner and Contractor shall determine fire watch activities. This shall include, but not be limited to, the who, what, where, when and how fire watch activities shall be performed. As a minimum, the

Owner shall provide the necessary manpower to conduct fire watch activities during scheduled installations. Non-scheduled work shall be the fire protection contractor's responsibility to provide all necessary manpower and equipment to conduct fire watch duties.

4. RETROFIT FINAL ACCEPTANCE TESTING: Partial system modifications and add on changes shall be accepted tested as per NFPA 7-1.6.2. Complete fire system replacement shall use NFPA 72 - 1-7.2.
5. Other (e.g. Project Meetings, Installation Progress Reports to Engineer)

D. MODIFICATIONS TO EXISTING SYSTEM

1. The system shall consist of, but not be limited to, the following: indicated plans and associated REFERENCES - APPLICABLE LISTINGS, CODES, STANDARDS, DOCUMENTS

E. STANDARDS AND CODES

1. All equipment shall be installed and complied with the current adopted provisions of the following codes and standards.
2. All equipment shall be U.L. listed for its intended use, as a minimum, the following standards shall apply:
 - a. U.L. 268 and 268A - Smoke Detectors for Fire Protective Signaling Systems. - Detectors Duct Application.
 - b. U.L. 864 - Control Units for Fire Protective Signaling Systems.
3. National Fire Protection Association Standards.
 - a. NFPA No. 70 - 2008 Edition with 2011 NYC Amendments- National Electrical Code.
 - b. NFPA No. 72 - 2016 Edition - National Fire Alarm Code.
 - c. NFPA No. 90A - 1996 Edition - Installation of Air Conditioning & Ventilating Systems.
 - d. NFPA No. 101 - 2015 Edition - Life Safety Code
4. All raceways and wiring shall be installed in compliance with NFPA Standard 70 (National Electrical Code - Article 760). Codes shall be implicitly followed, in particular with regard to material type and quality, circuitry extensions from and connections to outlet and junction boxes, panel boards and similar appurtenances.
5. The fire alarm system and its installation shall comply with all applicable requirements of The Americans with Disabilities Act of 2010.
6. The fire alarm system and its installation shall comply with all applicable requirements of the New York State Uniform Fire Protection and Building Code.
7. The fire alarm system and its installation shall comply with all other local codes and authorities having jurisdiction, including but not limited to, owners engineering design guidelines.

1.4 DEFINITIONS

- A. Initiating Device: A system component that originates transmission of a change of state condition, such as a smoke detector, manual fire alarm box, supervisory switch, etc.
- B. Initiating Device Circuit: A circuit to which automatic or manual initiating devices are connected where the signal received does not identify the individual device operated. Typically known as a "Zone" for conventionally wired systems or circuits.

- C. Notification Appliance: A fire alarm system component such as a bell, horn, speaker, strobe, printer, etc., that provides an audible or visual output or both.
- D. Notification Appliance Circuit: A circuit or path directly connected to a notification appliance.
- E. Signaling Line Circuit: A circuit or path between any combination of circuit interfaces, control units, or transmitters over which multiple system input or output signals or both are carried. (When used with addressable analog initiating devices, these SLC circuits are also known as "Addressable Loops")
- F. Note: Both Signaling Line Circuits and Initiating Line Circuits operate initiating devices, however, they provide different communication capabilities. Code requirements differ greatly for performance and capacities. Refer to NFPA 72, Tables 3-5.1 & 3-6.1.

1.5 SYSTEM DESCRIPTION

- A. The system shall operate as an integrated multiplexed protected premises fire alarm/emergency communication monitoring and control system.
 - 1. Changes in the status of monitored points shall be detected by the microprocessor based fire command station utilizing distributed processing, peer-to-peer networking with remote system panel's located throughout the facility if required.
 - 2. Sensor "dirty" and "excessively dirty" trouble conditions shall report automatically.
 - 3. Devices shall be listed by U.L. for sensitivity testing by means of the portable programmer/tester or by readout from the control panel. Each addressable device address shall be set electronically, devices requiring dip switch settings, rotary switch settings, staples or jumper settings are not acceptable.
 - 4. As a minimum, RSP's shall consist of an enclosure, power supply, digital communications circuitry, mother boards, batteries and hardware, modules, audio hardware, and circuitry described for inclusion in the fire alarm control panel as required to function as specified. System control panels shall function in standalone fail safe mode upon loss of the FCS processing, communications, or communications wiring.
 - 5. Smoke detectors shall alarm at their programmed sensitivity settings and shall not revert to a common default setting when their operating system segment is in the default mode.
 - 6. System individually identifies each addressable initiating device and other addressable monitor functions using multiplexing interfacing techniques.
 - 7. System is capable of individually operating each alarm indicating appliance, and other control functions, using multiplexing techniques.
 - 8. The FCS shall be listed and capable for the release FM200, Deluge and Pre-action systems.
- B. Life safety alarm function programs shall perform automatically upon system alarm actuation. In addition, control points may be operated manually at any time by the attendant through appropriate keyboard commands. The system FCS shall also provide integral programmable function control switches to allow personnel to manually operate specific preprogrammed control output functions, as required.

1.6 QUALITY ASSURANCE

- A. It is the intent of these Specifications to provide a complete fire alarm system that complies in all respects with the requirements of all applicable codes and standards. Equipment, materials, software, installation practices, etc. that do not meet these requirements or do not meet the performance standards herein specified shall not be acceptable.

- B. Fire alarm system equipment furnished under this Specification shall be UL listed, under the appropriate category, as a product of a single manufacture. All central control equipment shall be listed under UL category UOJZ as a single control unit. The manufacture shall have been engaged in the production of this type of equipment for at least ten (10) years.
- C. The equipment furnished under this Specification shall be that of the specified manufacture or approved equal. All information herein is intended to establish minimum standards of performance, quality and construction, and is based upon Compatible equipment MXL addressable analog equipment designed and manufactured by Cerberus Compatible equipment, a Division of Cerberus Technologies, Inc., Cedar Knolls, NJ, USA, whose catalog and numbers are used, shall indicate the materials as well as the operating features required. It is not the intent of these specifications to eliminate competitive equipment.
- D. Before commencing work the Contractor shall submit data showing that the manufacturer has successfully installed fire alarm systems of the same scope, type and design as specified. The Contractor shall also include the names and locations of at least three installations where such systems have performed satisfactorily for the preceding 18 months.
 - 1. The Contractor shall submit three copies of all required Licenses and Bonds as required in the State or Province having jurisdiction.
 - 2. The installing Contractor shall employ on staff a minimum of one NICET level 2 technician or a professional Engineer, registered in the State of the installation.
 - 3. The installing Contractor shall be qualified by Underwriter's Laboratories certifying the complete system meets UL upon completion of the installation. Ongoing maintenance and testing shall be provided to the Owner under a maintenance contract to maintain the certification.
 - 4. Installation contractors unable to comply with the provisions of 1.06 shall present proof of engaging the services of a subcontractor qualified to furnish the required services.
- E. Provide the services of a representative or technician from the manufacturer of the system. The representative or technician is to be certified and experienced in the installation and operation of the type of system provided. The representative shall be licensed in the State, if required by law. The fire alarm Contractor shall supervise installation, software programming, software documentation, adjustments, preliminary testing, final testing and certification of the system. The fire alarm Contractor shall also be required to provide operational instruction to the Owner's personnel. Instruction shall include system operation, maintenance, programming, and arm/disarm procedures.
- F. All fire alarm system equipment furnished under this Specification shall be UL listed, under the appropriate category, as the product of a single manufacturer. All control equipment shall be listed under UL as a single control unit. The manufacturer shall have been engaged in the production of this type of equipment for at least ten (10) years and have a fully equipped service organization capable of responding within 4 hours from the initial contact for warranty or regular service work. Emergency and/or off hours calls shall be responded to within 4 hours of initial contact seven days a week.
- G. With bid submittal, the Contractor shall state what, if any, specific points of the proposed system's operation or the equipment's quality differ in any way from this Specification by submission of a complete technical proposal to include supporting literature and drawings. Only those departures from these Specifications, submitted in writing at the time of bid, shall be considered by the Engineer during the submittal review phase. Failure to submit all departures

from these Specifications at the time of bid shall be cause for summary rejection of any submittal documents where additional departures are discovered.

- H. Acceptance of substitutions, based on submittal documents furnished by the Contractor, shall only be construed as permission to proceed with the installation pending final test and approval of the system. The Contractor shall continue to bear the liability for replacement of substituted equipment, if in the opinion of the Owner or Engineer, the substitute equipment fails to perform as specified, or fails to meet approval of all authorities having jurisdiction within three (3) months after scheduled Project completion.
- I. Should conflicts arise between project drawings and/or these Specifications, regarding design, quantities of devices or circuits, the higher quantity or cost shall be considered as correct, unless directed by the Engineer to provide other appropriate measures.
- J. It is the Contractor's responsibility to submit acceptable equipment for review by the Engineer. The Contractor shall bear all liability for damages arising from his failure to submit equipment that meets these Specifications, including, but not limited to, any penalties for failure to meet construction deadline.
- K. Final determination of compliance with these Specifications shall rest with the Engineers, who, at their discretion, may require proof of performance at the cost of the Contractor. Required proof may include, but shall not be limited to, expense paid visits by representatives of the Owner and Engineer to sites where identical equipment is installed and providing beneficial use.

1.7 SUBMITTALS

- A. Prior to the start of work, the Contractor shall provide a complete and comprehensive submittal for review by the Engineer. These are to describe the proposed system and its equipment. Failure to provide a complete submittal shall be grounds for summary rejection of any incomplete submittal documentation. Contractor's who provide Resubmittal's, due to prior rejection, shall be subject to a review fee, should the Engineer elect to do so. The complete submittal shall include, but not be limited to, all of the following material:
 - 1. Complete manufacturer's catalog data including supervisory power usage, alarm power usage, physical dimensions, finish and mounting requirements.
 - 2. Complete drawings covering the following shall be submitted by the Contractor for the proposed system. Floor plans in a CAD compatible format showing all equipment and raceways, marked for size, conductor count with type and size, showing the percentage of allowable National Electric Code fill used.
 - 3. A complete proposed system database including a description of all logic strings, control by event programming and point identification labels on a 3.5" high density floppy disk and in a formatted printed form, as required for off site editing, shall be submitted for evaluation by the Owner.
 - a. The program shall include all required interactive control functions between the local network systems and the methods for implementing these actions.
 - 4. Provide the address, telephone number, and contact person(s) of the manufacturer's local service facility for normal and off hour warranty issues.
 - 5. If the fire alarm system and its equipment is supplied by a manufacturer's distributor, as part of the submittal documentation, the manufacturer shall provide, on its corporate letterhead, a "letter of support". Said "letter of support" shall state that, when in the opinion of the Engineer, the distributor's efforts require backup and/or assistance, the manufacturer shall provide, at no cost to the Owner, all required technical support and manpower, in a

timely manner, during the installation period and for a one (1) year guarantee period starting on the date of final acceptance by the Owner and the Authority Having Jurisdiction. If said "letter of support" is not submitted, the manufacturer's equipment will be deemed unacceptable and shall be grounds for summary rejection.

6. Provide a fire alarm system function matrix. Matrix shall illustrate alarm output events in association with initiating devices input events. Matrix shall represent a summary of the installed system alarm, supervisory and trouble functions. Include any and all departures, exceptions, variances or substitutions from these Specifications and/or drawings at the time of bid. Failure to provide this requirement shall be cause for summary rejection of submittal documents where additional departures are discovered. (See NFPA Appendix A-7-5.2.2(i) 2016).
7. Provide manufacturer's printed product data, catalog pages and descriptions of any special installation requirements and/or procedures. Drawings depicting any special physical installation requirements shall show physical plans, elevations, all dimensions, conduit entry, minimum access clearances and any other details required.
8. Provide a signed letter and notarized statement on the manufacture's letterhead, stating that each analog addressable data communications circuit shall support one hundred (100%) of the circuits and addressable devices in alarm or operated at the same time, during both primary (AC) and secondary (battery) power conditions.
9. Provide shop drawings as follows:
 - a. Single line riser diagram showing all equipment, all connections and number and size of all conductors and conduits.
 - b. Provide samples of various items when requested by the Architect/Engineer.
10. The fire alarm Contractor shall provide copies of certification for service technicians formal training by the system manufacturer. As a minimum, certification documents shall indicate training dates, systems qualified, name of individual certified and current status.

1.8 SYSTEM OPERATION

A. Description

INITIATION	OPERATION
1. Triggering of duct smoke detector; or of area smoke or heat detector	Initiate an automatic alarm zone verification sequence. Upon verification, sound evacuation and alert tone signals and recorded announcements through loudspeaker stations, and flash visual fire warning signals. Sound audible signal and display "duct smoke" detector and zone identification at fire command station and outlying annunciators. Operate relay at fire command station to accommodate transmission of an "automatic" signal through telephone company wires to a central station location. Operate outlying addressable modules to accommodate transmission of signals to dampers, fans, elevators, and other equipment, as scheduled and/or as specified hereinafter. Display status of affected equipment at Fire Command Station and outlying annunciators.

- B. Reset of all alarm initiating device circuits, alarm notification circuits, and equipment control relays shall be accomplished from the fire command station. In no case shall the above alarm

reset procedure cause the resetting of equipment control relays (for fans, dampers, etc.). Such devices shall require separate reset from the fire command station.

- C. It shall be possible to disconnect any floor, or any device or combination of devices on any floor, from the system to allow for maintenance, repairs, or the addition of system devices and wiring without disabling any other floor. Such disconnection shall cause a visual "disabled" annunciation at the fire command station identifying the floor and/or devices.
- D. System operation shall be providing automatic and/or manual shutdown of fans larger than 2,000 CFM, and of dampers and other equipment in response to alarm initiation, as well as central status reporting. Any fans over 2,000 CFM shall be provided with manual control (and status reporting) from FCS. Controls shall be provided in accordance with a schedule on the drawings and/or as described hereinafter. Include provisions at the FCS in outlying system equipment control cabinets, and in outlying addressable module boxes (or cabinets) - each located within 3'-0" of the associated motor starter, smoke purge damper control device or other equipment control device, control circuitry extensions (i.e., final connections) from the addressable module boxes to the controlled equipment and connections, all as required to achieve this control.
- E. System Configuration
 - 1. Each duct smoke detector shall constitute a separate zone for reporting to the fire command station. For display at the fire command station (FCS) and at outlying annunciator(s), each reporting zone (i.e., device) shall be individually identified, except that multiple smoke detectors (or multiple heat detectors) located within a single space may be identified by a common display. It shall be possible to separately identify and display the address of the individual detector(s) in alarm within any such space by means of an appropriate command at the FCS keyboard or keypad.
 - 2. Control (automatic and/or manual) and status reporting (monitoring) of equipment via the fire protective alarm system as specified hereinafter shall be accomplished by means of addressable control modules (ACM's) and addressable monitoring modules of the status reporting type (AMM/S's) located within 3'-0" of the controlled equipment in outlying addressable monitor boxes similar to those specified above for the AMM/ID's. Addressable modules (ACM's and AMM/S's) shall be provided in accordance with the following:
 - a. ACM's and AMM/S's shall be of a type intended for connection to NFPA 72, Style 6 "branch signalling circuits (SLC's) as described hereinbefore, and shall be connected to the appropriate SLC serving the floor on which they are located.
 - b. Each ACM shall provide (2) SPDT contacts suitable for use at voltages up to 250 VAC and capable of interrupting 10 amperes inductive, and shall derive its operating and supervisory current at 24VDC from the SLC. If necessary, these contact ratings shall be accommodated by means of auxiliary control relays mounted within or adjacent to the same addressable monitor boxes as the ACM's, and deriving their operating power from the associated ACM's, or directly from the associated ECC via separate supervised power supply conductors.
 - c. Each AMM/S shall function so as to provide a readily identifiable status indication at the FCS in response to a 120 or 208 VAC signal from the associated controlled equipment. Incorporate an auxiliary status (monitoring) relay for each AMM/S to convert a 120 or 208 VAC AC signal to a "dry" contact if the AMM/S requires a "dry" contact for proper status signal initiation. Auxiliary status relays, if required, shall be mounted in the same outlying addressable module boxes as their associated AMM/S's.

- d. At locations (such as motor control centers) where multiple equipment controllers are installed, the addressable modules (and any associated auxiliary relays) may be grouped in common addressable module boxes.
3. Outlying addressable module boxes, each complete as indicated, shall be provided for equipment requiring automatic or manual control by the FPA system on the basis of the following:
 - a. One box including two ACM's ("stop", start") and one AMM/S ("running") for each fan over 2,000 CFM (including fans in self-contained air conditioning units).
 - b. One addressable module box for each supply or return damper at the duct or shaft entries to each floor supplied by a multi-floor fan system which will be permitted to run during a fire. Include one ACM ("close") and one AMM/S ("closed") intended to accomplish automatic floor-by-floor isolation for smoke control purposes.
 - c. One addressable module box for each damper requiring individual manual control from the central damper control panel (specified hereinafter for normal after-hours control), but for which direct manual or automatic control by the fire alarm system is not specified. Include one ACM ("closed") and one AMM/S ("closed").
 - d. One addressable module box, including two ACM's ("recall", "recall to alternate floor") and one AMM/S ("elevators recalled") for each bank of elevators. Provide two additional ACM's ("de-energize/re-energize elevator power panel) for each bank of elevators if the elevator machine room and/or associated shaft is sprinklered. Also, include one AMM/S per bank ("panel de-energized").
 - e. One addressable box, including one ACM for the fire stair door unlocking system.
 - f. One addressable module box, including one ACM, for the fire/smoke door release system.
 - g. One addressable module box, including one ACM for each fire stair or elevator machine room smoke vent.
 - h. One addressable module box, including one ACM for each escalator controller.
 - i. Additional addressable module boxes as necessary to comply with the scheduled control of equipment in response to system alarm actuating devices.
4. Priority of Signals:
 - a. Accomplish automatic response functions by the first zone initiated. Alarm functions resulting from initiation by the first zone are not altered by subsequent alarms. The highest priority is an alarm signal. Supervisory and trouble signals have second- and third-level priority. Higher-priority signals take precedence over signals of lower priority, even though the lower-priority condition occurred first. Annunciate all alarm signals regardless of priority or order received.
 - b. Noninterfering: Zone, power, wire, and supervise the system so a signal on one zone does not prevent the receipt of signals from any other zone. All zones are manually resettable from the FACP after the initiating device or devices are restored to normal. Systems that require batteries or battery backup for the programming function are unacceptable.
 - c. Fire Alarm Control Panel (FACP) Response: The manual or automatic operation of an alarm-initiating or supervisory-operating device causes the FACP to transmit an appropriate signal including the following:
 - 1) General alarm.
 - 2) Fire-suppression system operation alarm.
 - 3) Smoke or heat detector alarm.
 - 4) Valve tamper supervisory.
 - 5) Door release.
 - 6) Elevator recall.
 - 7) Elevator shutdown.

- 8) Dumbwaiter shutdown.
 - 9) System trouble.
 - 10) Fan shutdown.
 - 11) Smoke-control initiation.
 - d. Transmission to Remote Central Station: Automatically route alarm, supervisory, and trouble signals to a remote central station service.
 - e. Silencing at the FACP: Switches provide capability for acknowledgment of alarm, supervisory, trouble, and other specified signals at the FACP; and capability to silence the local audible signal and light a light-emitting diode (LED). Subsequent zone alarms cause the audible signal to sound again until silenced by switch operation. Restoring alarm, supervisory, and trouble conditions to normal extinguishes the associated LED and causes the audible signal to sound again until restoration is acknowledged by switch operation.
5. Smoke detectors indicated in mechanical equipment rooms shall be of the combination photocell plus fixed temperature/rate-of-rise type.
 6. Smoke detection devices shall have integrally mounted pilot lamps giving a "triggered" indication.
 7. Smoke detection devices which are mounted in ducts shall be supplied with remote "triggered" indication pilot wired in parallel, in an approved manner, with the similar pilots included integrally with detection units. The pilots for duct detectors shall each be flush or surface mounted within 15 feet circuiting distance of its associated detector. Mounting and location to be as directed by the Architect.
 8. Smoke detectors indicated as being located in floor or ceiling cavities of the air handling type shall be equipped with "air shields" where air velocities are such as to require these appurtenances for the proper detection of smoke.
 9. Recording of Events:
 - a. Print a record all alarm, supervisory, and trouble events on the system printer. Printouts are by zone, device, and function. When the FACP receives a signal, the alarm, supervisory, and trouble conditions are printed. The printout includes the type of signal (alarm, supervisory, or trouble) the zone identification, date, and the time of the occurrence. The printout differentiates alarm signals from all other printed indications. When the system is reset, this event is also printed, including the same information for device, location, date, and time. A command initiates the printout of a list of existing alarm, supervisory, and trouble conditions in the system.
 - 1) Circuit Supervision: Indicate circuit faults by both a zone and a trouble signal at the FACP. Provide a distinctive indicating audible tone and LED-indicating light. The maximum permissible elapsed time between the occurrence of the trouble condition and its indication at the FACP is 200 seconds.

F. System Trouble Functions

1. Receipt of a system trouble alarm, shall cause the following actions and indications:
 - a. Activate "Trouble Alarm" notification to the FCS computer terminal display indicating device address, device type, device location, time and date.
 - b. Activate "Trouble Alarm" notification to the appropriate receiving agency and/or on site location as shown on the drawings.
 - c. Audible signals shall be silenced from the control panel by an acknowledge switch.
 - d. Record within system history, the occurrence of the event, the time of occurrence and the device initiating the event.
 - e. Record all events at the system alarm printer.

2. The fire alarm system wiring (except control wiring to fans, dampers, 120Vac door holders, etc.) shall be electrically supervised to automatically detect and report trouble conditions to the FCS.
3. Any opens or grounds on Interface Addressable Module alarm initiating or supervisory circuit wiring and any opens, grounds or shorts across the addressable data communications, remote annunciator data communications, alarm speaker, Warden telephone or alarm strobe light circuit wiring shall initiate a system trouble condition.
4. System addressable devices shall be supervised for placement and normal operation. Removal of an addressable device or the failure of its internal electronic circuitry shall initiate a system trouble condition.
5. The following FCS and/or remote transponder control panels shall initiate a system trouble condition when the following occurs:
 - a. Primary 120/220 VAC power loss.
 - b. Battery disconnects.
 - c. Battery low voltage.
 - d. FCS remote transponder or graphic LCD annunciator panel power loss.
 - e. FCS primary alarm log printer power loss.
6. Operating a central station agency alarm disconnect switch (if equipped), or any manual control commands that alter the system from its normal programmed standby configuration shall initiate a trouble condition.
7. Trouble conditions shall automatically activate an audible signal and flash the general system trouble LED indicator at the FCS. Pressing the trouble acknowledge key on the FCS shall silence the audible signal and continuously light the LED indicator, until the trouble condition is repaired. Subsequent trouble conditions shall resound the audible signal and again flash the LED. Each trouble condition must be individually acknowledged.
8. Removal of or failure of internal electronic circuitry of any addressable device shall initiate a system trouble condition.

PART 2 - SYSTEM OPERATION

2.1 BASIC SYSTEM EQUIPMENT, CIRCUITING, ADDRESSING AND OPERATING CAPABILITIES

1. Duct smoke sensors shall be photoelectric. Each smoke sensor and air duct housing shall be self-compensating for the effects of air velocity (from 300 to 4,000 CFM), temperature, humidity and atmospheric pressure. It shall not be necessary to field adjust the sensitivity to compensate for the above effects. Each smoke sensor shall utilize solid state components and be equipped with an alarm indicating LED which shall flash when the smoke sensor is activated and shall be provided with a form "C" remote relay with contacts rated at 3 amps 120 VAC or 24 VDC. The smoke sensors address shall be set by electronic means only, no mechanical means such as dipswitches, rotary dials or by inserting programmable pins shall be used. The smoke sensor mounting base shall be of the twist/lock type. Each duct smoke detector shall be provided with remote status panel with LED mounted flush on single gang plate with Legend "Alarm" and system identification name plate.
2. The intelligent interface module shall be listed by Underwriters' Laboratories, Inc. The unit shall incorporate a custom microprocessor based integrated circuit which shall provide communication with main fire control panel. The interface module shall supervise and monitor normally open or normally closed dry contacts. The interface module shall report the contact's status to the control panel. The intelligent interface module shall be dynamically supervised and uniquely identifiable by the control panel. The intelligent

interface module's address shall be set by electronic means only, no mechanical means such as dipswitches, rotary dials or by inserting programmable pins shall be used. The intelligent interface module shall be used to uniquely identify field devices such as water flow switches, tamper switches, OS&Y valves or as directed by these specifications and project drawings.

3. The intelligent interface module shall be used when remote relay functions are required for system functional requirements, such as but not limited to, fan shut downs. Relay dry contacts shall be rated at 2 amp. 120 VAC resistive or 30 VDC resistive and shall be Form "C".
4. The FCS addressable data communications circuits shall support one hundred percent (100%) of the addressable devices in alarm or operated at the same time, during both primary (AC) and secondary (battery) power conditions. Systems which cannot support one hundred percent (100%) of the system address capacity in alarm or operated simultaneously cannot assure appropriate system alarm responses and shall not be acceptable.
5. The system shall provide status indicators and control switches for all of the following functions:
 - a. HVAC supply and exhaust fans.
 - b. Fire and/or smoke dampers.
6. Manual control and annunciation of system audio status shall be provided by a set of modular switch units. Each module shall include eight discreet, momentary push button switched devices. Membrane type switches for this purpose shall not be acceptable.
 - a. Each switch shall include space for labeling switch function. The label shall be protected behind a clear protective membrane cover. In addition, each switch shall have two LED's associated with it. One of the LED's shall be amber in color and shall indicate a fault condition on a zone or zone's associated with that switch. The second LED shall be dual color red/green, and be capable through software configuration, to clearly indicate zone status including which audio source is active (i.e. Evacuation, Alert, Page, etc.)
7. Status only annunciation shall be provided by a set of modular visual Led indicators. Each module shall be capable, through system software mapping to include, but not limited to alarms and troubles. Each module shall include eight individual status indicators each containing one dual color LED for red and green status, and one amber color LED for zone integrity monitoring.
8. HVAC supply-exhaust units and fire and smoke dampers shall be provided with a hand off-on-auto switch module with LED indicators. LED indication shall be red for "off", green for "on" and amber for monitoring circuit integrity. In addition, visual indication shall be provided for positive feedback confirmation of field devices. LED status annunciation shall be real time and actual, derived from a monitored auxiliary contact on the fan contactor, sail switch or atmospheric pressure switch installed downstream from the fan.
9. Devices shall be listed by U.L. for sensitivity testing by means of the portable programmer/tester or by readout from the control panel. Device address and sensitivity assignments shall be predetermined electronically, devices requiring dip switch settings, rotary switch settings, staples or jumper settings are not acceptable.
10. Smoke detectors shall alarm at their programmed sensitivity settings and shall not revert to a common default setting when their operating system segment is in the default mode.
11. Software and Firmware Control:
 - a. All software and firmware provided with a fire alarm system shall be listed for use with the fire alarm control unit.

- b. A record of installed software and firmware version numbers shall be maintained at the location of the fire alarm control unit.
 - c. All software and firmware shall be protected from unauthorized changes through the use of "access levels."
12. Conductors
- a. Each conductor shall be identified as shown on the drawings at each with wire markers at terminal points. Attach permanent wire markers within 2 inches of the wire termination. Marker legends shall be visible.
 - b. All wiring shall be supplied and installed in compliance with the requirements of the National Electric Code, NFPA 70, Article 760, and that of the manufacturer wiring guides.
 - c. Wiring for analog loop circuits, conventional detection circuits, speaker circuits and telephone circuits shall based on the fire alarm manufactures wiring guidelines, but shall not be smaller then #16 AWG.
 - d. Plenum rated cable, if used, shall be rated for 150§ degrees Celsius with an insulation of Teflon or its equivalent.
 - e. Splices shall be made with UL listed mechanical connectors or shall be soldered and taped to assure reliable service.
 - f. Crimp-on type spade lugs shall be used for termination's of stranded conductors to binder screw or stud type terminals. Spade lugs shall have upset legs and insulation sleeves sized for the conductors.
 - g. Wire nuts or other solderless splicing devices shall not be used.
 - h. Permanently label or mark each conductor at both ends with permanent alphanumeric wire markers.
 - i. A consistent color code for fire alarm system conductors throughout the installation shall be provided. The installation Contractor shall submit for approval prior to installation of wire, a proposed color code for system conductors to allow rapid identification of circuit types.
 - j. All nominal voltage branch circuit power feeds (120/220 Vac) shall be identified "labeled" at both ends of the circuit to indicate it's source and purpose.
 - k. Wiring within system control panels shall be arranged and routed to allow accessibility to equipment for adjustment and maintenance and to isolate nominal voltage wiring from system low voltage wiring.
 - l. Splices in electrical conductors in vertical risers are prohibited except when the length of conductors exceeds 150 feet in vertical risers, an approved terminal cabinet shall be used.

2.2 WIRE

- A. Wire: Solid-copper conductors with 600-V rated, 75 deg C, color-coded insulation.
 - 1. Low-Voltage Circuits: No. 16 AWG, minimum.
 - 2. Line-Voltage Circuits: No. 12 AWG, minimum.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Install system according to NFPA standards referenced in Parts 1 and 2 of this Section.

3.2 EQUIPMENT INSTALLATION

- A. Smoke detection devices which are mounted in ducts shall be supplied with remote "triggered" indication pilot wired in parallel, in an approved manner, with the similar pilots included integrally with detection units. The pilots for duct detectors shall each be flush or surface mounted within 15 feet circuiting distance of its associated detector. Mounting and location to be as directed by the Architect. Duct smoke detectors shall be low-flow type, and to be suitable to be installed in ducts with air velocity ranging between 100 feet per minute and 4,000 feet per minute.
- B. Smoke detectors indicated as being located in floor or ceiling cavities of the air handling type shall be equipped with "air shields" where air velocities are such as to require these appurtenances for the proper detection of smoke.
- C. Device Location-Indicating Lights: Locate in public space near the device they monitor.

3.3 WIRING INSTALLATION

- A. Wiring Method: Install wiring in metal raceway according to Division 26 Section "Raceway and Boxes for Electrical Systems". Conceal raceway except in unfinished spaces and as indicated.
- B. Wiring within Enclosures: Install conductors parallel with or at right angles to the sides and back of the enclosure. Bundle, lace, and train the conductors to terminal points with no excess. Connect conductors that are terminated, spliced, or interrupted in any enclosure associated with the fire alarm system to terminal blocks. Mark each terminal according to the system's wiring diagrams. Make all connections with approved crimp-on terminal spade lugs, pressure-type terminal blocks, or plug connectors.
- C. Cable Taps: Use numbered terminal strips in junction, pull or outlet boxes, cabinets, or equipment enclosures where circuit connections are made.
- D. Color Coding: Color-code fire alarm conductors differently from the normal building power wiring. Use one color code for alarm circuit wiring and a different color code for supervisory circuits. Color-code audible alarm-indicating circuits differently from alarm-initiating circuits. Use different colors for visual alarm-indicating devices. Paint fire alarm system junction boxes and covers red.
- E. The minimum temperature rating of the cables shall be 150 Deg. Celsius.

3.4 IDENTIFICATION

- A. Identify system components, wiring, cabling, and terminals according to Division 26 Section "Identification for Electrical Systems."

3.5 GROUNDING

- A. Ground cable shields and equipment according to system manufacturer's instructions to eliminate shock hazard and to minimize, to the greatest extent possible, ground loops, common mode returns, noise pickup, cross talk, and other impairments.

- B. Signal Ground Terminal: Locate at main equipment rack or cabinet. Isolate from power system and equipment grounding.
- C. Install grounding electrodes of type, size, location, and quantity as indicated. Comply with installation requirements of Division 26 Section "Grounding and Bonding for Electrical Systems".
- D. Ground equipment and conductor and cable shields. For audio circuits, minimize, to the greatest extent possible, ground loops, common mode returns, noise pickup, cross talk, and other impairments. Provide 5-ohm ground at main equipment location. Measure, record, and report ground resistance.

3.6 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Provide services of a factory-authorized service representative to supervise the field assembly and connection of components and the pretesting, testing, and adjustment of the system.

3.7 FIELD TESTING

- A. Each addressable analog smoke detector shall be individually field tested prior to installing the device at its designated location to ensure reliability after shipment and storage conditions. A dated log indicating correct address, type of device, sensitivity and initials of the technician performing test - using test equipment specifically designed for that purpose - shall be prepared and kept for final acceptance documentation. After testing, the detection devices and base shall be labeled with the system address, date and initials of the installing technician. Labeling shall not be visible after installation is complete.
- B. Wiring runs shall be tested for continuity, short circuits and grounds before system is energized. Resistance, current and voltage readings shall be made as work progresses.
 - 1. A systematic record shall be maintained of all readings using schedules or charts of tests and measurements. Areas shall be provided on the logging form for readings, dates and witnesses.
 - 2. The acceptance inspector shall be notified before the start of any required tests. All items found at variance with the drawings or this specification during testing or inspection by the acceptance inspector, shall be corrected.
 - 3. Test reports shall be delivered to the acceptance inspector as completed.
- C. All test equipment, instruments, tools and labor required to conduct the system tests shall be made available by the installing Contractor. The following equipment shall be a minimum for conducting the tests:
 - 1. Ladders and scaffolds as required to access all installed equipment.
 - 2. Multimeter for reading voltage, current and resistance.
 - 3. Intelligent device programmer-tester.
 - 4. Laptop computer with programming software for any required program revisions.
 - 5. Two way radios, flashlights, smoke generation devices and supplies.
 - 6. Spare printer paper.
 - 7. An approved device for measuring air flow through air duct smoke detector sampling assemblies.
 - 8. Decibel meter.
 - 9. Testing documentation.

- D. In addition to the testing specified to be performed by the installing Contractor, the installation shall be subject to test by the acceptance inspector.

3.8 FINAL ACCEPTANCE TESTING

- A. A written "Acceptance Test Procedure" (ATP) for testing the fire alarm system components and installation will be prepared by the Engineer in accordance with NFPA 72 and this Specification. The Contractor shall be responsible for the performance of the ATP, demonstrating the function of the system and verifying the correct operation of all system components, circuits and programming.
- B. A final Asbuilt Function Matrix shall be prepared by the installing Contractor referencing each alarm input to every output function affected as a result of an alarm, trouble or supervisory condition on that input. In the case of outputs programmed using more complex logic functions involving "any", "or", "not", "count", "time", and "timer" statements; the complete output equation shall be referenced in the matrix.
- C. A complete listing of all device labels for alpha-numeric annunciator displays and logging printers shall be prepared by the installing Contractor prior to the ATP.
- D. The acceptance inspector shall use the system record drawings in combination with the documents specified. During the testing procedure to verify operation as programmed. In conducting the ATP, the acceptance inspector shall request a demonstration of any or all input and output functions. The items tested shall include but not be limited to the following:
 - 1. System wiring shall be tested to demonstrate correct system response and correct subsequent system operation in the event of:
 - a. Open, shorted and grounded intelligent analog signaling circuit.
 - b. Open, shorted and grounded network signaling circuit.
 - c. Open, shorted and grounded conventional zone circuits.
 - d. Open, shorted and grounded speaker, telephone circuits.
 - e. Intelligent device removal.
 - f. Primary power or battery disconnected.
 - g. Incorrect device at address.
 - h. Printer trouble, off line or out of paper.
 - i. Loss of data communications between system control panels.
 - j. Loss of data communications between system annunciators.
 - 2. System evacuation alarm indicating appliances shall be demonstrated as follows:
 - a. All alarm notification appliances actuate as programmed.
 - b. Audibility and visibility at required levels.
 - 3. System indications shall be demonstrated as follows:
 - a. Correct message display for each alarm input at the control panel, each remote alpha-numeric LCD display.
 - b. Correct annunciator light for each alarm input, at each annunciator and color graphic terminal.
 - c. Correct printer logging for all system activity.
 - 4. System on-site and/or off-site reporting functions shall be demonstrated as follows:
 - a. Correct alarm custom message display, address, device type, date and time transmitted for each alarm input.
 - b. Correct trouble custom message display, address, device type, date and time transmitted for each alarm input.
 - c. Trouble signals received for disconnect.

5. Secondary power capabilities shall be demonstrated as follows:
 - a. System primary power shall be disconnected for a period of time as specified herein. At the end of that period, an alarm condition shall be created and the system shall perform as specified for a period as specified.
 - b. System primary power shall be restored for forty eight hours and system charging current shall be normal trickle charge for a fully charged battery bank.
 - c. System battery voltages and charging currents shall be checked at the fire alarm control panel using the test codes and displayed on the LCD display.
- E. In the event of system failure to perform as specified and programmed during the ATP procedure, at the discretion of the acceptance inspector, the test shall be terminated.
 1. The installing Contractor shall retest the system, correcting all deficiencies and providing test documentation to the acceptance inspector.
 2. In the event that software changes are required during the ATP, a utility program shall be furnished by the system manufacturer to compare the edited program with the original. This utility shall yield a printed list of the changes and all system functions, inputs and outputs affected by the changes. The items listed by this program shall be the minimum acceptable to be retested before calling for resumption of the ATP. The printed list and the printer log of the retesting shall be submitted before scheduling of the ATP.
 3. The acceptance inspector may elect to require the complete ATP to be performed again if, in his opinion, modifications to the system hardware or software warrant complete retesting.

3.9 DOCUMENTATION

- A. System documentation shall be furnished to the Owner and shall include but not be limited to the following:
 1. System record drawings and wiring details including one set of reproducible masters and drawings on 3 ½ inch floppy disks in a DXF format suitable for use in a CAD drafting program.
 2. System operation, installation and maintenance manuals.
 3. Written documentation for all logic modules as programmed for system operation with a matrix showing interaction of all input signals with output commands.
 4. Documentation of system voltage, current and resistance readings taken during the installation, testing and ATP phases of the system installation.
 5. System program "hard copy" showing system functions, controls and labeling of equipment and devices.
 6. All specified documentation as required.

3.10 TEST EQUIPMENT

- A. The Contractor shall furnish to the Owner all test equipment as required to program the field analog devices, specifically an intelligent device programmer-tester or a calibrated smoke generator with power source.

3.11 WARRANTY/SERVICES

- A. The Contractor shall warrant the entire system against system hardware and electrical defects including programming software defects for a period described in the contract general conditions, but not less than one year. This period shall begin upon satisfactory completion and certification of final acceptance testing of the system and sign acceptance of consulting Engineer. Contractor

shall provide to Owner a letter stating the start-date and end-date of warranty period. In addition, the Contractor shall also provide an updated list of name(s) and phone number(s) for normal and off hours contacts necessary to respond to warranty issues. Response to warranty notification shall require a reply within 24 hours of initial contact.

3.12 TRAINING

- A. The fire alarm Contractor shall furnish training as follows for a minimum of four employees of the system user:
1. Training in the receipt, handling and acknowledgment of alarms.
 2. Training on system operation including manual control of output functions from the FCS.
 3. Training in the testing of the system including logging of detector sensitivity, field test of devices and response to common troubles.
 4. The total training requirement shall be a minimum of 8 hours but shall be sufficient to cover all items specified.
 5. The manufacture shall provide a written schedule of training dates for factory training of owners representatives. Include all fee's, dates, times, phone numbers and contact individual.

END OF SECTION 28 31 13

EXHIBIT D: DRAWINGS

FASHION INSTITUTE OF TECHNOLOGY STATE UNIVERSITY OF NEW YORK

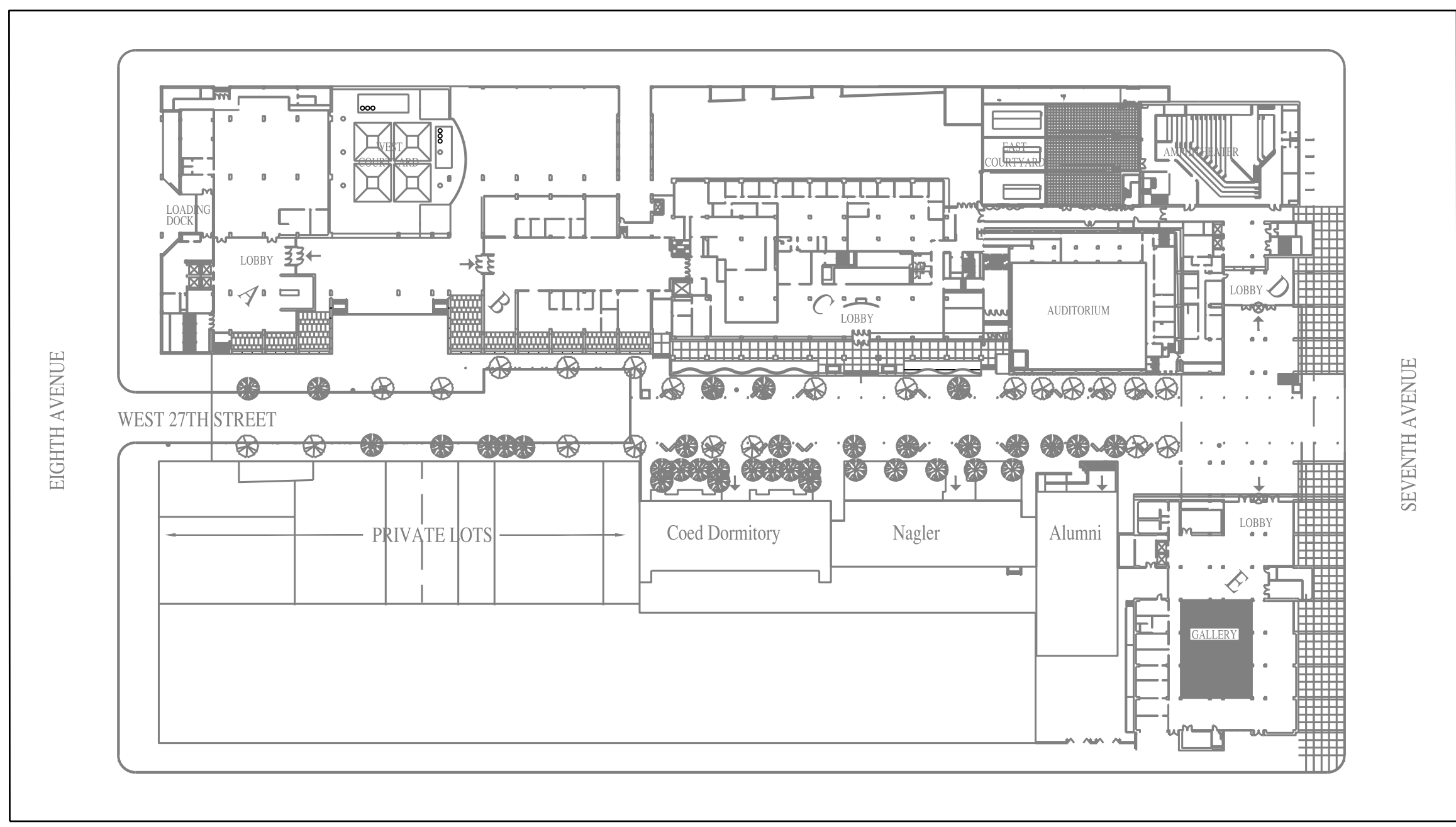
GOODMAN LOWER GALLERY NEW HVAC EQUIPMENT

282 7TH AVENUE NEW YORK NY 11901
BLOCK: 776 LOT NO.: 40 BIN: 1014236

CONTRACT # C1592



PROJECT DATA LOCATION:
282 7TH AVENUE
NEW YORK, NY 10001
PROPERTY IS NOT LOCATED
IN SPECIAL FLOOD HAZARD
AREA.



SITE PLAN
NOT TO SCALE

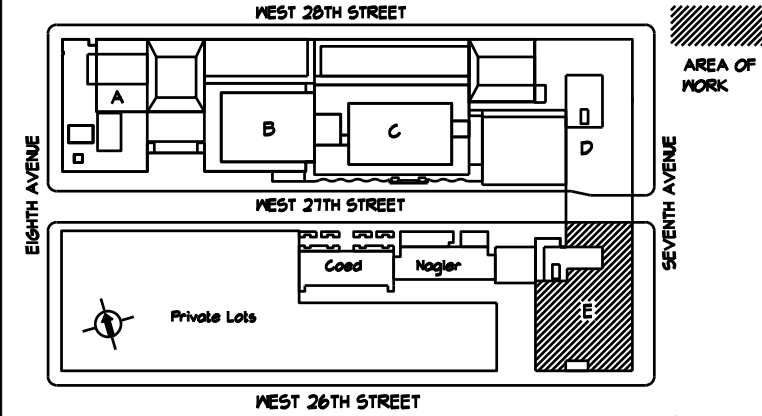
LIST OF DRAWINGS	
DRAWING NAME	DRAWING TITLE
T-001.00	TITLE SHEET
ENERGY	
EN-001.00	MECHANICAL ENERGY COMPLIANCE
MECHANICAL	
M-001.00	MECHANICAL SYMBOLS, ABBREVIATIONS, AND NOTES
M-011.00	SUBCELLAR MECHANICAL DUCTWORK DEMOLITION PLAN
M-012.00	ROOF MECHANICAL DEMOLITION PLAN
M-021.00	SUBCELLAR MECHANICAL PIPING DEMOLITION PLAN
M-101.00	SUBCELLAR MECHANICAL DUCTWORK PLAN
M-102.00	ROOF MECHANICAL PLAN
M-201.00	SUBCELLAR MECHANICAL PIPING PLAN
M-401.00	CELLAR THRU 6TH FLOOR SHAFT RISER MECHANICAL PART PLANS
M-501.00	MECHANICAL DETAILS 1
M-502.00	MECHANICAL DETAILS 2
M-503.00	MECHANICAL DETAILS 3
M-504.00	MECHANICAL DETAILS 4
M-801.00	MECHANICAL AIR RISER DIAGRAM
M-802.00	MECHANICAL PIPING DIAGRAM
M-701.00	MECHANICAL SCHEDULES
M-801.00	MECHANICAL CONTROL DIAGRAMS
M-802.00	AC-2E MECHANICAL CONTROL DIAGRAM
M-803.00	GLYCOL WATER FLOW CONTROL DIAGRAM
M-804.00	COOLING TOWER CT-E1 CONTROL DIAGRAM ALTERNATE 1
ELECTRICAL	
E-001.00	ELECTRICAL GENERAL NOTES, DRAWING LIST, SYMBOLS AND ABBREVIATIONS
E-011.00	ELECTRICAL SUB-CELLAR DEMOLITION PLAN
E-012.00	ELECTRICAL ROOF DEMOLITION PLAN
E-101.00	SUBCELLAR ELECTRICAL POWER PLAN
E-102.00	ROOF ELECTRICAL POWER PLAN
E-401.00	ELECTRICAL MCC ELEVATIONS
E-501.00	ELECTRICAL DETAILS
E-601.00	ELECTRICAL ONE-LINE DIAGRAM
E-602.00	ELECTRICAL RISER DIAGRAM
E-701.00	ELECTRICAL PANEL SCHEDULES
FIRE ALARM	
FA-001.00	FIRE ALARM SYMBOL LIST, ABBREVIATIONS, NOTES, AND MATRIX
FA-011.00	SUBCELLAR FIRE ALARM DEMOLITION PLAN
FA-101.00	SUBCELLAR FIRE ALARM PLAN
STRUCTURAL	
T-100.00	STRUCTURAL COVER SHEET
A-100.00	EXISTING STEEL FRAME
A-200.00	PROPOSED STEEL FRAME
A-300.00	CONNECTION DETAILS

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REV. NO.	DATE	REVISIONS
12/20/2024	ISSUED FOR BID	



LOCATION PLAN
NOT TO SCALE
BLOCK: 776
LOT: 40
BIN: 1014236

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New York, NY 10001

MEP Consultants
MGE
MG Engineering D.P.C. / we engineer success
116 West 32nd Street, 12th Floor, New York, N.Y. 10001
P 212.643.9055 www.mgedpc.net

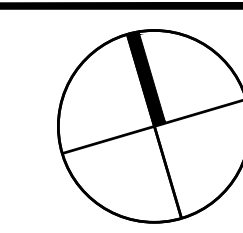
Environmental Consultants
EPM, Inc.
983 Marcus Ave. Suite 109
Lake Success, NY 11042 / (516) 328-1194

Structural Consultants
Darius Toraby Architects P.C.
236 West 27th Street 1401
New York, NY 10001 / (212) 242-2955

PROJECT:
GOODMAN LOWER GALLERY
NEW HVAC EQUIPMENT
282 7TH AVENUE NEW YORK, NY 10001

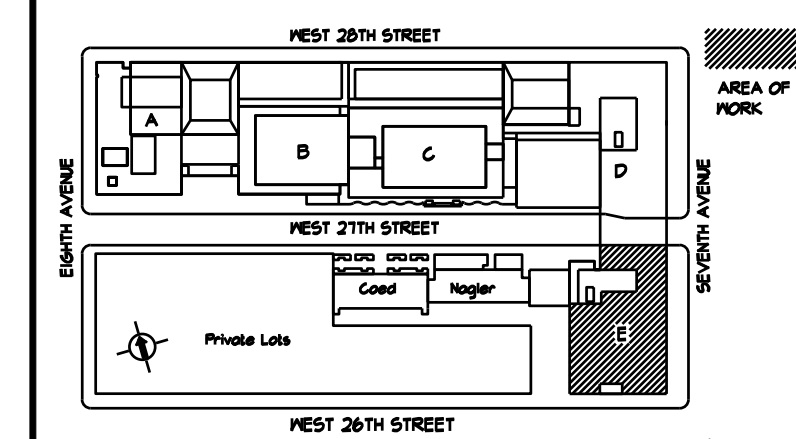
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TITLE SHEET

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	PROJECT No: 896978
	DRAWING BY: ASB
	CHK BY: DNE
	DWG No:
	T-001.00
SCALE: NTS	1 OF 1



rev. no. date revisions

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LOCATION PLAN NOT TO SCALE BLOCK: T16 LOT: 40 BIN: 1014236

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New York, NY 10001 / (212) 242-2955

PROJECT:
GOODMAN LOWER GALLERY
NEW HVAC EQUIPMENT
282 7TH AVENUE NEW YORK, NY 10001

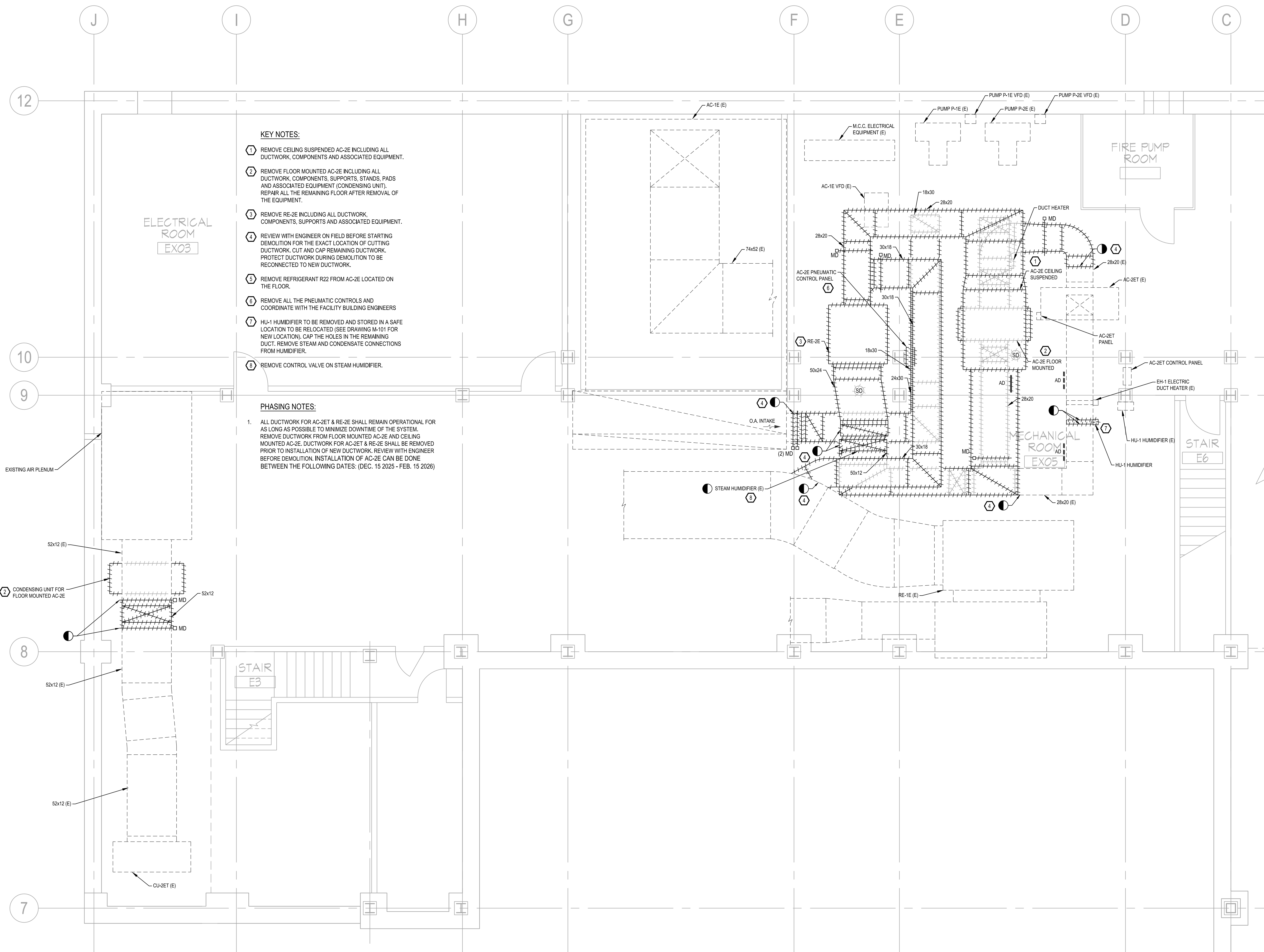
C1592
DRAWING TITLE:
SUBCELLAR MECHANICAL
DUCTWORK DEMOLITION PLAN

SEAL & SIGNATURE: DATE: 12/20/2024

PROJECT No: 8969.78
DRAWING BY: ASB
CHK BY: DN
DWG No:

M-011.00

SCALE: 1/4" = 1'-0" 2 OF 19



- KEY NOTES:**
- REMOVE CEILING SUSPENDED AC-2E INCLUDING ALL DUCTWORK, COMPONENTS AND ASSOCIATED EQUIPMENT.
 - REMOVE FLOOR MOUNTED AC-2E INCLUDING ALL DUCTWORK, COMPONENTS, SUPPORTS, STANDS, PADS AND ASSOCIATED EQUIPMENT (CONDENSING UNIT). REPAIR ALL THE REMAINING FLOOR AFTER REMOVAL OF THE EQUIPMENT.
 - REMOVE RE-2E INCLUDING ALL DUCTWORK, COMPONENTS, SUPPORTS AND ASSOCIATED EQUIPMENT.
 - REVIEW WITH ENGINEER ON FIELD BEFORE STARTING DEMOLITION FOR THE EXACT LOCATION OF CUTTING DUCTWORK. CUT AND CAP REMAINING DUCTWORK. PROTECT DUCTWORK DURING DEMOLITION TO BE RECONNECTED TO NEW DUCTWORK.
 - REMOVE REFRIGERANT R22 FROM AC-2E LOCATED ON THE FLOOR.
 - REMOVE ALL THE PNEUMATIC CONTROLS AND COORDINATE WITH THE FACILITY BUILDING ENGINEERS
 - HU-1 HUMIDIFIER TO BE REMOVED AND STORED IN A SAFE LOCATION TO BE RELOCATED (SEE DRAWING M-101 FOR NEW LOCATION). CAP THE HOLES IN THE REMAINING DUCT. REMOVE STEAM AND CONDENSATE CONNECTIONS FROM HUMIDIFIER.
 - REMOVE CONTROL VALVE ON STEAM HUMIDIFIER.

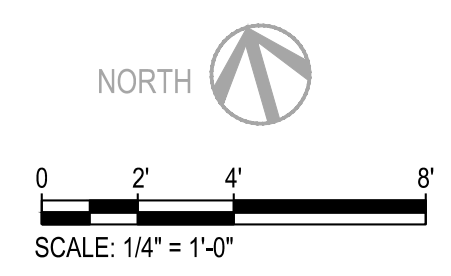
- PHASING NOTES:**
- ALL DUCTWORK FOR AC-2ET & RE-2E SHALL REMAIN OPERATIONAL FOR AS LONG AS POSSIBLE TO MINIMIZE DOWNTIME OF THE SYSTEM. REMOVE DUCTWORK FROM FLOOR MOUNTED AC-2E AND CEILING MOUNTED AC-2E. DUCTWORK FOR AC-2ET & RE-2E SHALL BE REMOVED PRIOR TO INSTALLATION OF NEW DUCTWORK. REVIEW WITH ENGINEER BEFORE DEMOLITION. INSTALLATION OF AC-2E CAN BE DONE BETWEEN THE FOLLOWING DATES: (DEC. 15 2025 - FEB. 15 2026)

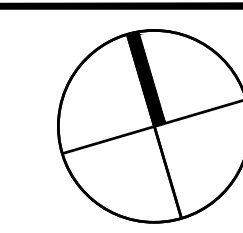
1 SUBCELLAR MECHANICAL DUCTWORK DEMOLITION PLAN

1/4" = 1'-0"

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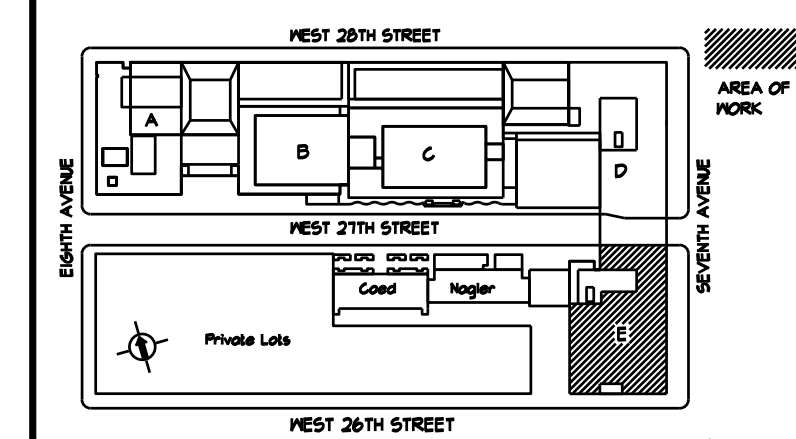
NEW YORK CITY ENERGY CONSERVATION CODE
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LOCATION PLAN NOT TO SCALE BLOCK: T16 LOT: 40 BIN: 1014236

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New York, NY 10001

MEP Consultants



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Lake Success, NY 11042 / (516) 328-1194

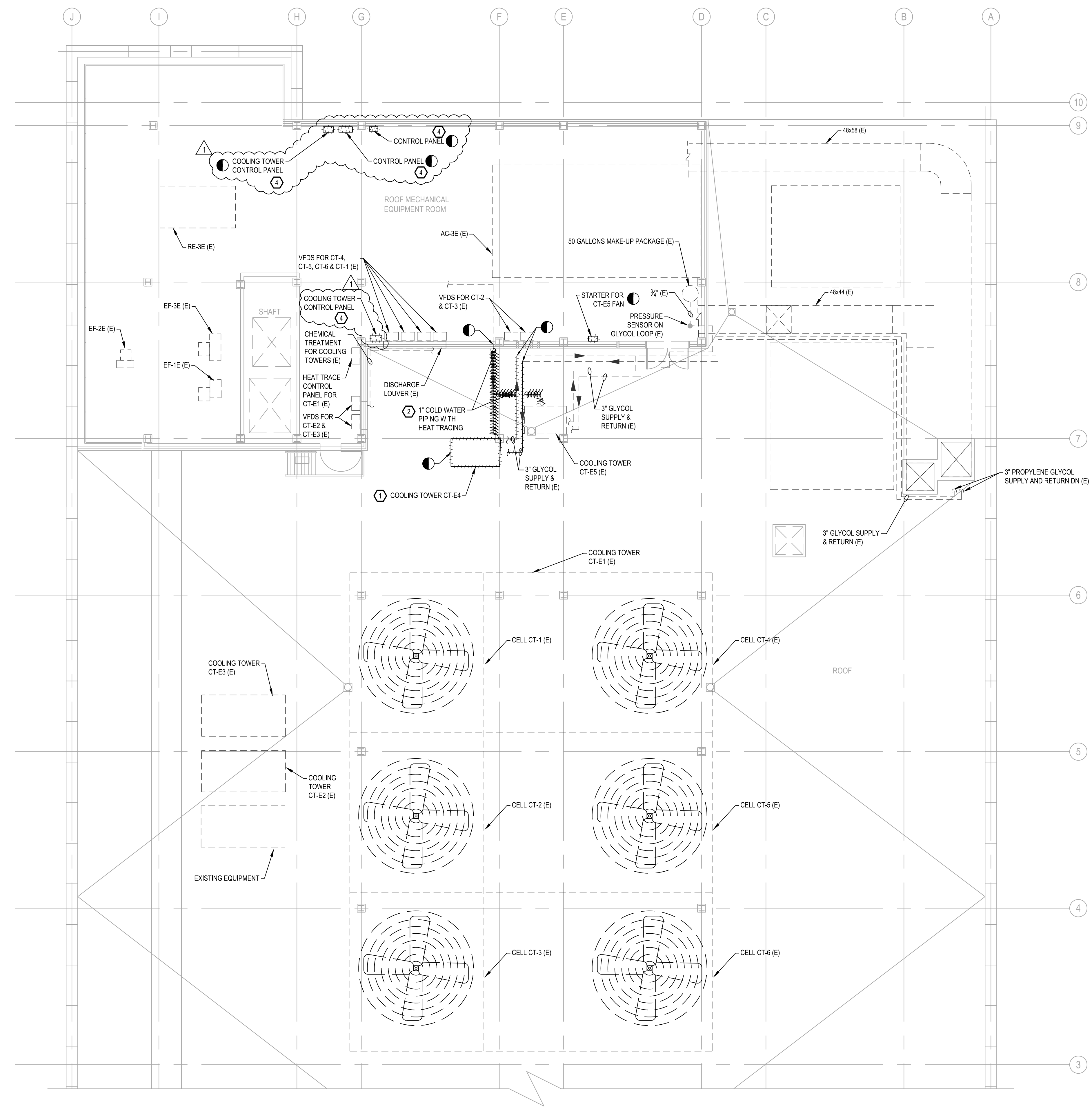
Structural Consultants

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New York, NY 10001 / (212) 242-2955

PROJECT:
GOODMAN LOWER GALLERY
NEW HVAC EQUIPMENT
282 7TH AVENUE NEW YORK, NY 10001

C1592
DRAWING TITLE:
ROOF MECHANICAL
DEMOLITION PLAN

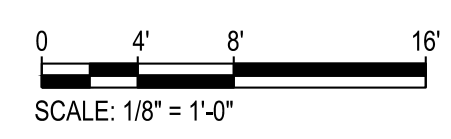
SEAL & SIGNATURE:	DATE: 12/20/2024
	PROJECT No: 896978
	DRAWING BY: ASB
	CHK BY: DN
	DWG No:
	M-012.00
	SCALE: 1/8" = 1'-0" 3 OF 19



- NOTES:**
- DEMOLISH EXISTING COOLING TOWER CT-E4. REFER TO PHASING NOTES ON THIS DRAWING BEFORE STARTING ANY DEMOLITION.
 - DEMOLISH EXISTING HEAT TRACING INCLUDING INSULATION AND HEAT TRACE CONTROLLERS ON COLD WATER CONNECTIONS TO COOLING TOWERS. DEMOLISH COLD WATER CONNECTIONS TO COOLING TOWERS.
 - DEMOLISH EXISTING FAN STARTER FOR COOLING TOWER CT-E5. THE EXISTING PUMP STARTER FOR COOLING TOWER CT-E5 IS EXISTING TO REMAIN.
 - DEMOLISH EXISTING CONTROL PANELS AND ASSOCIATED WIRING.
- PHASING NOTES:**
- EXISTING COOLING TOWER CT-E4 & ASSOCIATED PIPING AND EQUIPMENT SHOULD ONLY BE DEMOLISHED AFTER NEW COOLING TOWER CT-E6 HAS BEEN FULLY INSTALLED AND TESTED INCLUDING ALL NEW PIPING CONNECTIONS AND CONTROLS. START UP REPORT SHALL BE SUBMITTED TO ENGINEER.
- ALTERNATE-1 NOTES:**
- ALTERNATE-1 REPRESENTED BY TRIANGLE AND BUBBLE AS SHOWN.

1 ROOF MECHANICAL DEMOLITION PLAN

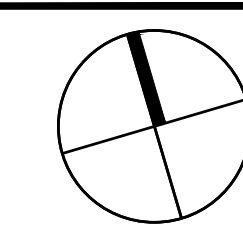
1/8" = 1'-0"



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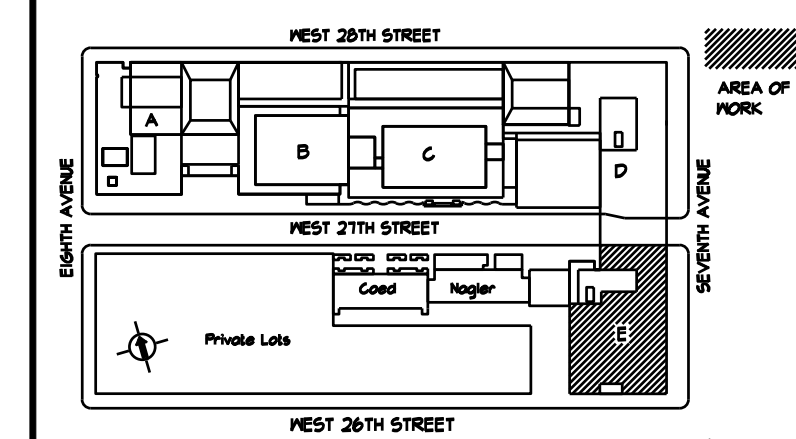
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LOCATION PLAN NOT TO SCALE BLOCK: T76 LOT: 40 BIN: 1014236

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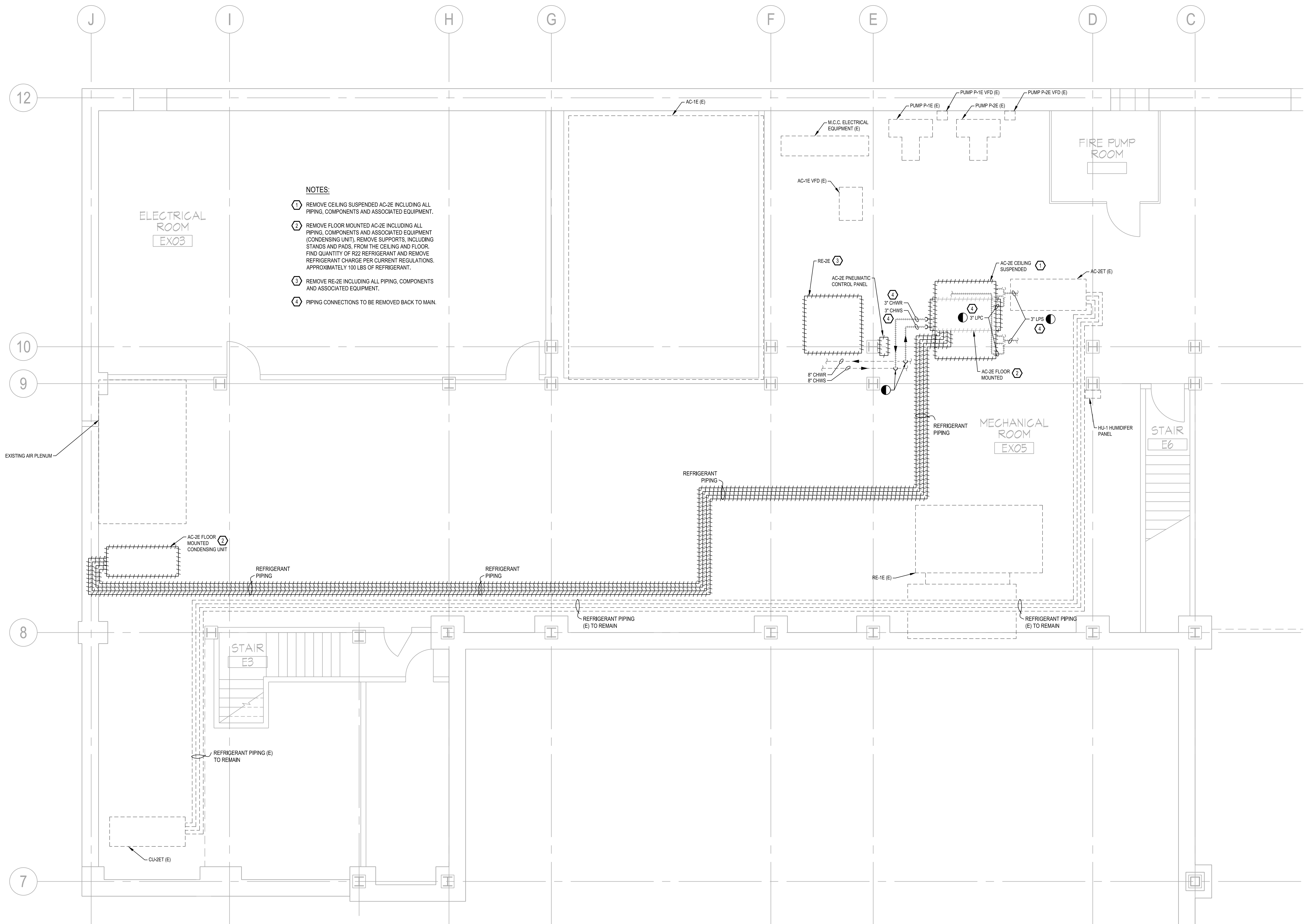
Structural Consultants

Darius Toraby Architects P.C.
236 West 27th Street 1401
New York, NY 10001 / (212) 242-2955

PROJECT:
GOODMAN LOWER GALLERY
NEW HVAC EQUIPMENT
282 7TH AVENUE NEW YORK, NY 10001

C1592
DRAWING TITLE:
SUBCELLAR MECHANICAL
PIPING DEMOLITION PLAN

SEAL & SIGNATURE:	DATE: 12/20/2024
	PROJECT No: 896978
	DRAWING BY: ASB
	CHK BY: DN
	DWG No:
	M-021.00
	SCALE: 1/4" = 1'-0" 4 OF 19



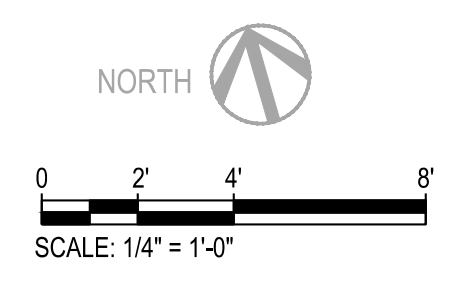
- NOTES:**
- 1 REMOVE CEILING SUSPENDED AC-2E INCLUDING ALL PIPING, COMPONENTS AND ASSOCIATED EQUIPMENT.
 - 2 REMOVE FLOOR MOUNTED AC-2E INCLUDING ALL PIPING, COMPONENTS AND ASSOCIATED EQUIPMENT (CONDENSING UNIT). REMOVE SUPPORTS, INCLUDING STANDS AND PADS, FROM THE CEILING AND FLOOR. FIND QUANTITY OF R22 REFRIGERANT AND REMOVE REFRIGERANT CHARGE PER CURRENT REGULATIONS. APPROXIMATELY 100 LBS OF REFRIGERANT.
 - 3 REMOVE RE-2E INCLUDING ALL PIPING, COMPONENTS AND ASSOCIATED EQUIPMENT.
 - 4 PIPING CONNECTIONS TO BE REMOVED BACK TO MAIN.

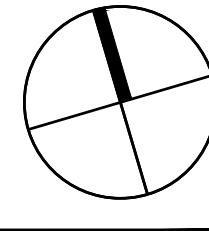
1 SUBCELLAR MECHANICAL DUCTWORK DEMOLITION PLAN

1/4" = 1'-0"

NEW YORK CITY BUILDING DEPARTMENT APPROVAL NOTE
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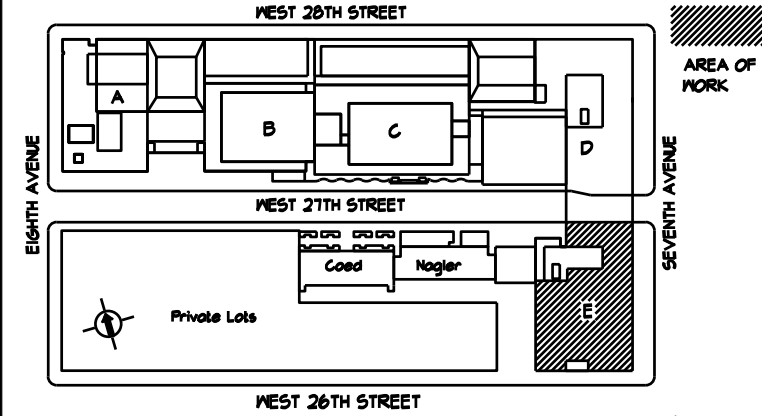
NEW YORK CITY ENERGY CONSERVATION CODE
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12/20/2024 ISSUED FOR BID



LOCATION PLAN
NOT TO SCALE

BLOCK: T76
LOT: 40
BIN: 1014236

Fashion Institute of Technology

227 West 27th Street
New York, NY 10001

MEP Consultants



Environmental Consultants

EPM, Inc.
983 Marcus Ave. Suite 109
Lake Success, NY 11042 / (516) 328-1194

Structural Consultants

Darius Toraby Architects P.C.
236 West 27th Street 1401
New York, NY 10001 / (212) 242-2955

PROJECT:
**GOODMAN LOWER GALLERY
NEW HVAC EQUIPMENT
282 7TH AVENUE NEW YORK, NY 10001**

C1592
DRAWING TITLE:
**SUBCELLAR MECHANICAL
DUCTWORK PLAN**

SEAL & SIGNATURE:	DATE: 12/20/2024
	PROJECT No: 896978
	DRAWING BY: ASB
	CHK BY: DN
	DWG No:
	M-101.00
	SCALE: 1/4" = 1'-0" 5 OF 19

J I H G F E D C

12

10

9

8

7

- NOTES:**
- CUT AND CAP REMAINING DUCTWORK. PROTECT DUCTWORK DURING DEMOLITION TO BE RECONNECTED TO NEW DUCTWORK.
 - SEE DRAWINGS M-201 FOR PIPING LAYOUT OF THIS FLOOR.
 - PROVIDE 24x24 ACCESS DOORS FOR EACH DAMPER AND SMOKE DETECTOR.
 - INSTALLATION OF THE NEW SUPPLY DUCT SHALL BE COMPLETED IN MAXIMUM 24 HOURS AND SHALL BE COORDINATED WITH THE OWNER WHEN THE GALLERY IS NOT IN USE. INSTALLATION OF AC-2E CAN BE DONE BETWEEN THE FOLLOWING DATES: (DEC. 15 2025 - FEB. 15 2026)

- KEY NOTES:**
- STARTERS FOR PUMPS P-11E & P-12E SHALL BE MOUNTED AND SUPPORTED FROM THE FLOOR. COORDINATE WITH THE FACILITY AND SUBMIT LOCATION FOR ENGINEER REVIEW.
 - INSTALL AIR HANDLING UNIT AC-2E ON 6" HOUSEKEEPING PAD.
 - INSTALL CEILING HUNG RETURN FAN RE-2E INCLUDING ALL SUPPORTS. (SEE DETAILS ON M-500S FOR DETAIL OF HANGING INLINE FANS).
 - HU-1 HUMIDIFIER TO BE RELOCATED IN NEW LOCATION SHOWN. CAP THE HOLES IN THE REMAINING DUCTWORK. PROVIDE NEW STEAM AND CONDENSATE CONNECTIONS FROM HUMIDIFIER. CONNECT NEW PIPING AS PER MANUFACTURER INSTRUCTIONS. REFER TO STEAM HUMIDIFIER DETAIL ON M-502.
 - PROVIDE NEW CONTROL VALVE ON STEAM HUMIDIFIER.

RIGGING NOTES:

RIGGING OF ALL UNITS INTO THE SUBCELLAR INCLUDING AC-2E, RE-2E, PUMPS 11E & 12E AND EXPANSION TANK SHALL BE THROUGH STAIRCASE E3 OR E6 AS SHOWN ON PLAN. COORDINATE WITH FIT. AC-2E MUST BE SHIPPED IN PANELS AND ASSEMBLED ON FIELD BY MANUFACTURER APPROVED CONTRACTOR.

REVIEW WITH ENGINEER ON FIELD BEFORE STARTING DEMOLITION FOR THE EXACT LOCATION OF CUTTING DUCTWORK.

ELECTRICAL ROOM
EX03

FIRE PUMP ROOM

MECHANICAL ROOM
EX05

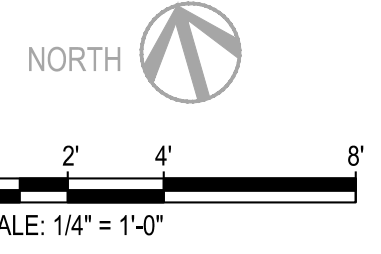
STAIR
E6

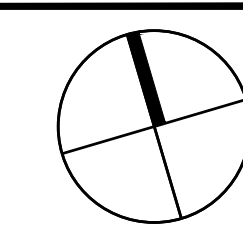
STAIR
E3

1 CELLAR MECHANICAL PLAN
1/4"=1'-0"

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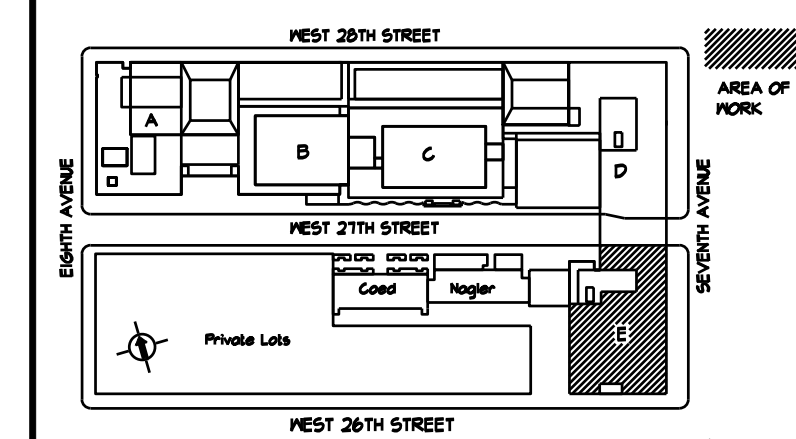
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LOCATION PLAN NOT TO SCALE BLOCK: T16 LOT: 40 BIN: 1014236

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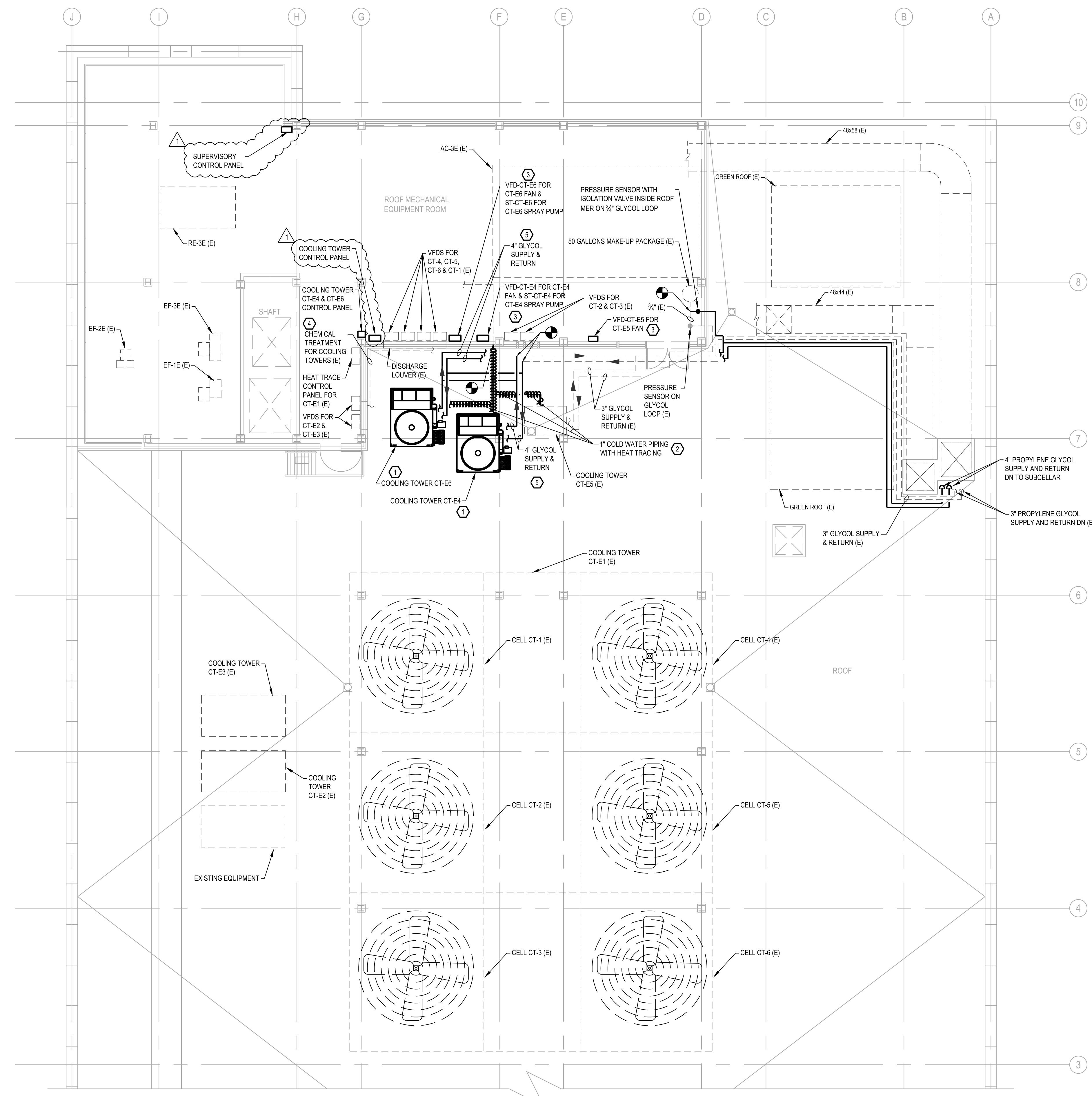
Structural Consultants

Darius Toraby Architects P.C.
236 West 27th Street 1401
New York, NY 10001 / (212) 242-2955

PROJECT:
GOODMAN LOWER GALLERY
NEW HVAC EQUIPMENT
282 7TH AVENUE NEW YORK, NY 10001

C1592
DRAWING TITLE:
ROOF MECHANICAL PLAN

SEAL & SIGNATURE:	DATE: 12/20/2024
	PROJECT No: 896978
	DRAWING BY: ASB
	CHK BY: DN
	DWG No:
	M-102.00
	SCALE: 1/8" = 1'-0" 6 OF 19



NOTES:

1. INSTALL NEW COOLING TOWERS ON THE NEW PLATFORM. REFER TO STRUCTURAL DRAWINGS FOR INFORMATION ON INSTALLATION OF THE NEW PLATFORM AND FOR EXACT LOCATION OF THE COOLING TOWERS. INSTALL COOLING TOWER, ACCESSORIES AND CONTROLS ACCORDING TO THE DRAWINGS AND SPECIFICATIONS.
2. FOR PIPING CONNECTION REFER TO DETAIL FOR MAKE UP WATER CONNECTION. PROVIDE NEW DRAIN PIPING TO THE NEAREST ROOF DRAIN. PROVIDE NEW MAKE UP WATER CONNECTIONS WITH HEAT TRACING. REFER TO HEAT TRACING NOTES.
3. INSTALL NEW VFD FOR COOLING TOWER FAN AND NEW STARTER FOR COOLING TOWER SPRAY PUMP. REFER TO M-701 FOR VFD AND STARTER SCHEDULE.
4. COORDINATE WITH FACILITY CHEMICAL TREATMENT CONTRACTOR NALCO FOR INSTALLATION OF NEW CHEMICAL TREATMENT PIPING CONNECTIONS FOR COOLING TOWER CT-E6 & CT-E4.
5. REFER TO PIPING DIAGRAM ON M-601 & PIPING CONTROL DIAGRAM ON M-603 FOR GLYCOL WATER CONNECTIONS. REFER TO DETAILS ON M-500 SERIES FOR ALL THE VALVES AND ACCESSORIES FOR PIPING.

PHASING NOTES:

1. EXISTING COOLING TOWER CT-E4 & ASSOCIATED PIPING AND EQUIPMENT SHOULD ONLY BE DEMOLISHED AFTER NEW COOLING TOWER CT-E6 HAS BEEN FULLY INSTALLED AND TESTED INCLUDING ALL NEW PIPING CONNECTIONS AND CONTROLS. START UP REPORT SHALL BE SUBMITTED TO ENGINEER.

HEAT TRACING NOTES:

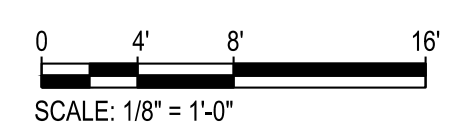
1. HEAT TRACE COLD WATER PIPING AS INDICATED, USING A LINEAR STRIP OF RAYCHEM XL-TRACE HEATING CABLE MODEL #5XL2-CR, 1 WATTS PER FOOT WITH 2" INSULATION. BASIS-OF-DESIGN PRODUCT. SUBJECT TO COMPLIANCE WITH REQUIREMENTS, PROVIDE NVENT (RAYCHEM PENTAIR THERMAL MANAGEMENT), XL-TRACE-GAF SERIES, OR APPROVED EQUAL MINIMUM MAINTENANCE TEMPERATURE OF 40°F AT THE MINIMUM AMBIENT TEMPERATURE SHALL BE -20°F. PROVIDE DIGITAL ELECTRONIC CONTROLLER DIGITRACE C910 AND CONNECT TO BMS SYSTEM. REFER TO ELECTRICAL DRAWINGS.

ALTERNATE-1 NOTES:

1. ALTERNATE-1 REPRESENTED BY TRIANGLE AND BUBBLE AS SHOWN.

1 ROOF MECHANICAL PLAN

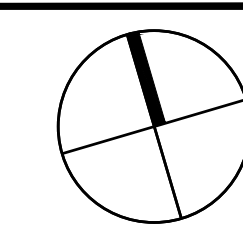
1/8" = 1'-0"



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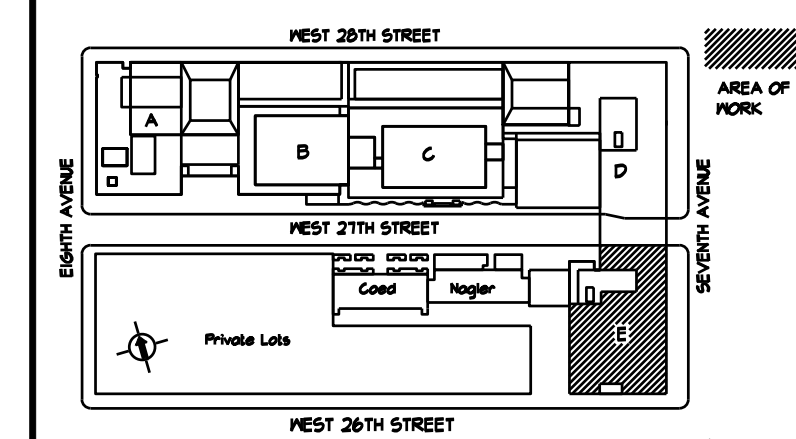
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LOCATION PLAN NOT TO SCALE BLOCK: T76 LOT: 40 BIN: 1014236

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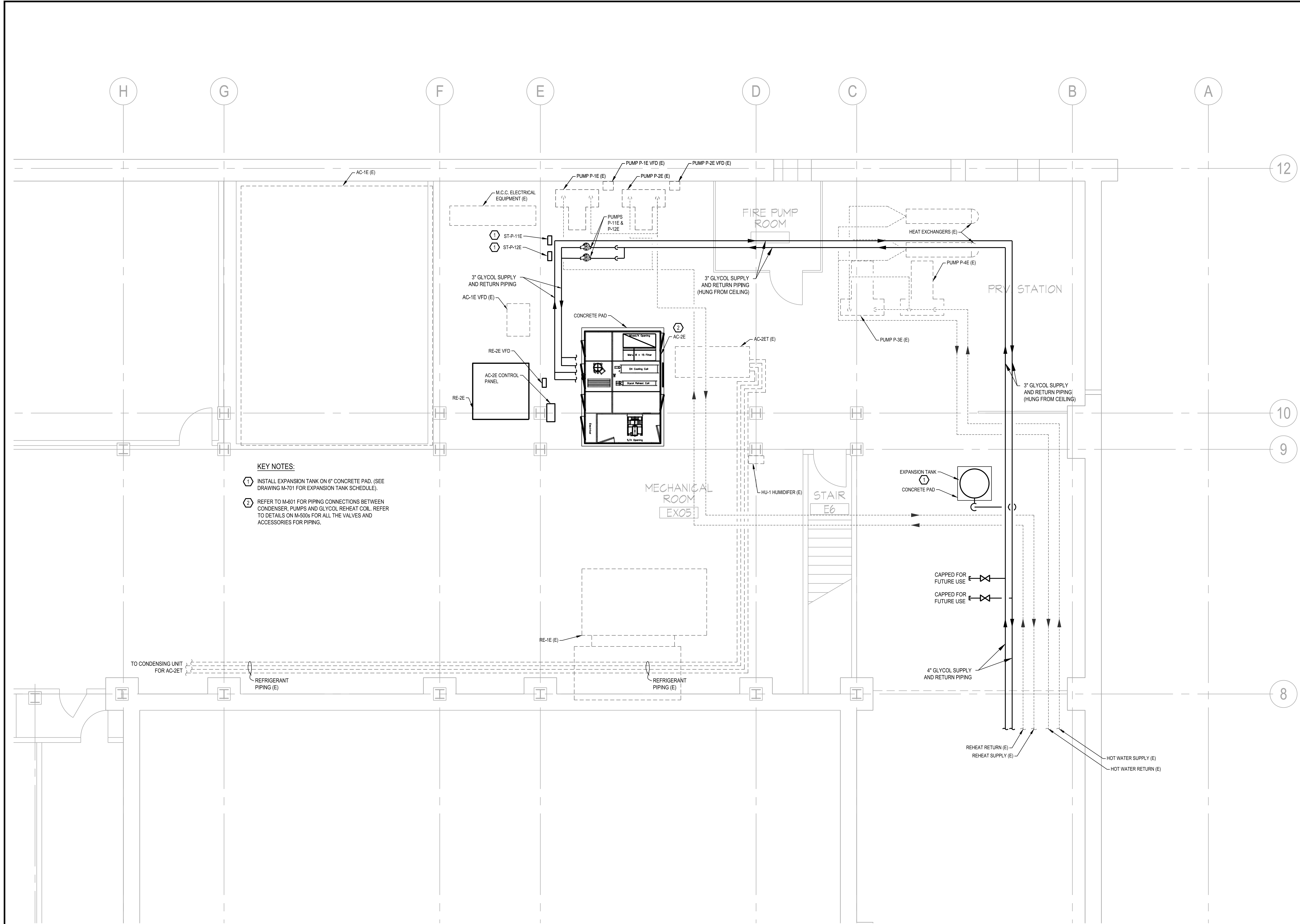
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Structural Consultants
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PROJECT:
 GOODMAN LOWER GALLERY
 NEW HVAC EQUIPMENT
 282 7TH AVENUE NEW YORK, NY 10001

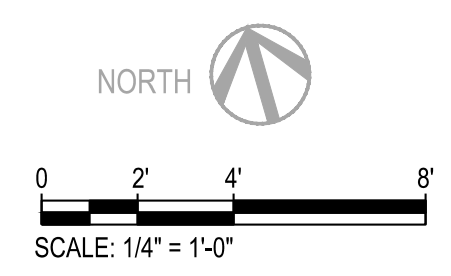
C1592
 DRAWING TITLE:
 SUBCELLAR MECHANICAL
 PIPING PLAN

SEAL & SIGNATURE:	DATE: 12/20/2024
	PROJECT No: 896978
	DRAWING BY: ASB
	CHK BY: DN
	DWG No:
	M-201.00
	SCALE: 1/4" = 1'-0" 7 OF 19



- KEY NOTES:**
- ① INSTALL EXPANSION TANK ON 8" CONCRETE PAD. (SEE DRAWING M-701 FOR EXPANSION TANK SCHEDULE).
 - ② REFER TO M-601 FOR PIPING CONNECTIONS BETWEEN CONDENSER, PUMPS AND GLYCOL REHEAT COIL. REFER TO DETAILS ON M-500s FOR ALL THE VALVES AND ACCESSORIES FOR PIPING.

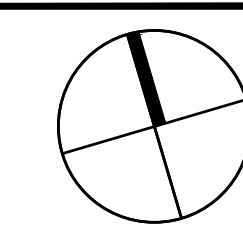
1 CELLAR MECHANICAL PLAN
 1/4" = 1'-0"



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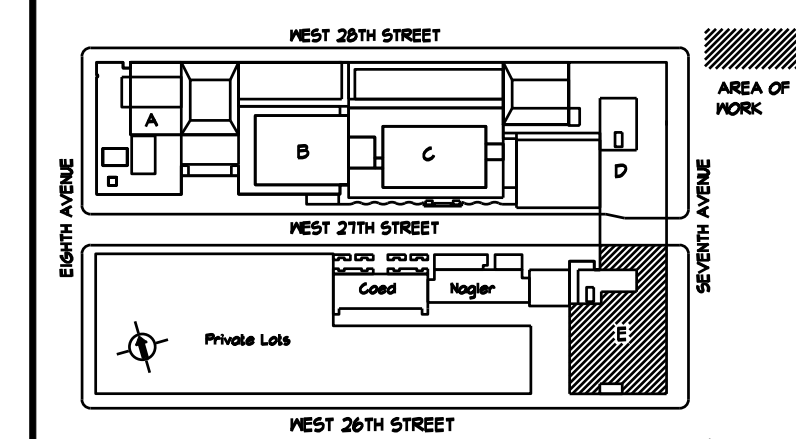
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LOCATION PLAN NOT TO SCALE
BLOCK: T16
LOT: 40
BIN: 1014236

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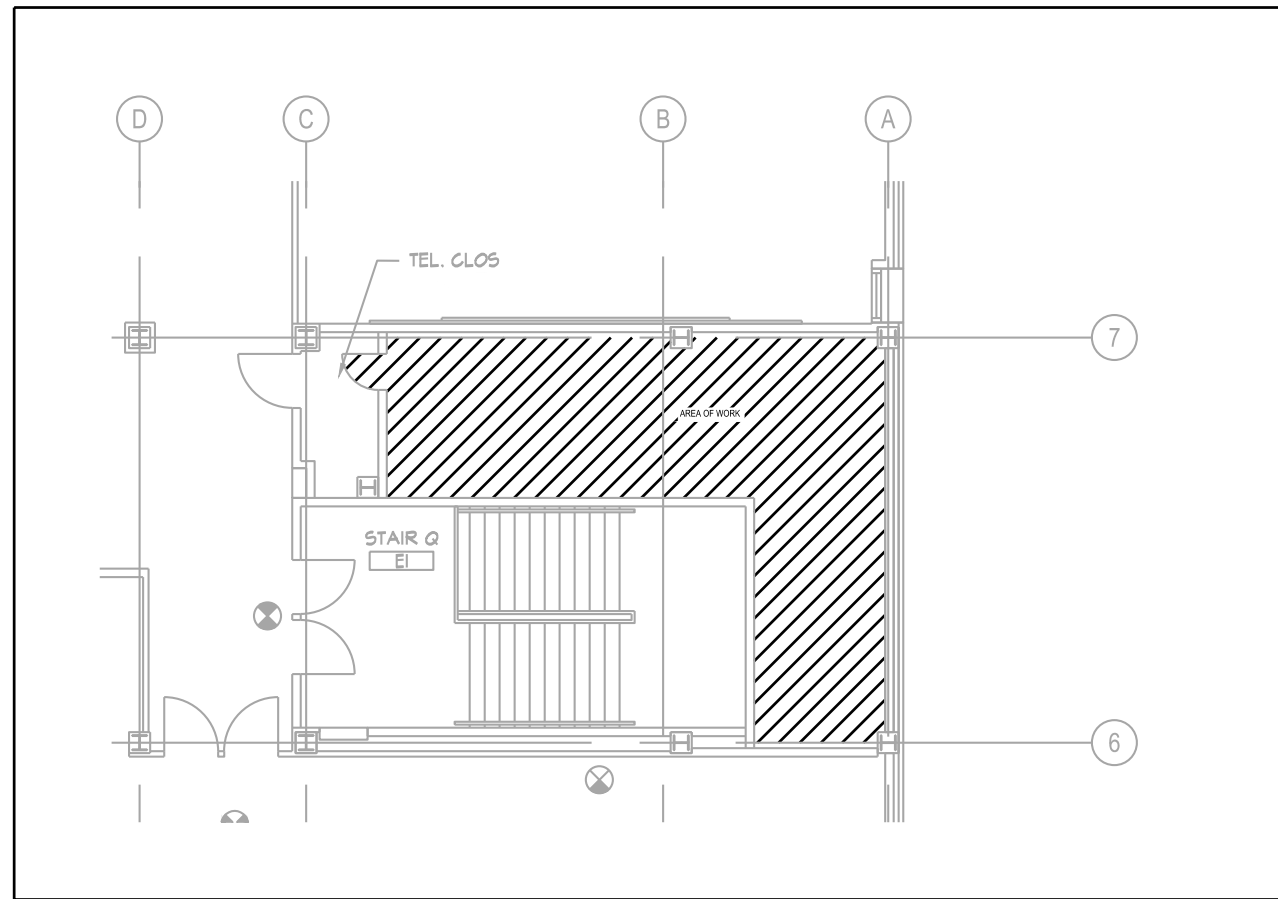
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New York, NY 10001 / (212) 242-2955

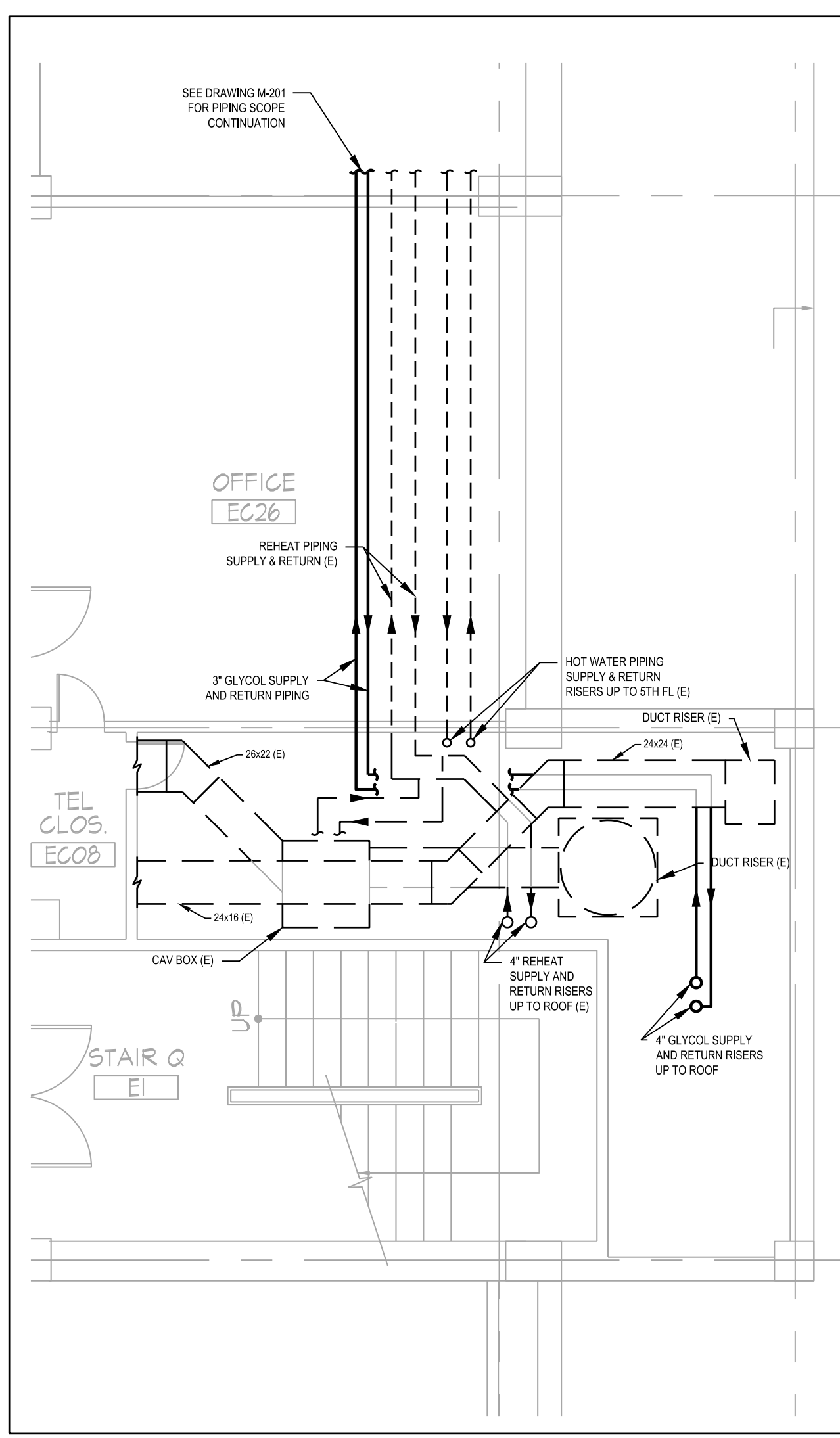
PROJECT:
GOODMAN LOWER GALLERY
NEW HVAC EQUIPMENT
282 7TH AVENUE NEW YORK, NY 10001

C1592
DRAWING TITLE:
CELLAR THRU 6TH FLOOR
SHAFT RISER
MECHANICAL PLANS

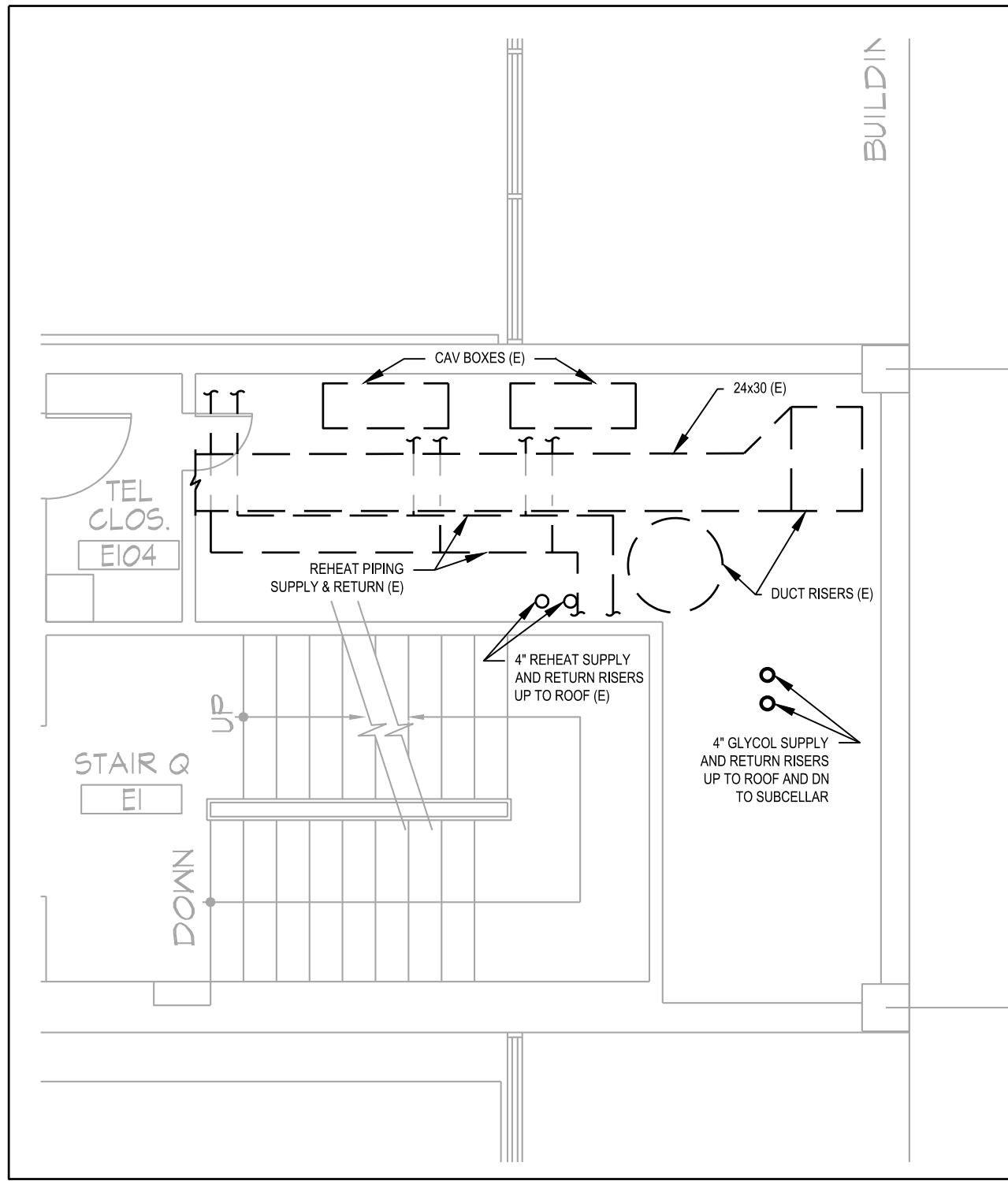
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	DRAWING BY: ASB
	CHK BY: DN
	DWG No:
	M-40100
	SCALE: AS SHOWN 8 OF 19



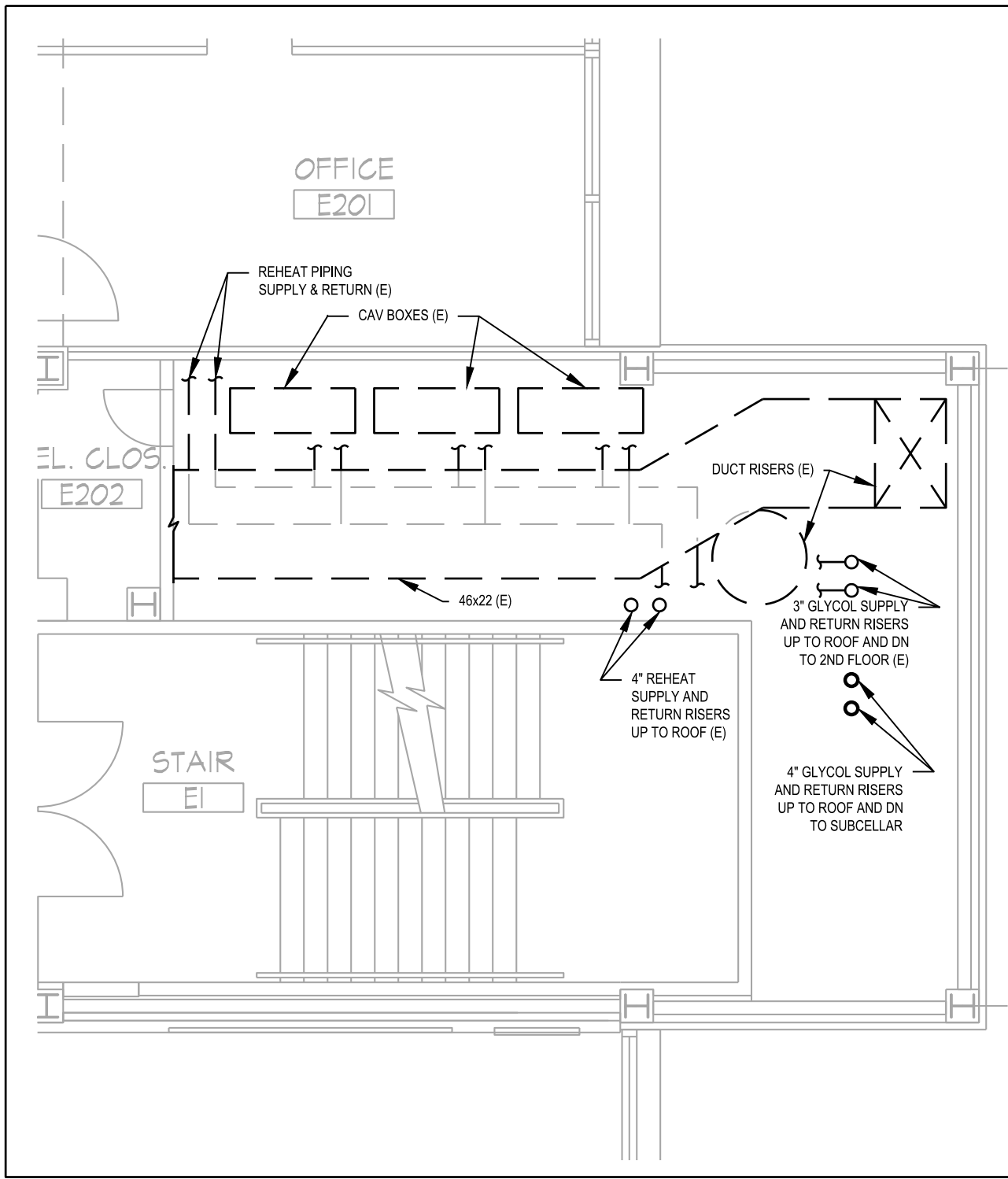
0 AREA OF WORK (TYP. CELLAR-SIXTH FLOOR)
3/32"=1'-0"



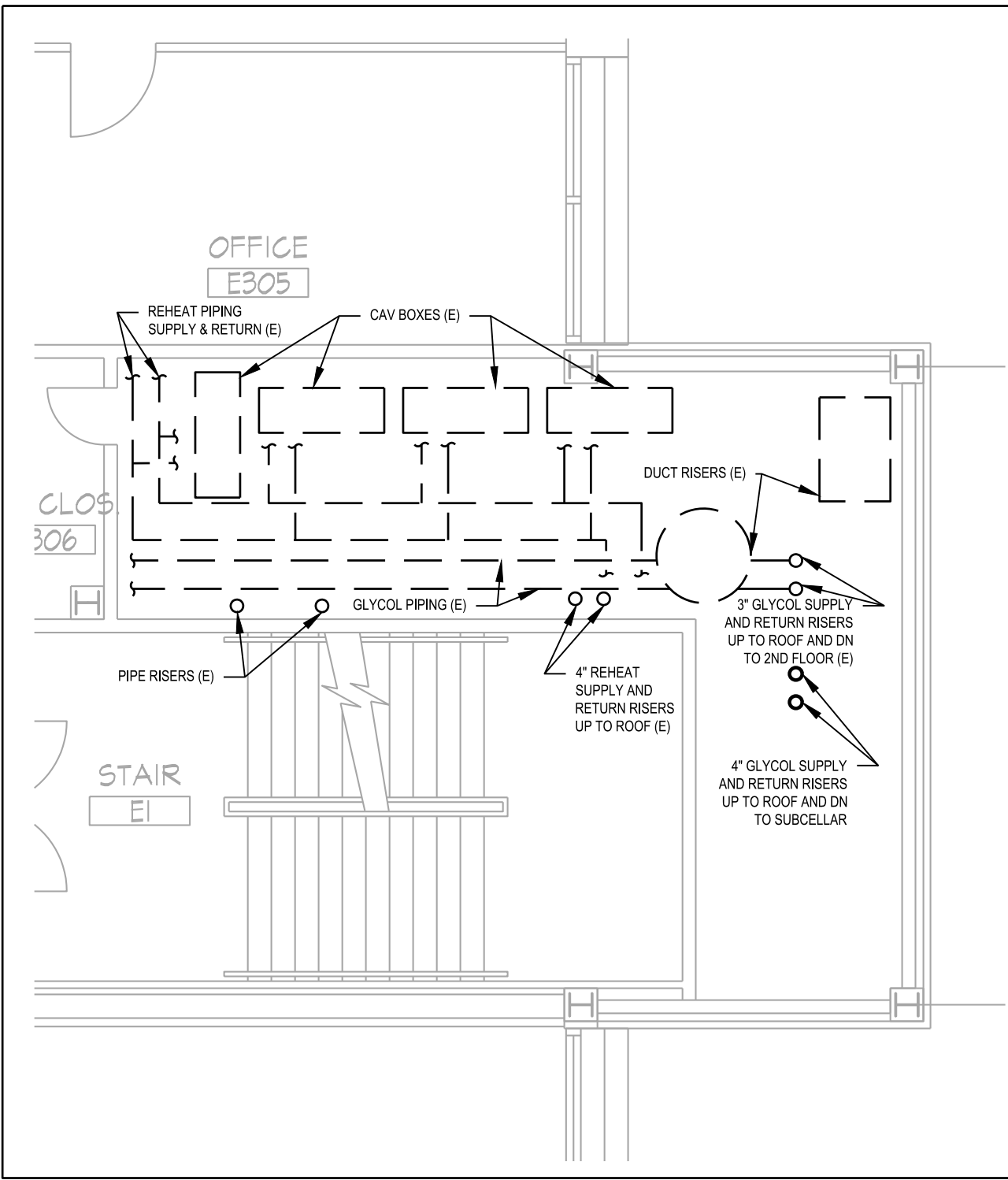
1 CELLAR MECHANICAL PLAN
3/16"=1'-0"



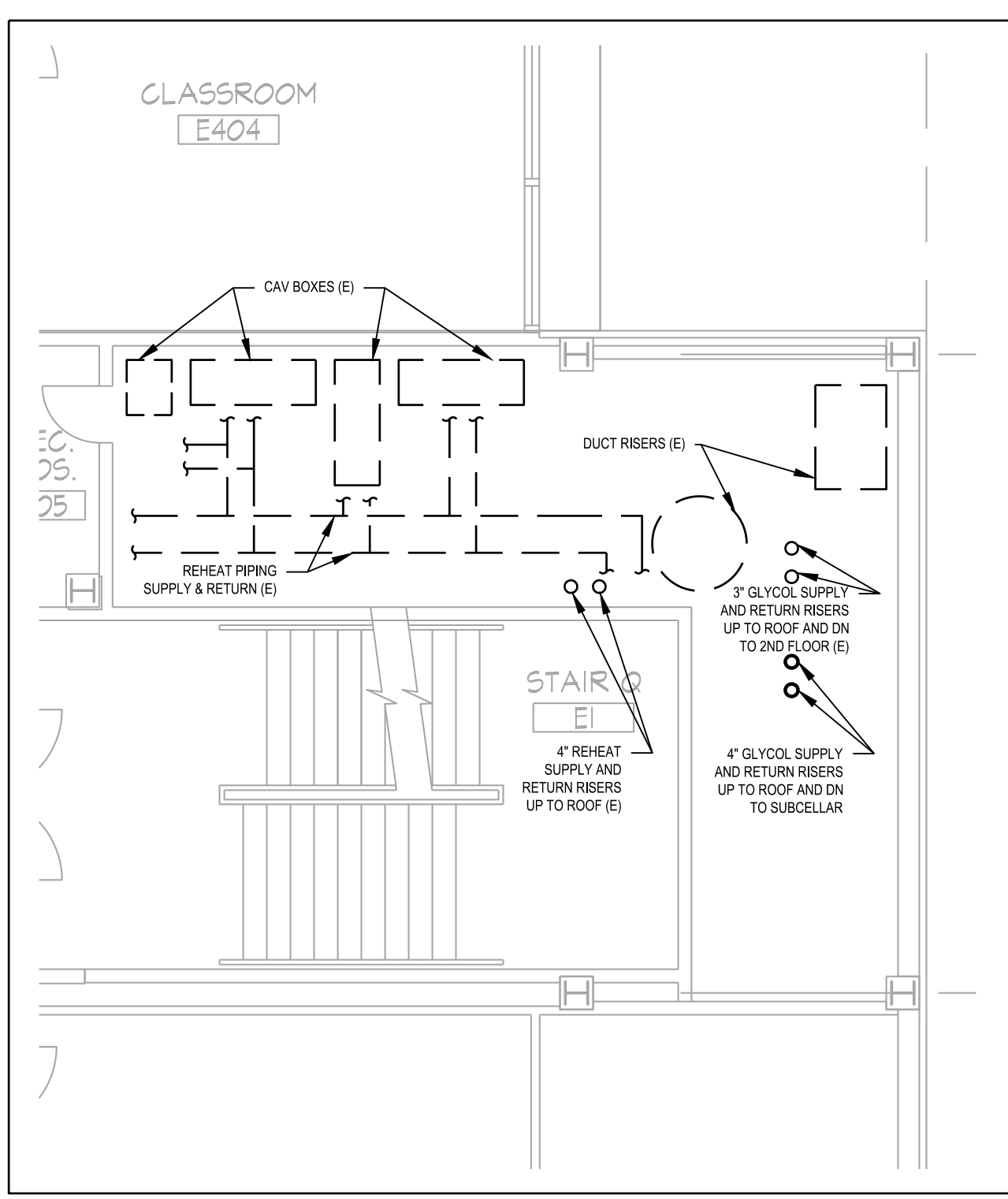
2 1ST FLOOR MECHANICAL PLAN
3/16"=1'-0"



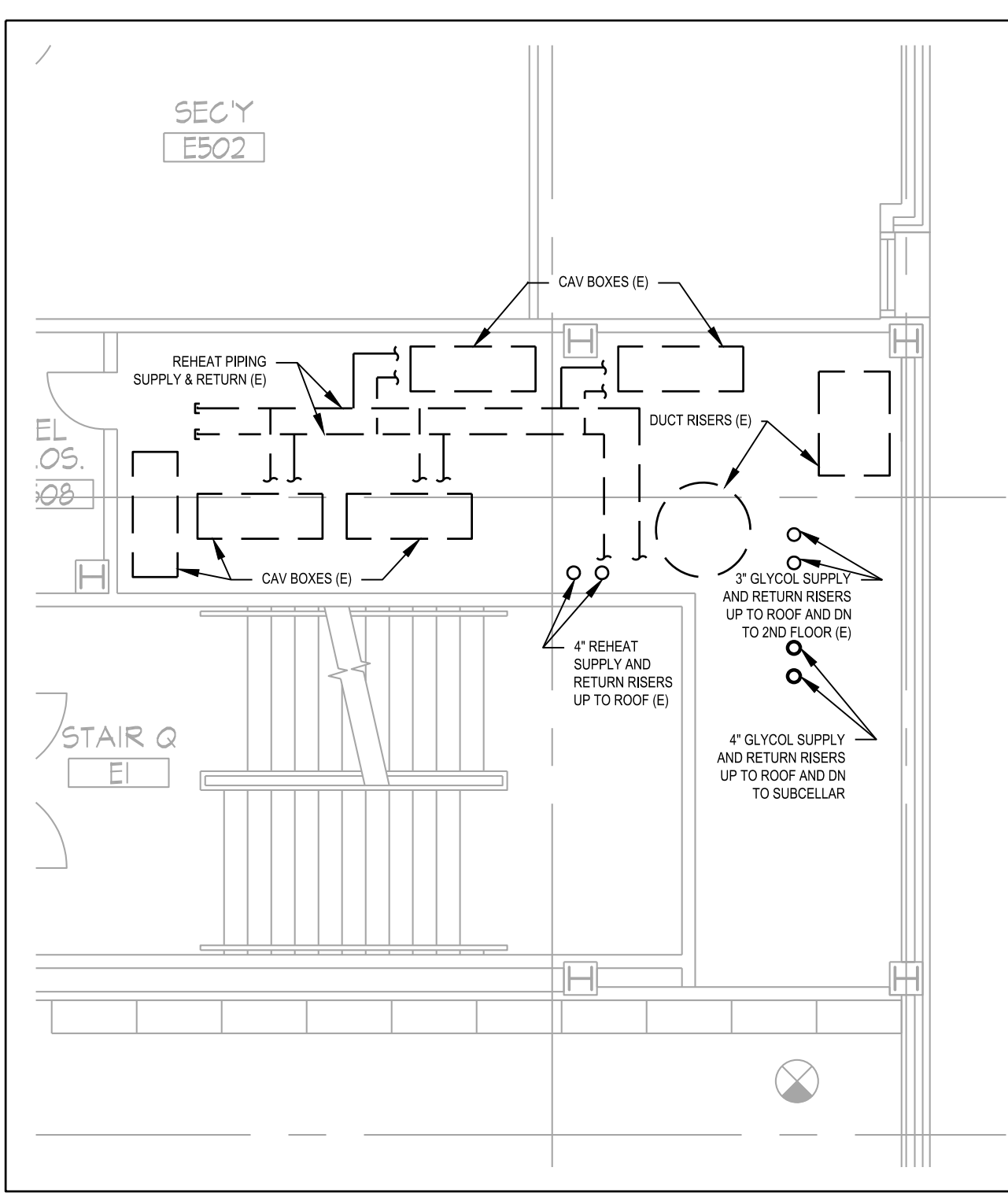
3 2ND FLOOR MECHANICAL PLAN
3/16"=1'-0"



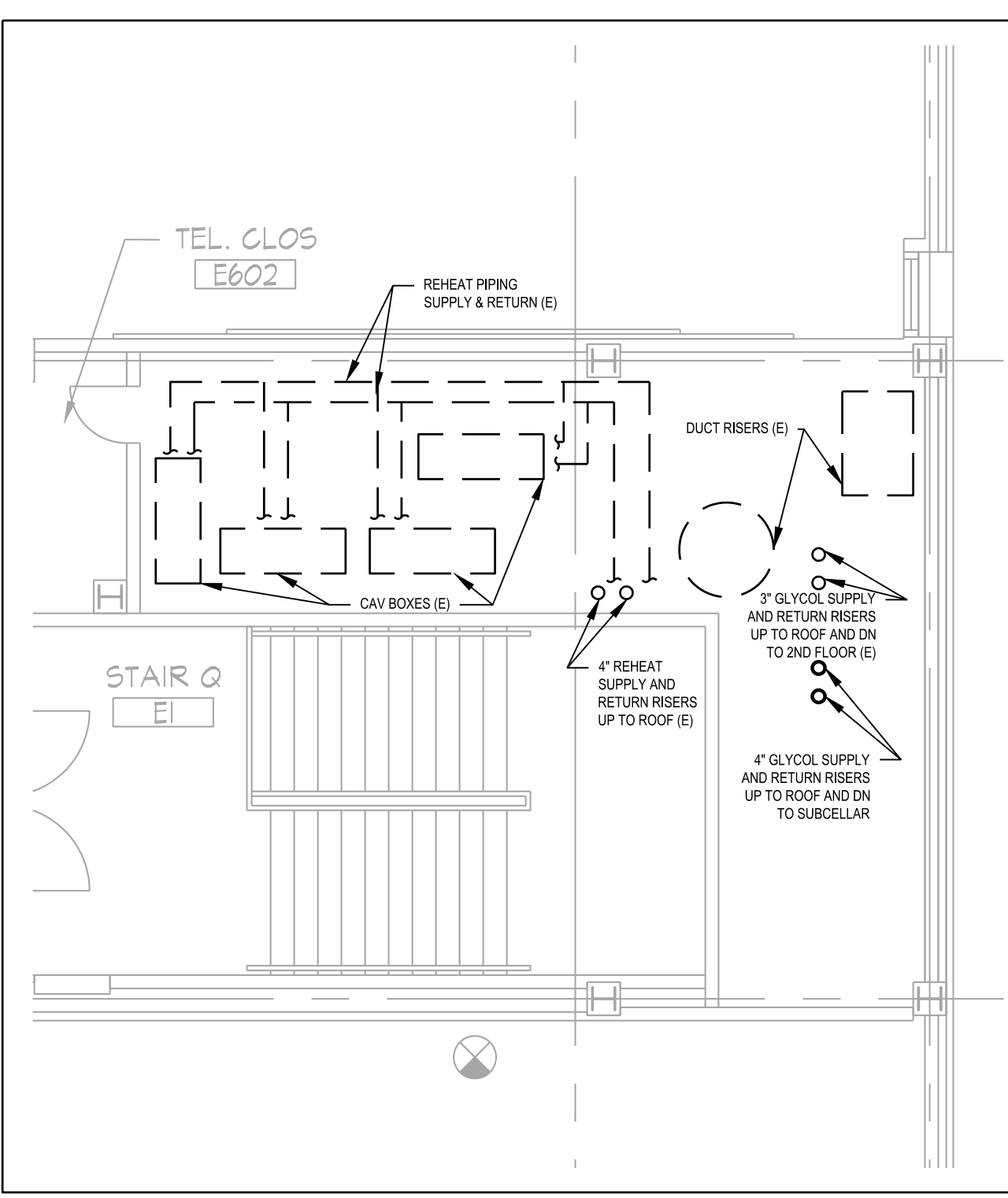
4 3RD FLOOR MECHANICAL PLAN
3/16"=1'-0"



5 4TH FLOOR MECHANICAL PLAN
3/16"=1'-0"

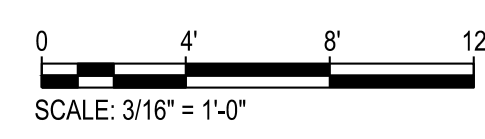


6 FIFTH FLOOR MECHANICAL PLAN
3/16"=1'-0"



7 SIXTH FLOOR MECHANICAL PLAN
3/16"=1'-0"

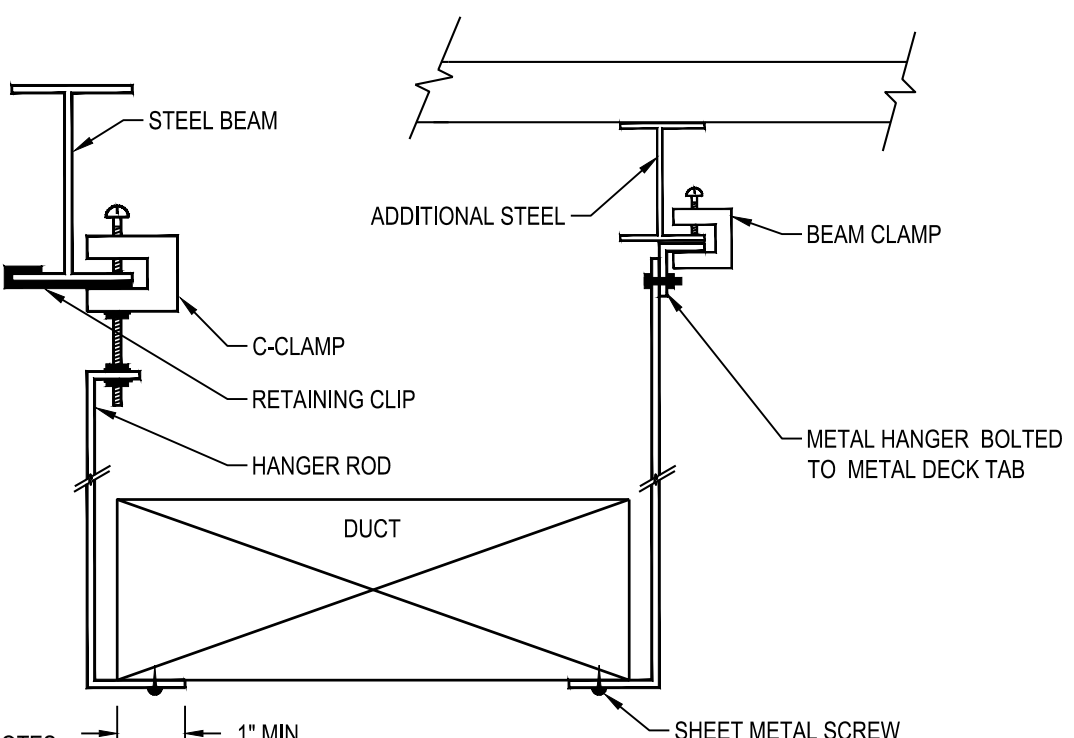
- NOTES:
- TEMPORARILY REMOVE AND CAP ANY REHEAT SUPPLY/RETURN PIPING THAT IS OBSTRUCTING ACCESS TO INSTALL THE NEW 4" GLYCOL SUPPLY. ANY REHEAT PIPING THAT IS REMOVED SHALL BE REINSTALLED AFTER THE CONSTRUCTION IS COMPLETED.
 - PROVIDE FIRE RATING PENETRATION AS PER DETAIL AT ALL SLAB PENETRATIONS.



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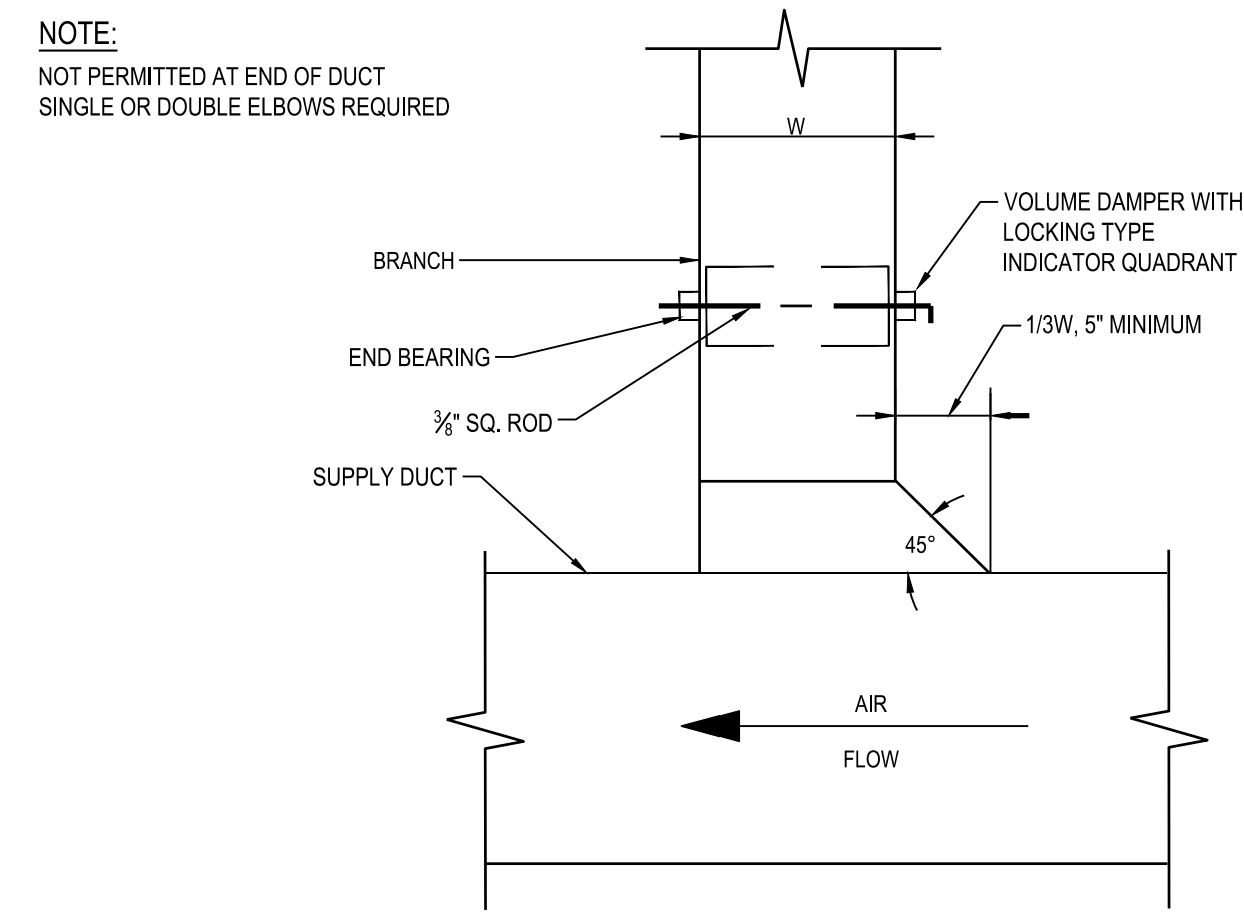


- NOTES:
- HANGERS SHALL BE OF METAL NOT LESS THAN 1/2" FOR DUCTS 2 SQ.FT. & LESS, AND NOT LESS THAN 3/4" FOR DUCTS LARGER THAN 2 SQ.FT.
 - WHERE CROSS-SECTIONAL AREA OF DUCT EXCEEDS 8 SQ.FT., HANGERS SHALL BE SPACED NOT MORE THAN 4 FT. ON CENTERS.
 - C-CLAMP FOR DUCTS UP TO 36" MAXIMUM DIMENSION.

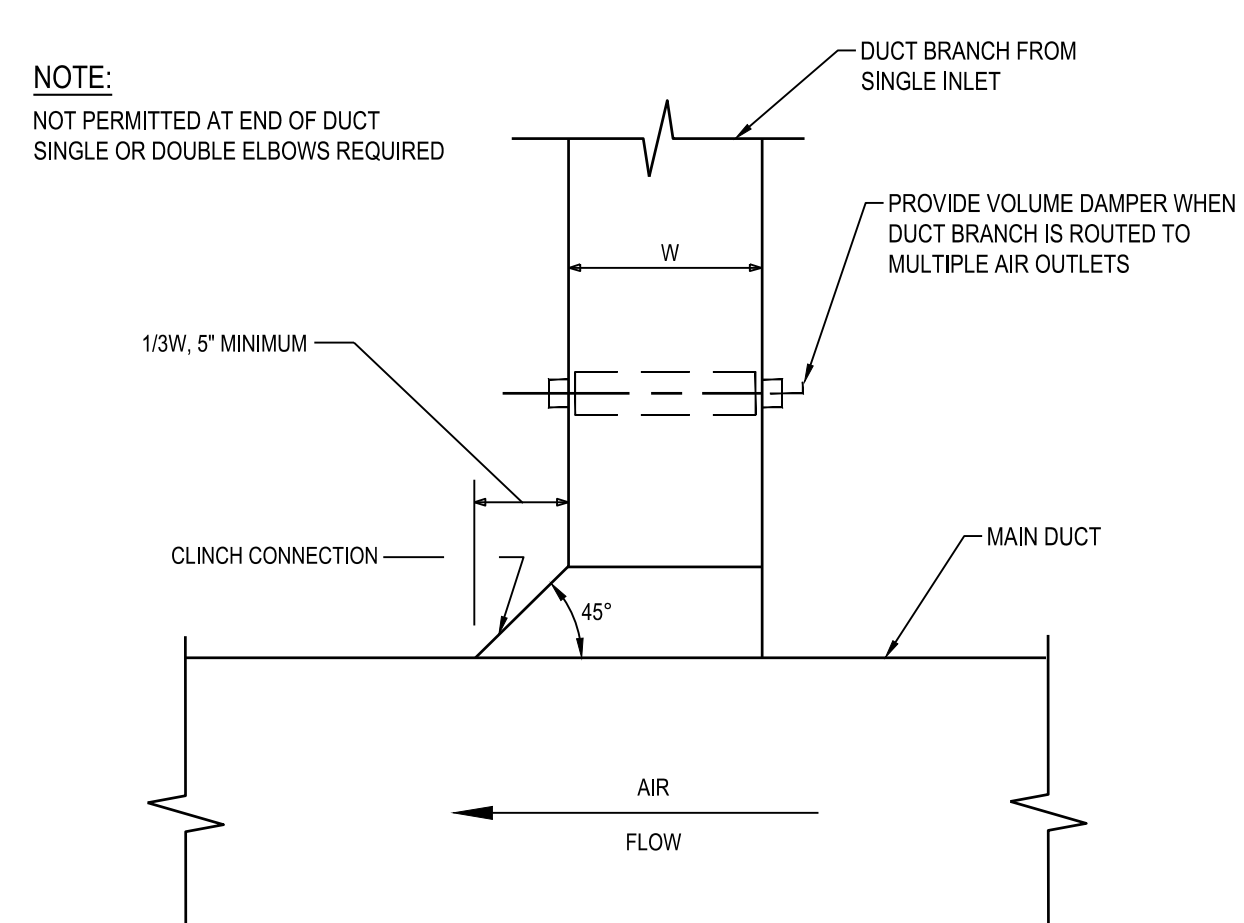
DUCT SUPPORT ATTACHMENT TO STRUCTURE

DUCT SUPPORT SCHEDULE								
HALF OF DUCT PERIMETER	PAIR AT 10 FT. SPACING		PAIR AT 8 FT. SPACING		PAIR AT 5 FT. SPACING		PAIR AT 4 FT. SPACING	
	STRAP	WIRE/ROD	STRAP	WIRE/ROD	STRAP	WIRE/ROD	STRAP	WIRE/ROD
30"	1" x 22 GA	10 GA (.135)	1" x 22 GA	10 GA (.135)	1" x 22 GA	12 GA (.159)	1" x 22 GA	12 GA (.159)
72"	1" x 18 GA	3/8"	1" x 20 GA	1/4"	1" x 22 GA	1/4"	1" x 22 GA	1/4"
96"	1" x 16 GA	3/8"	1" x 18 GA	3/8"	1" x 20 GA	3/8"	1" x 22 GA	1/4"
120"	10" x 16 GA	1/2"	1" x 16 GA	3/8"	1" x 18 GA	3/8"	1" x 20 GA	1/4"
168"	10" x 16 GA	1/2"	10" x 16 GA	1/2"	1" x 16 GA	3/8"	1" x 18 GA	3/8"
192"	-	1/2"	10" x 16 GA	1/2"	1" x 16 GA	3/8"	1" x 16 GA	3/8"

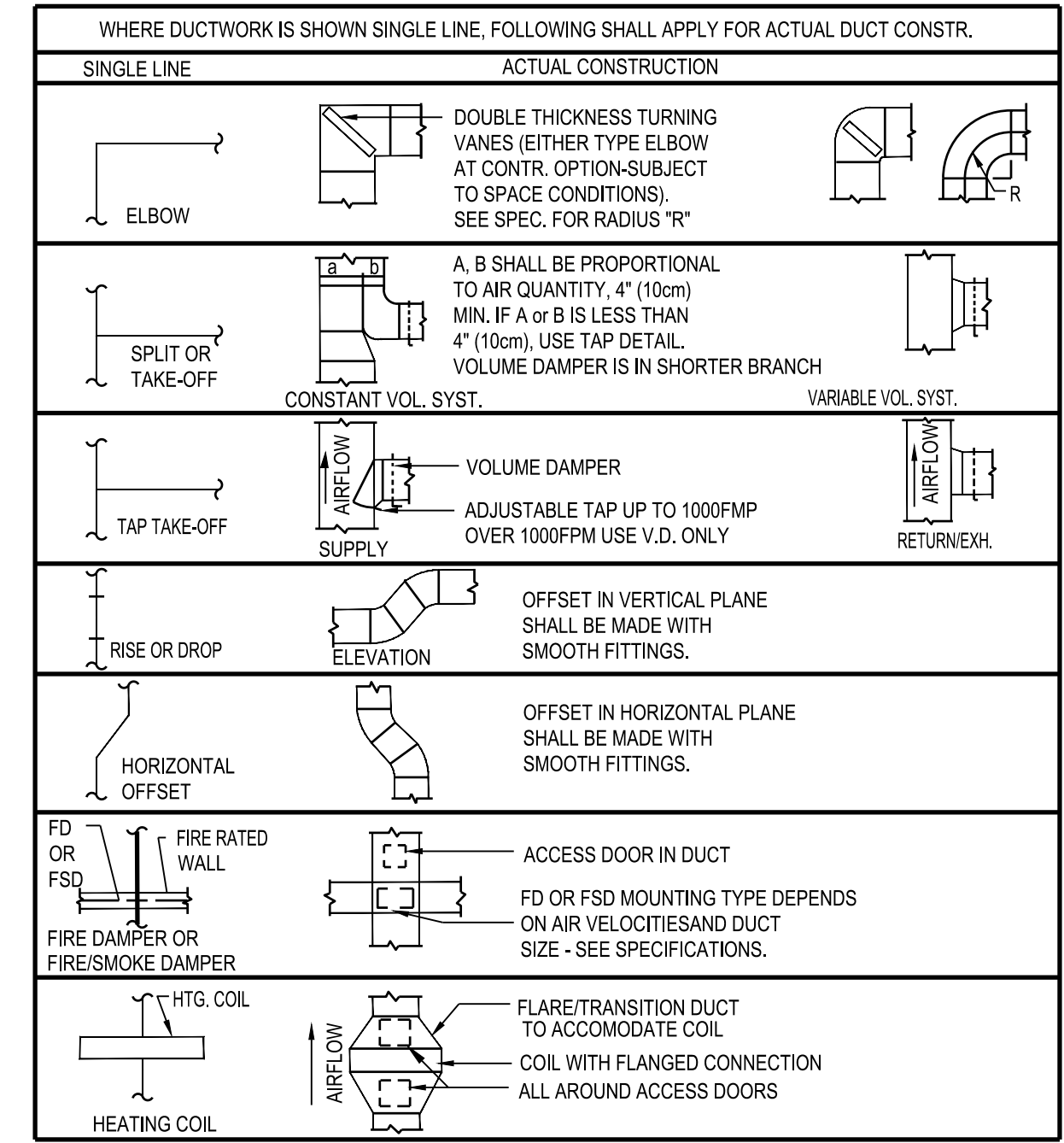
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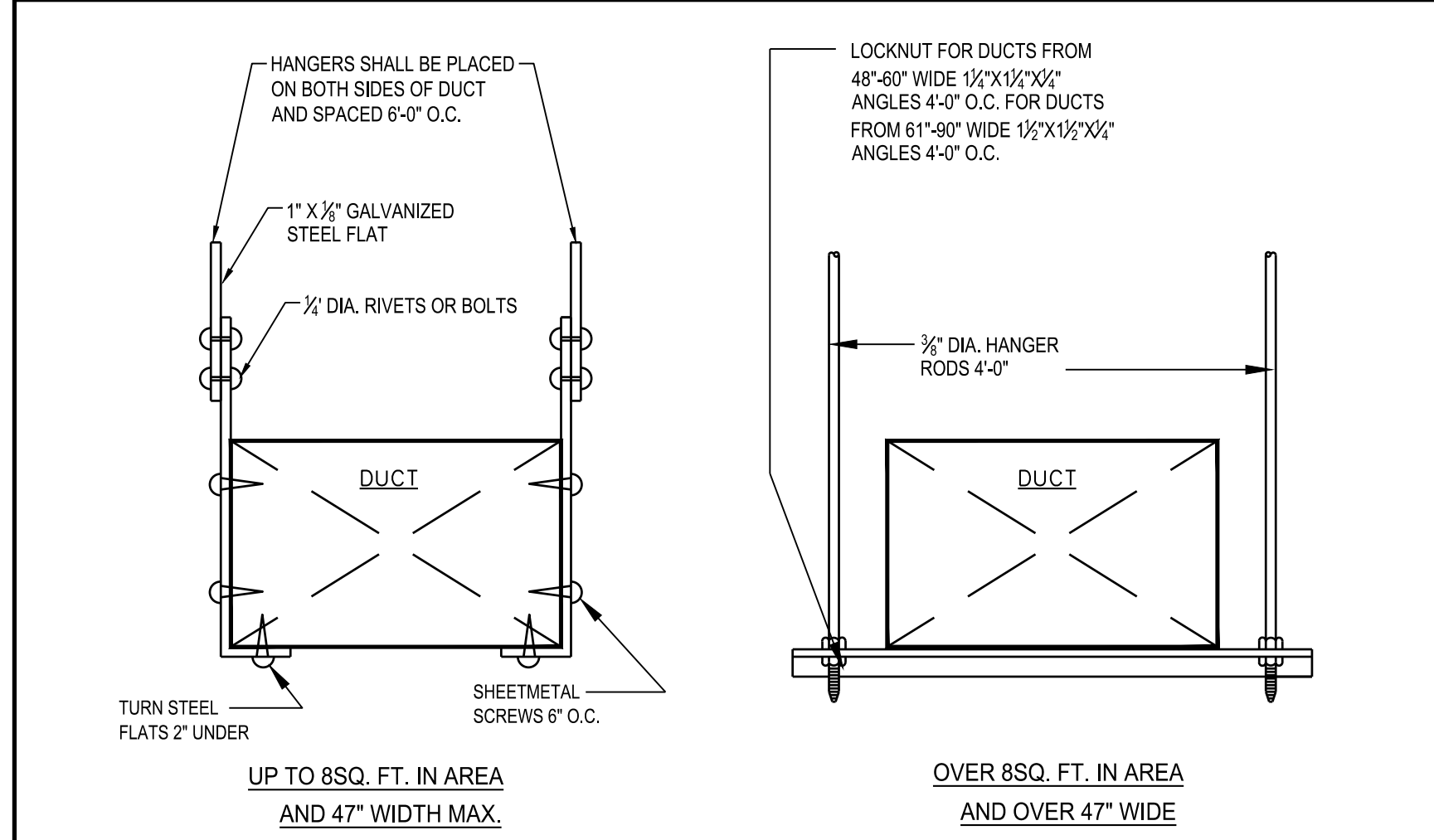
2 RECTANGULAR SUPPLY DUCT BRANCH THROAT CONNECTION
Not to Scale



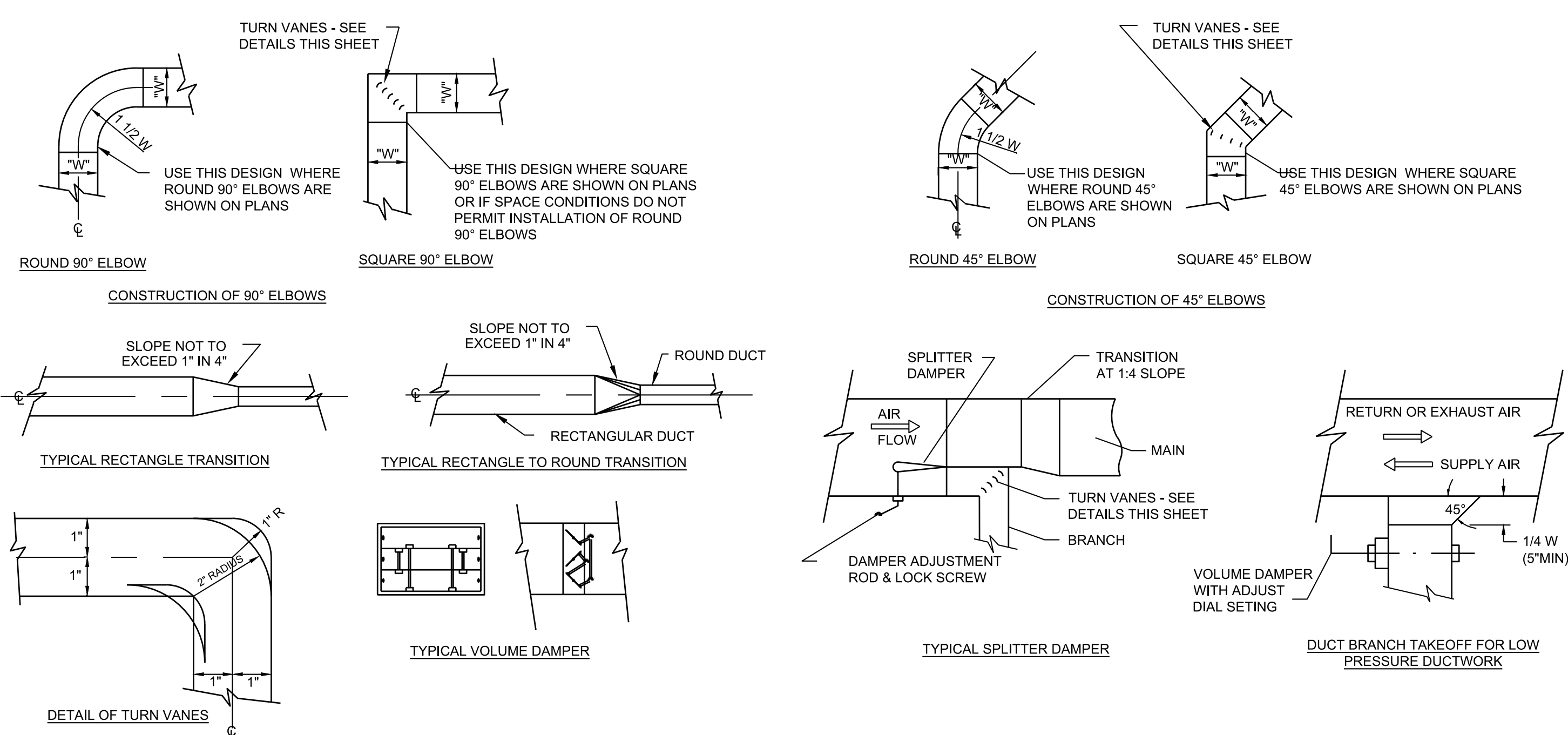
3 RECTANGULAR RETURN/EXHAUST DUCT TAP
Not to Scale



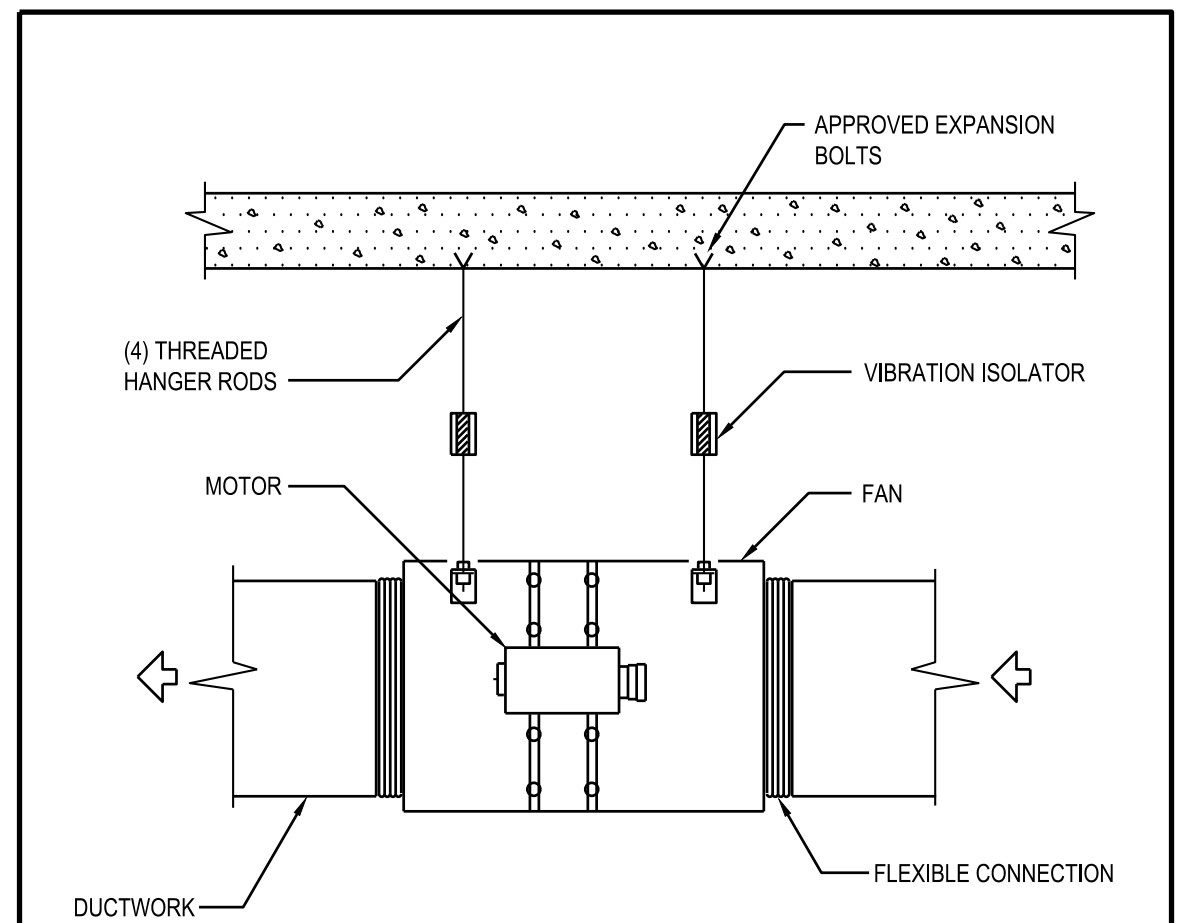
4 INTERPRETATION OF SINGLE LINE DUCTWORK
Not to Scale



5 METHOD OF SUPPORTING DUCTS
Not to Scale



6 DUCTWORK DETAILS
Not to Scale



7 Inline Fan Hanging Support Detail
Not to Scale

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LOCATION PLAN NOT TO SCALE

BLOCK: T16
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P 212 643 9055 www.mgepc.com

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PROJECT:
GOODMAN LOWER GALLERY
NEW HVAC EQUIPMENT
282 7TH AVENUE NEW YORK, NY 10001

C1592
DRAWING TITLE:
MECHANICAL DETAILS 1

SEAL & SIGNATURE: _____ DATE: 12/20/2024

PROJECT No: 896978
DRAWING BY: ASB
CHK BY: DN
DWG No: _____

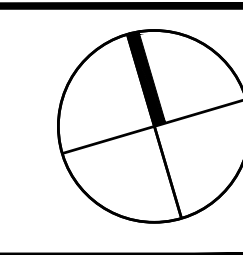
M-501.00

SCALE: N.T.S. 9 OF 19

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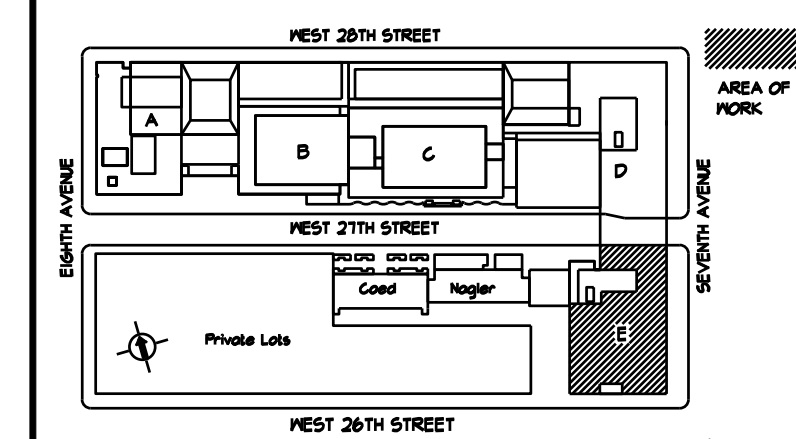
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LOCATION PLAN NOT TO SCALE BLOCK: T16 LOT: 40 BIN: 1014236

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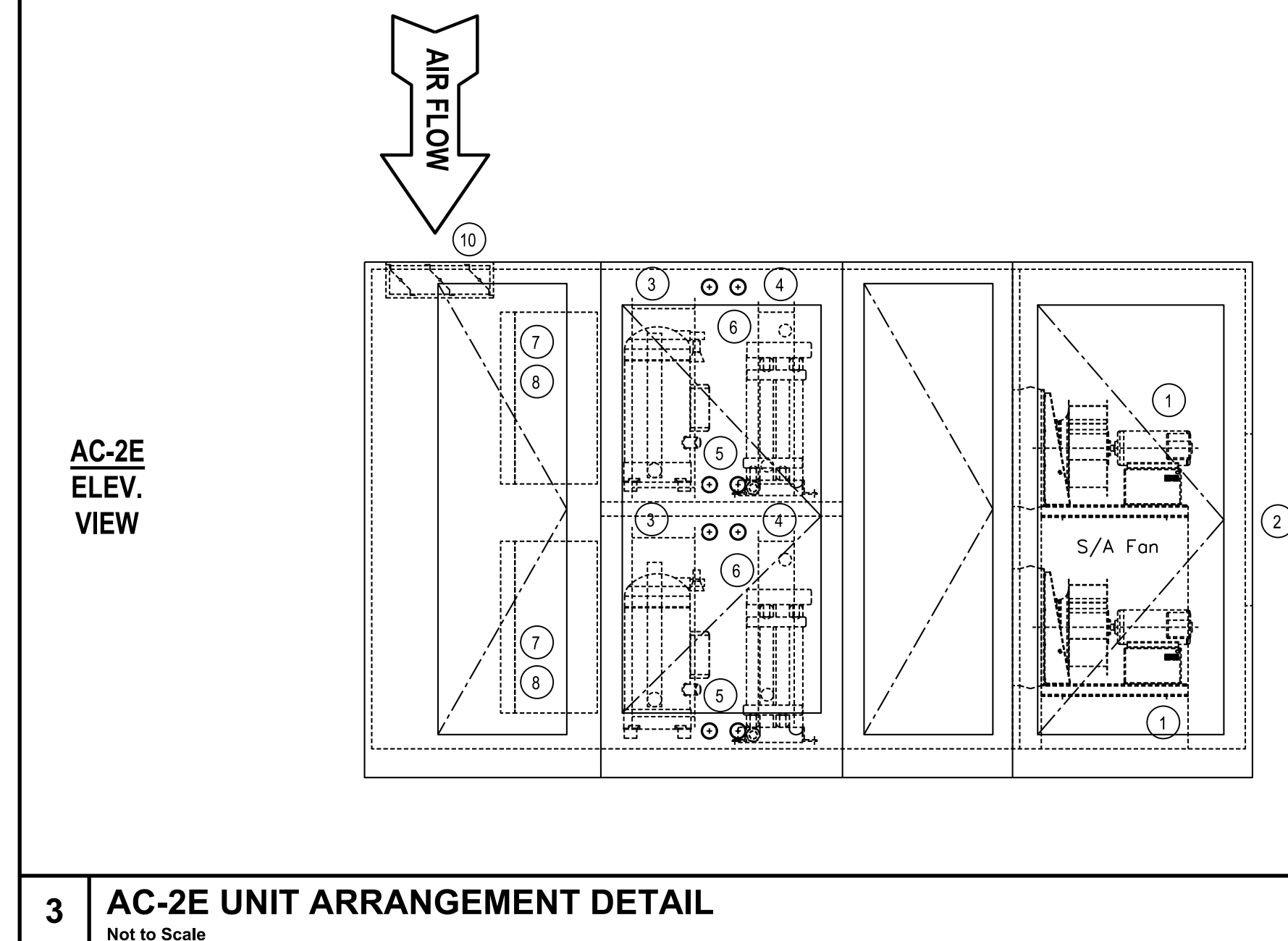
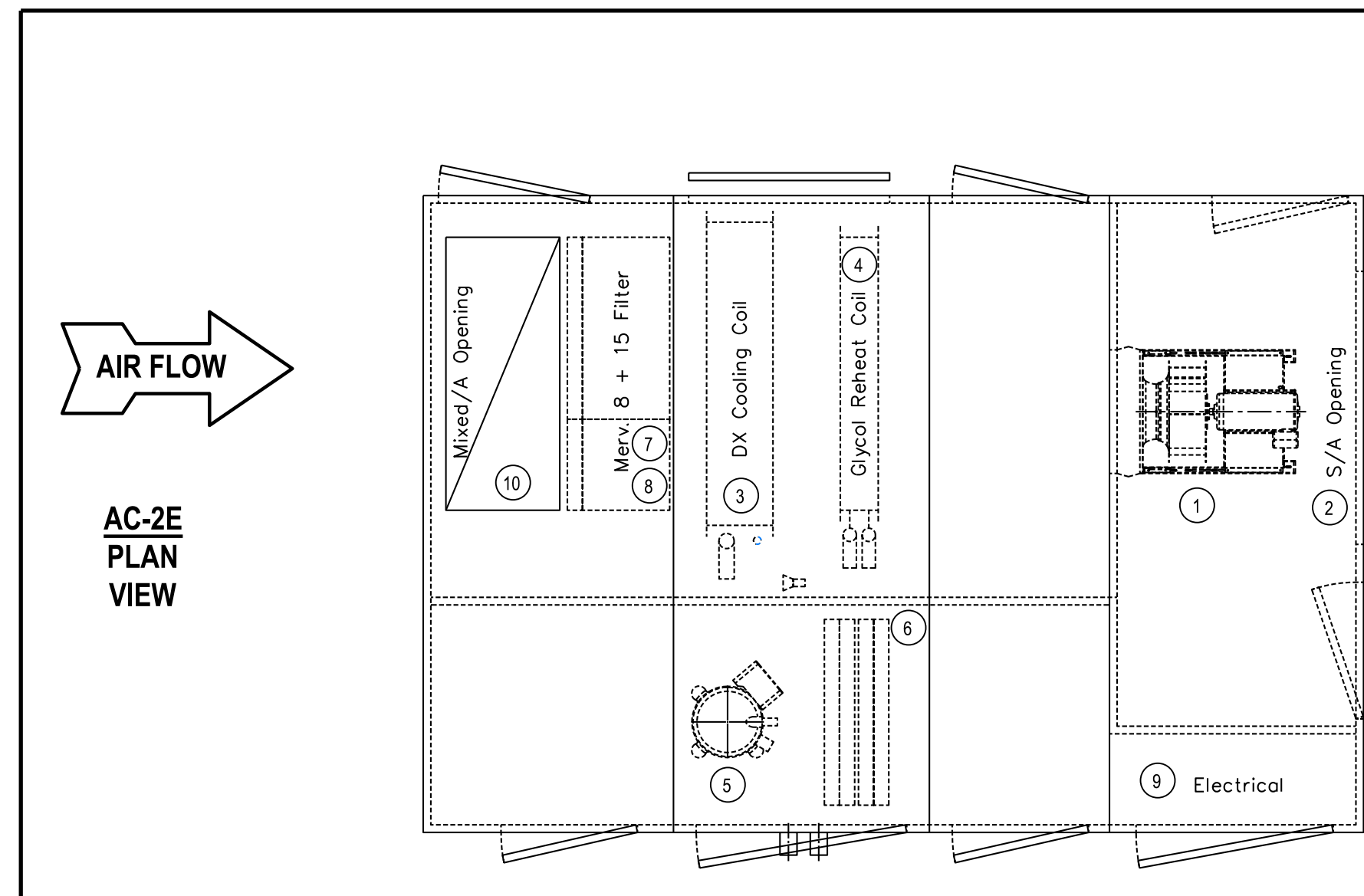
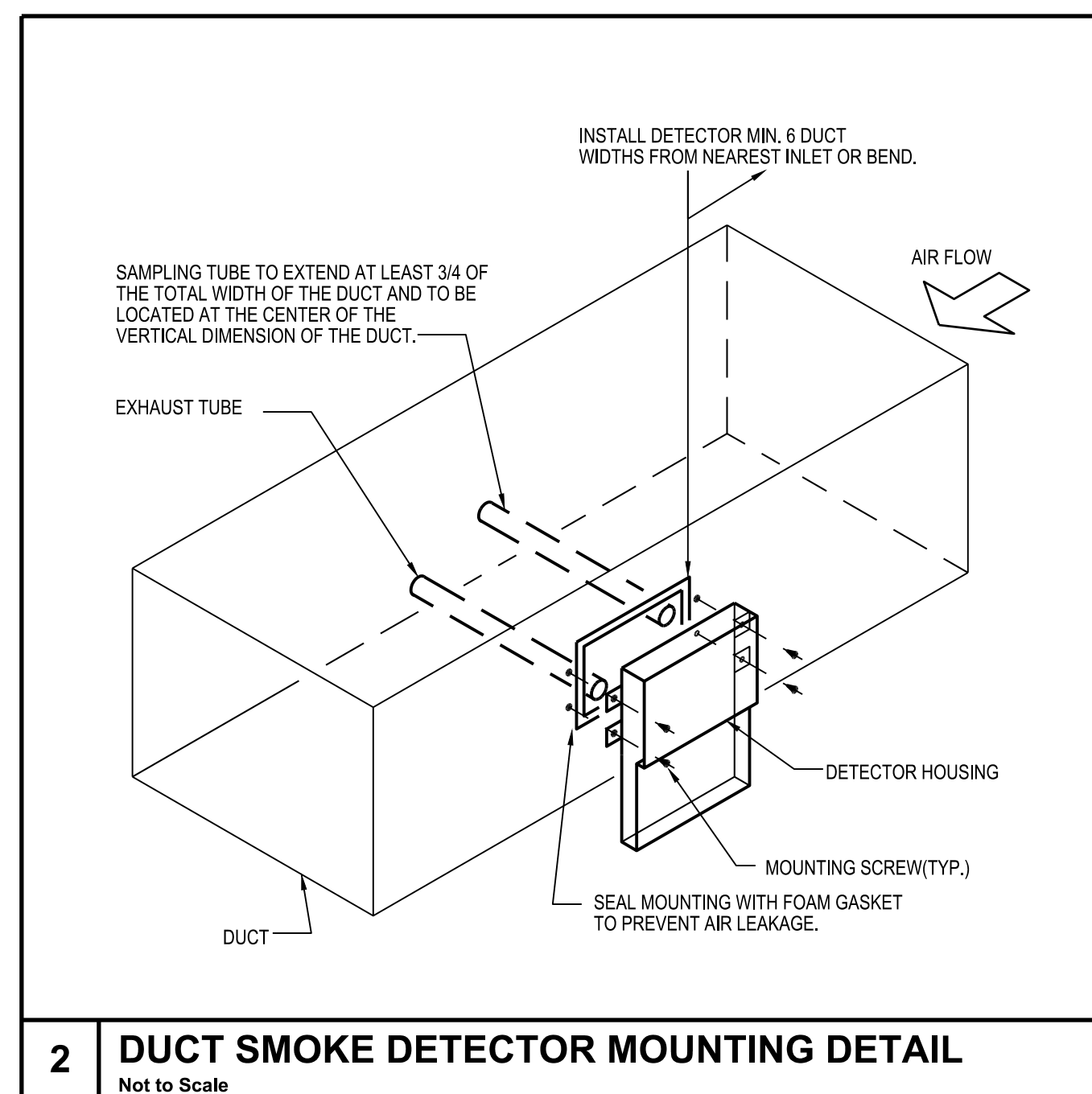
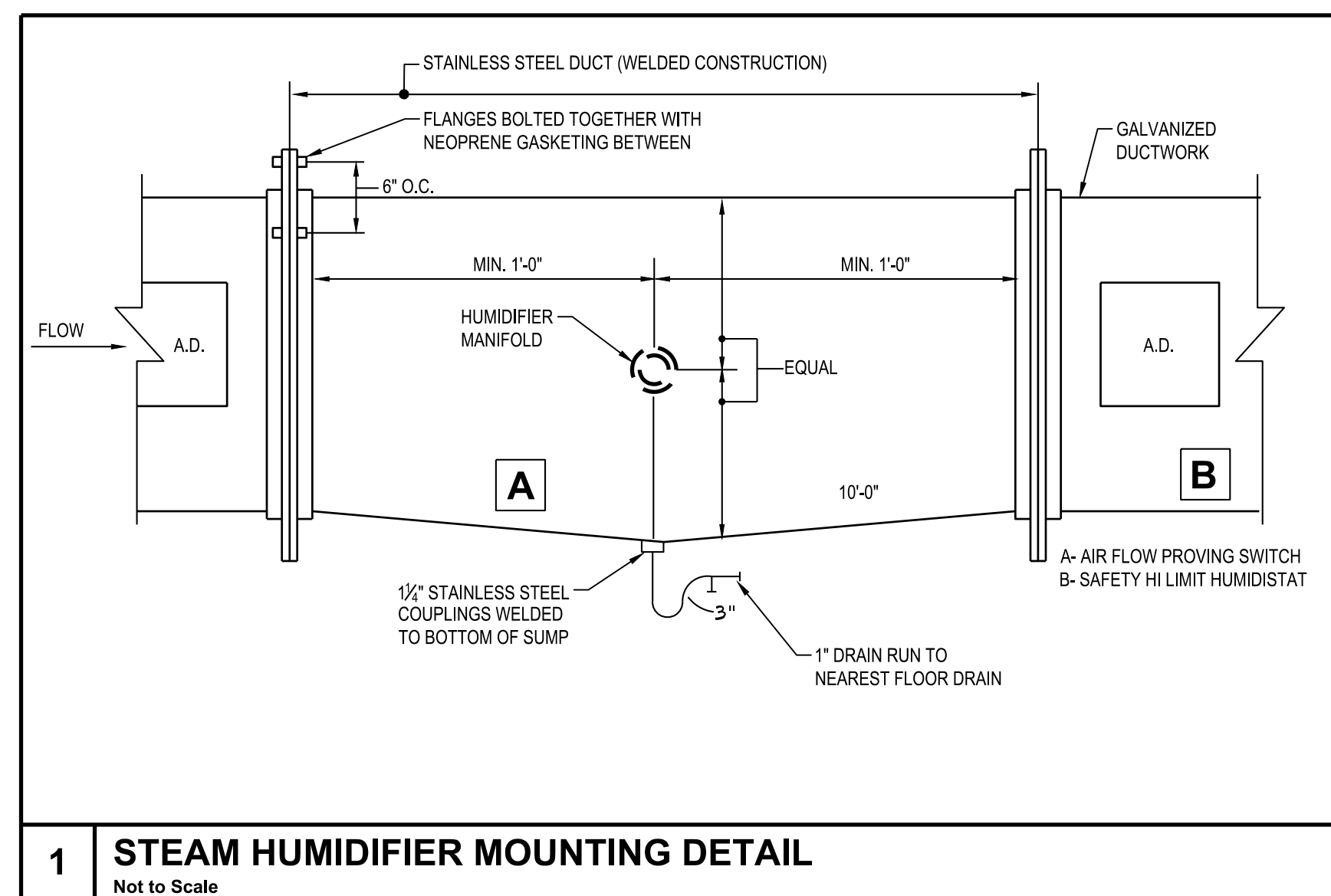
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NEW HVAC EQUIPMENT
282 7TH AVENUE NEW YORK, NY 10001

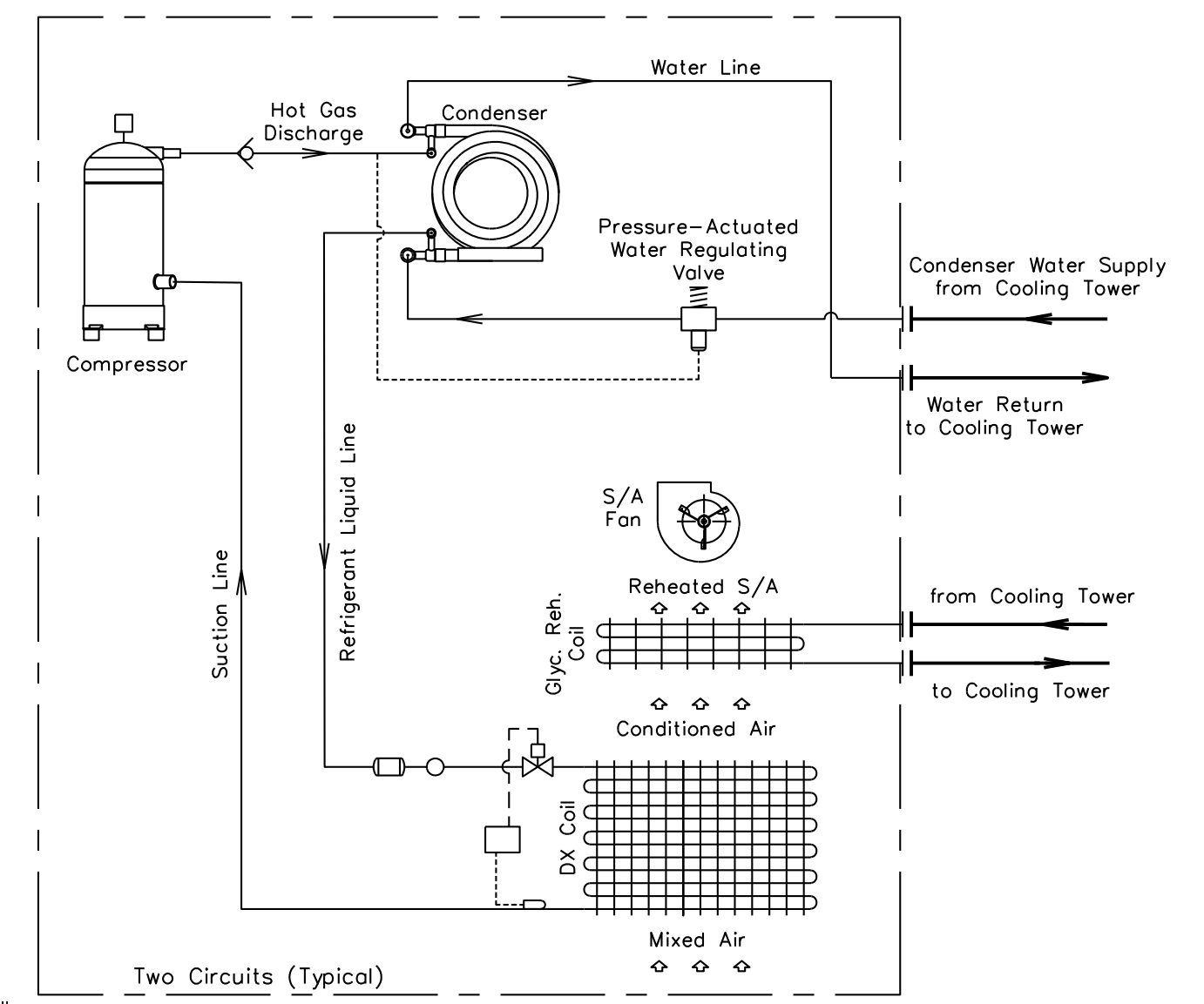
C1592
DRAWING TITLE:
MECHANICAL DETAILS 2

SEAL & SIGNATURE:	DATE: 12/20/2024
	PROJECT No: 896978
	DRAWING BY: ASB
	CHK BY: DN
	DWG No:
	M-502.00
	SCALE: N.T.S. 10 OF 19



- 1 S/A FAN
- 2 S/A OPENING
- 3 DX COOLING COIL
- 4 GLYCOL REHEAT COIL
- 5 COMPRESSOR
- 6 CONDENSER
- 7 12" MERV 14 FILTER FINAL RESISTANCE 1.2"
- 8 MERV 8 FILTER FINAL RESISTANCE 0.8"
- 9 POWER PANEL & ELECTRICAL CONTROL
- 10 RIA OPENING

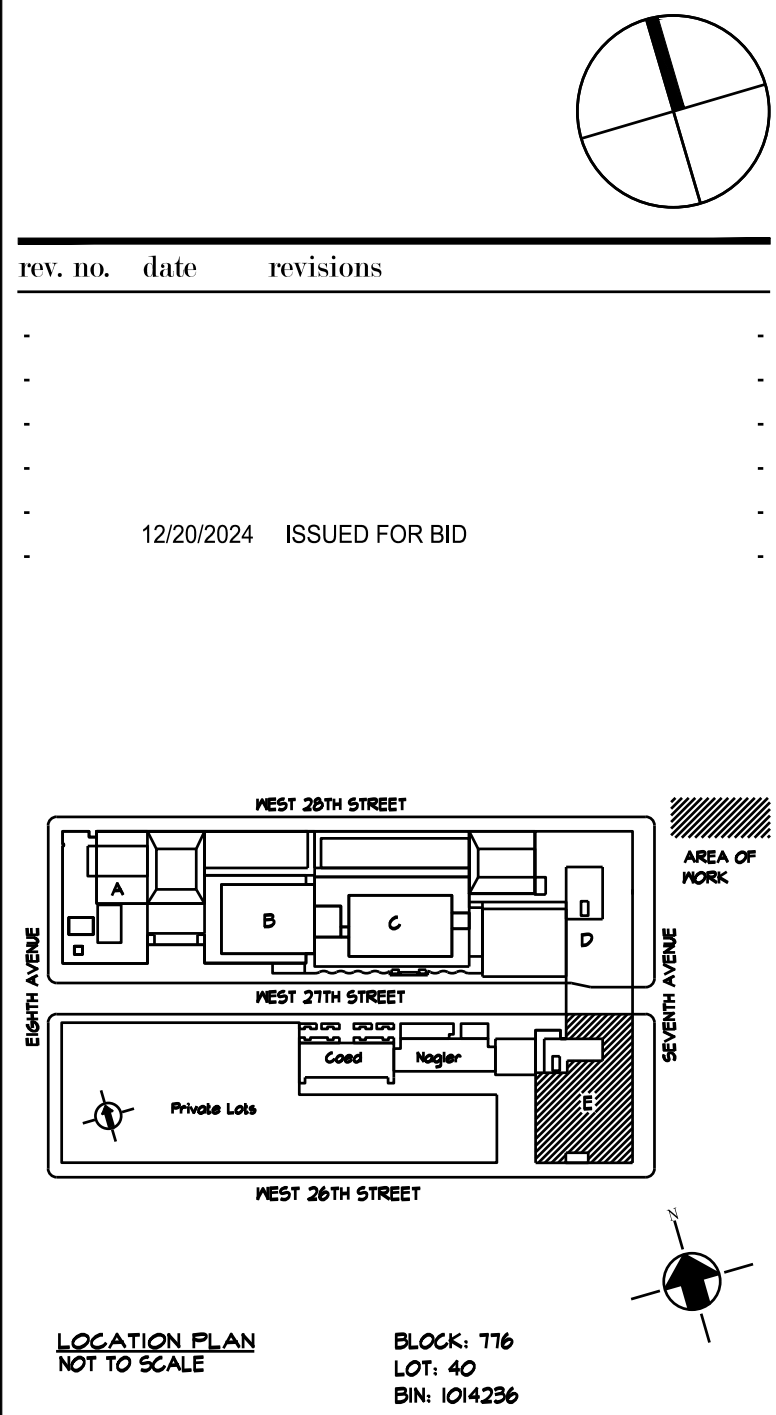
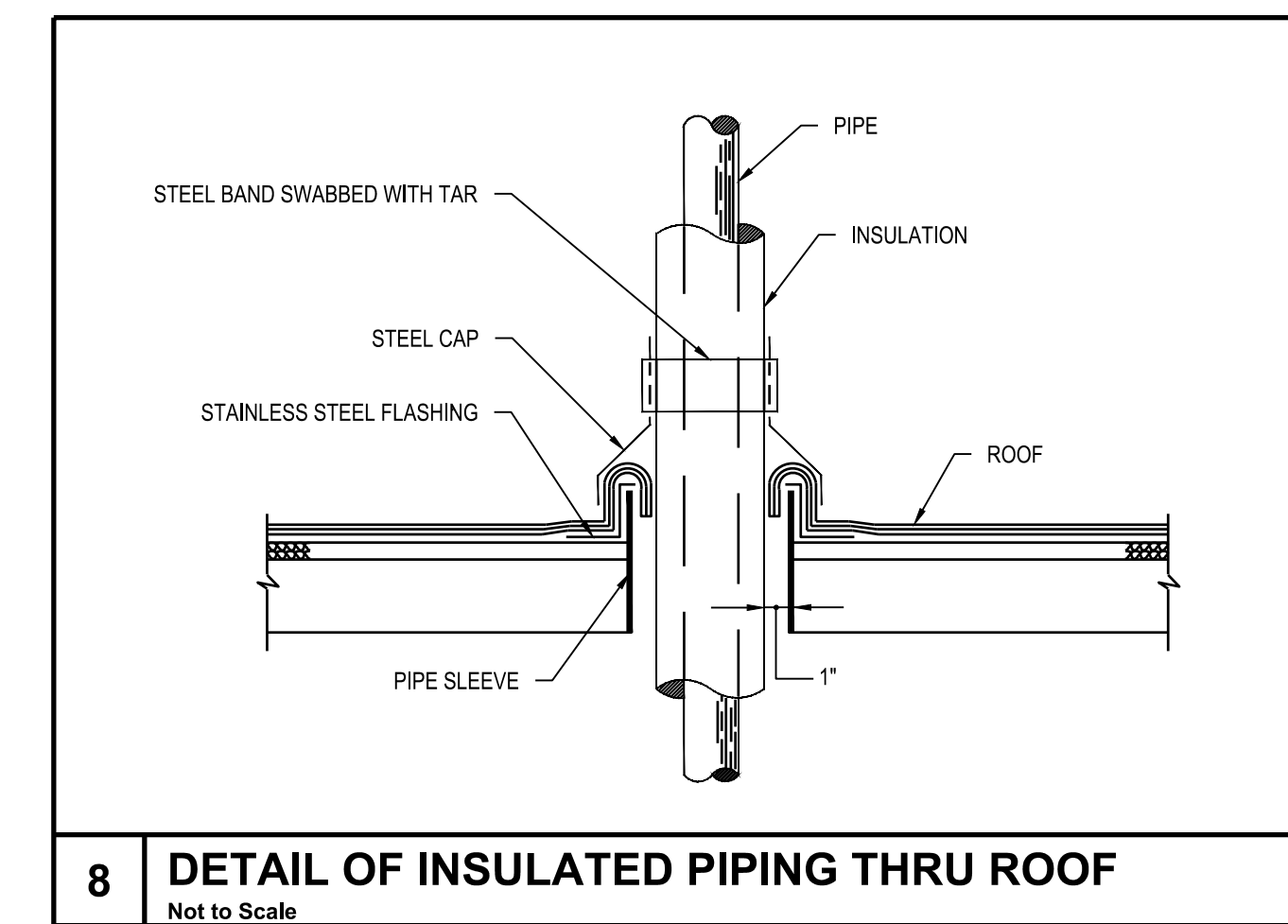
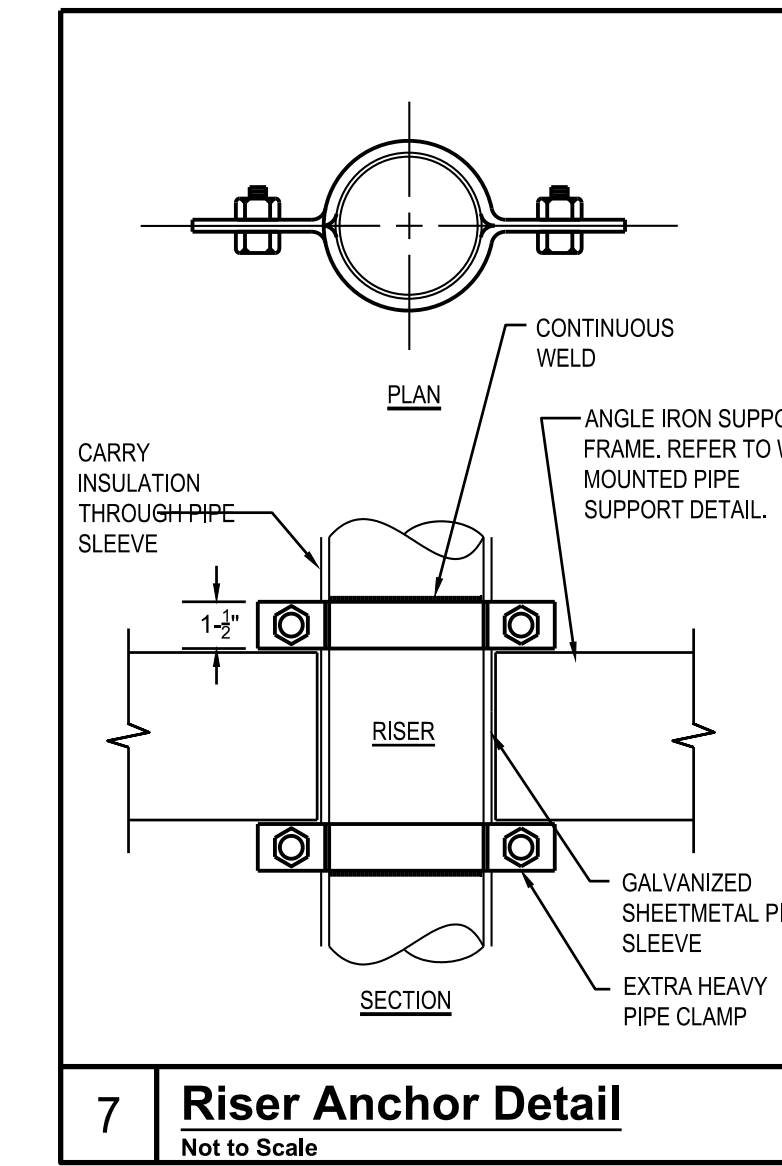
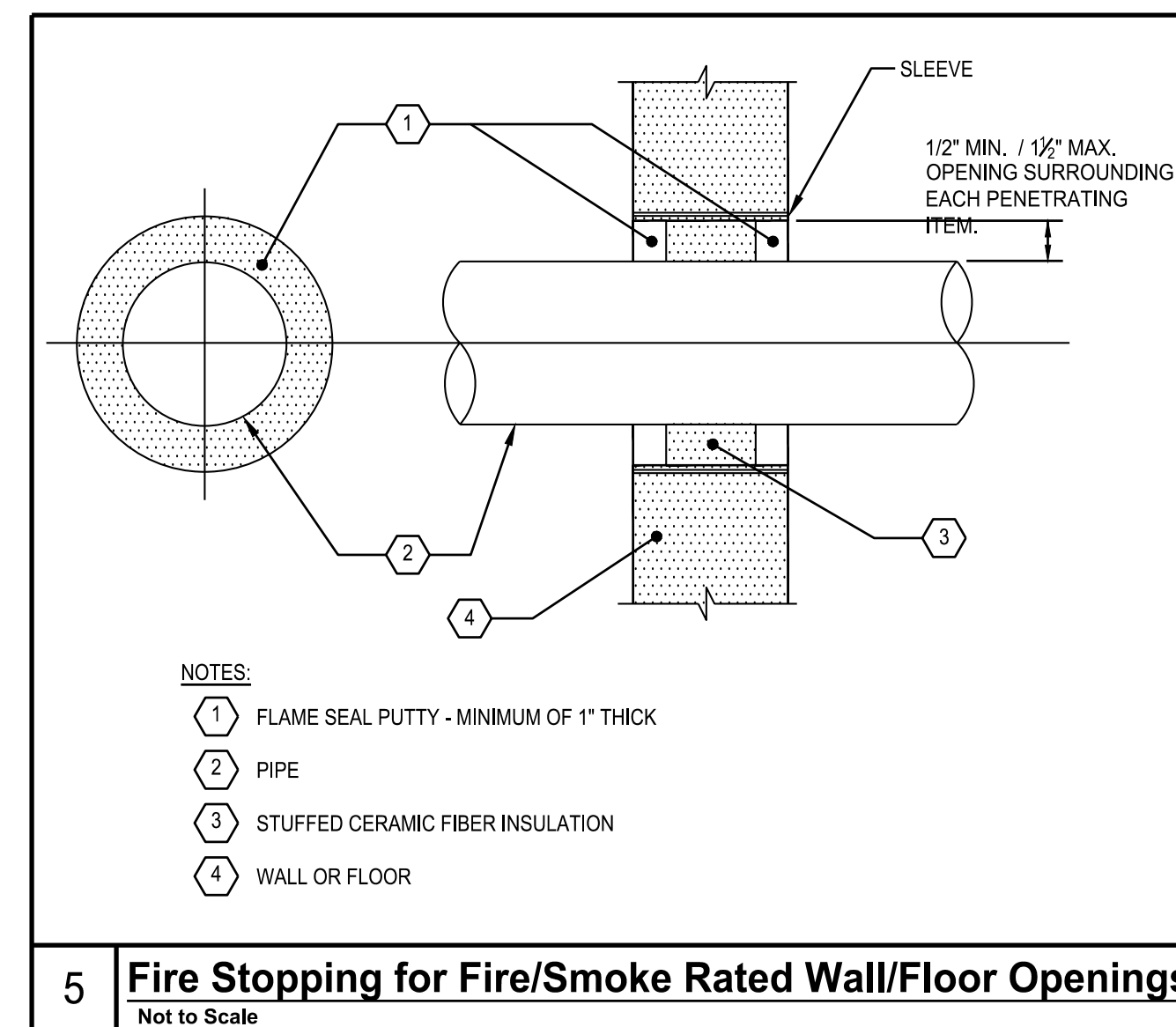
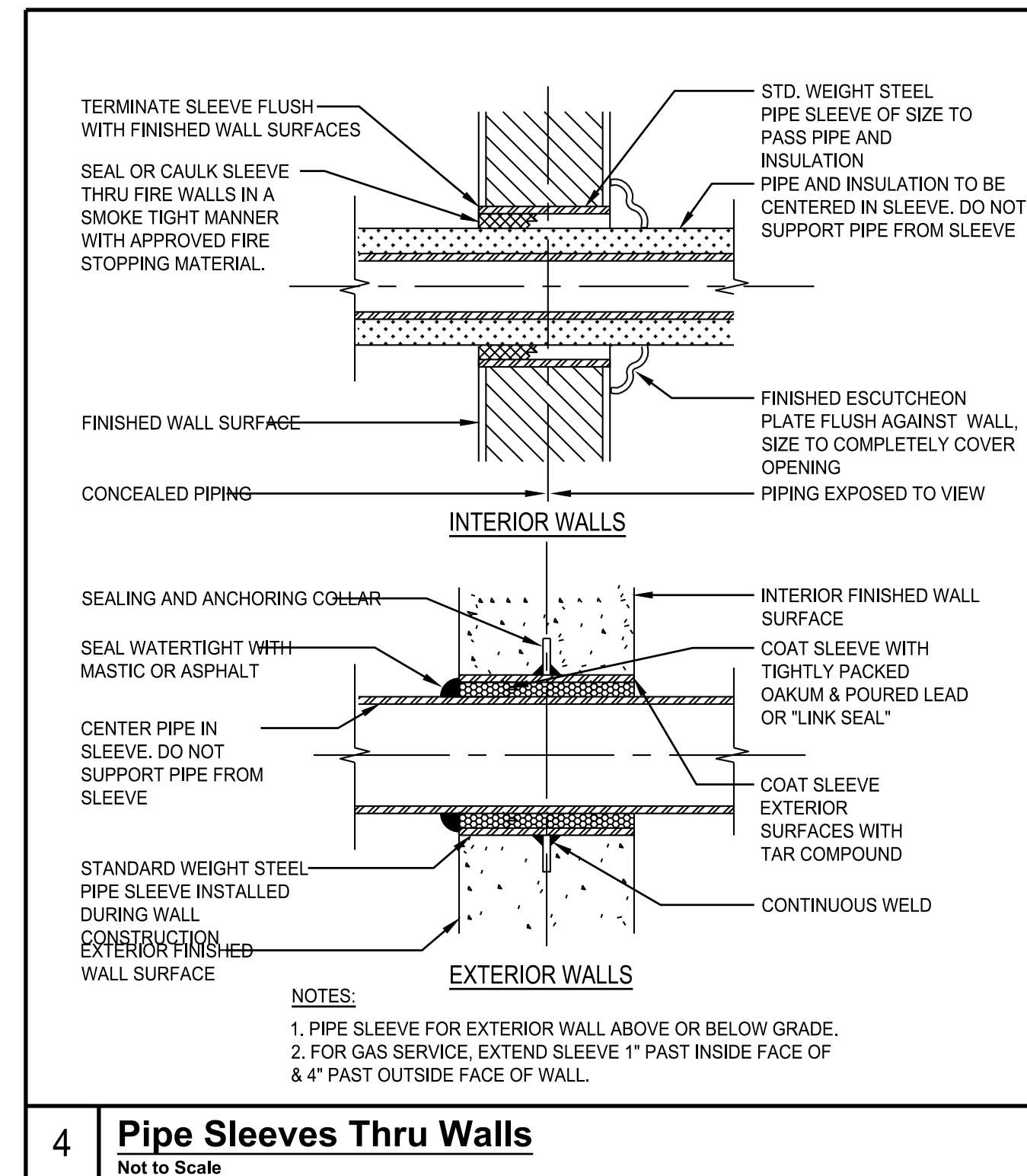
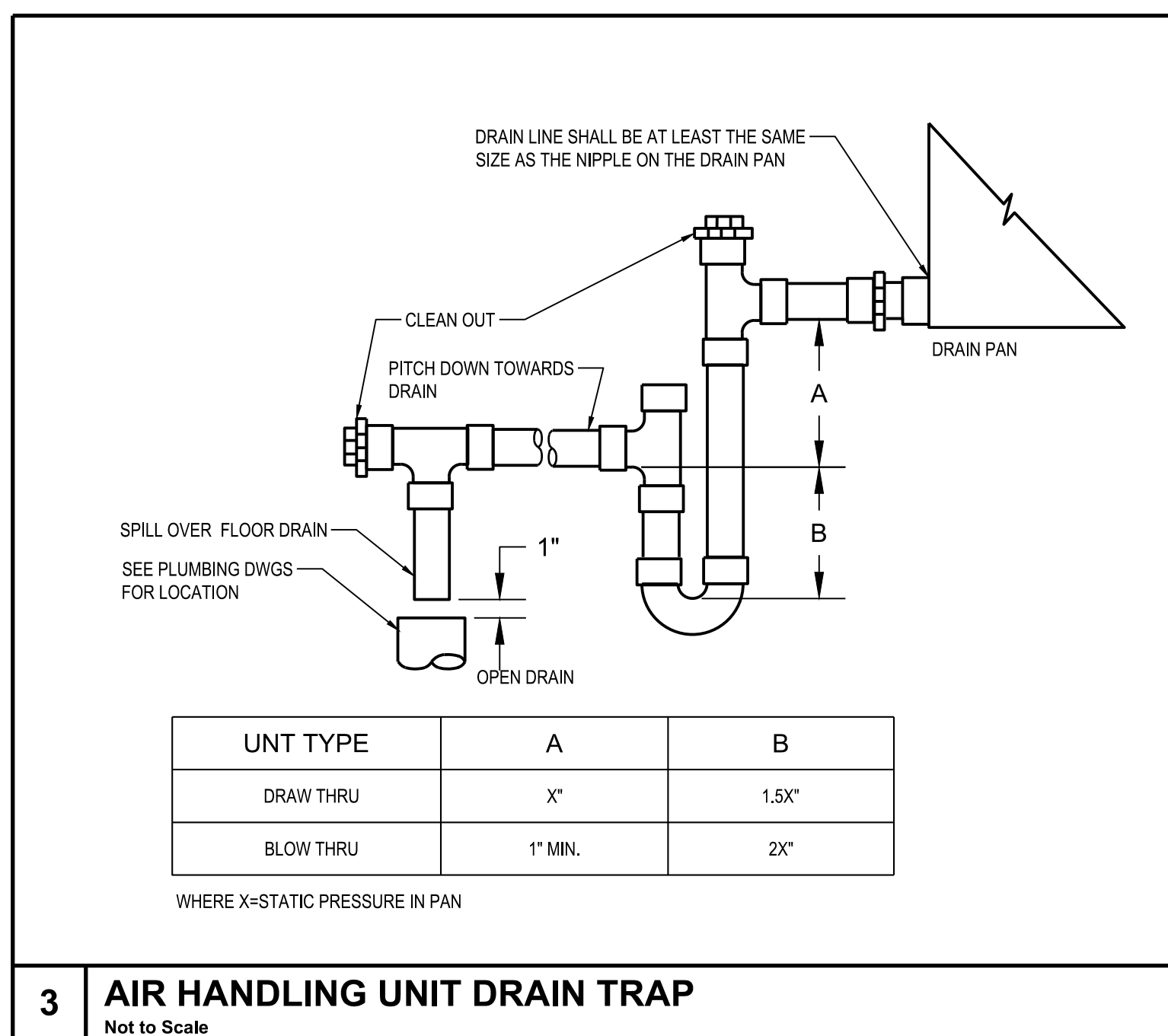
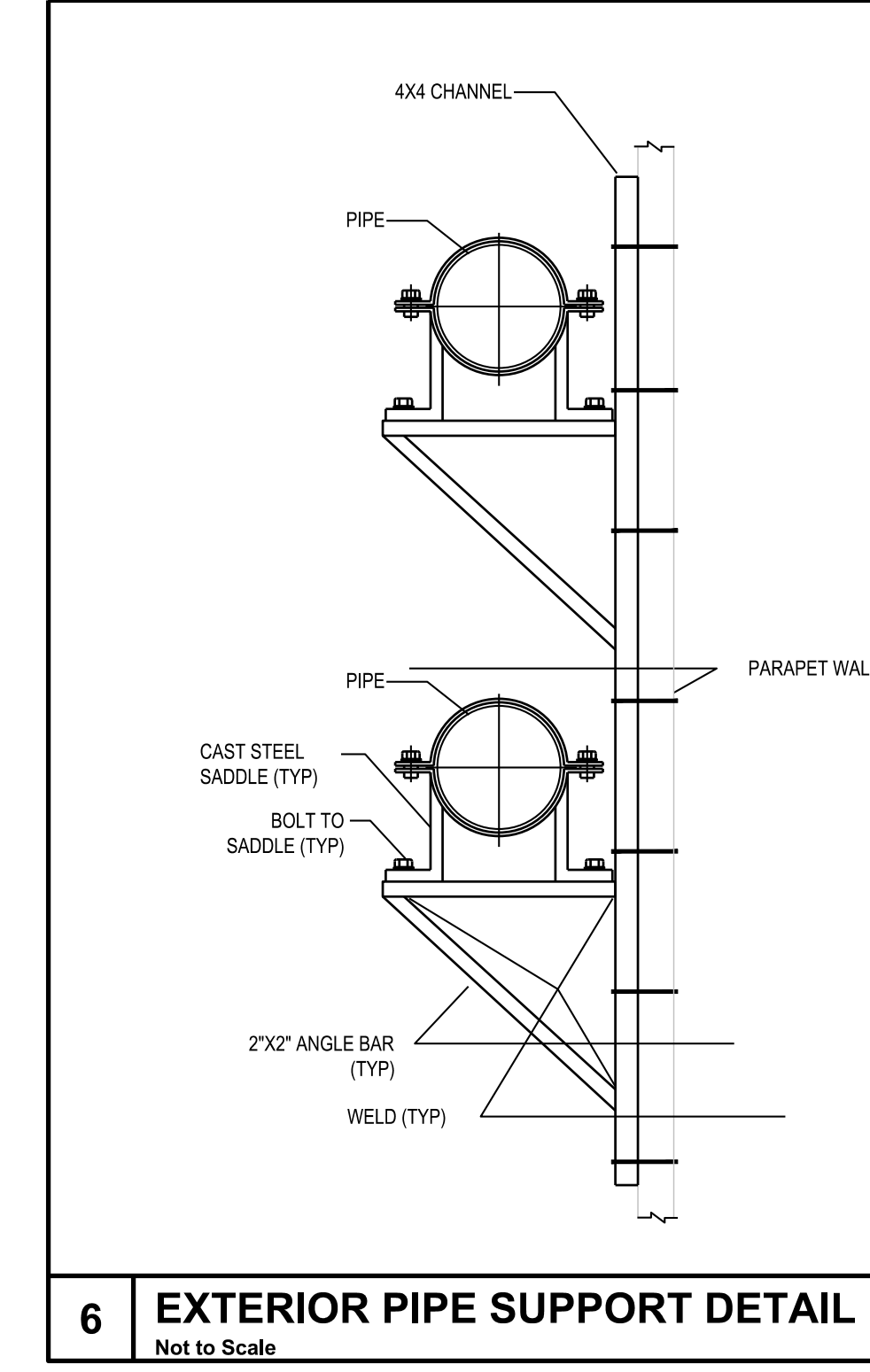
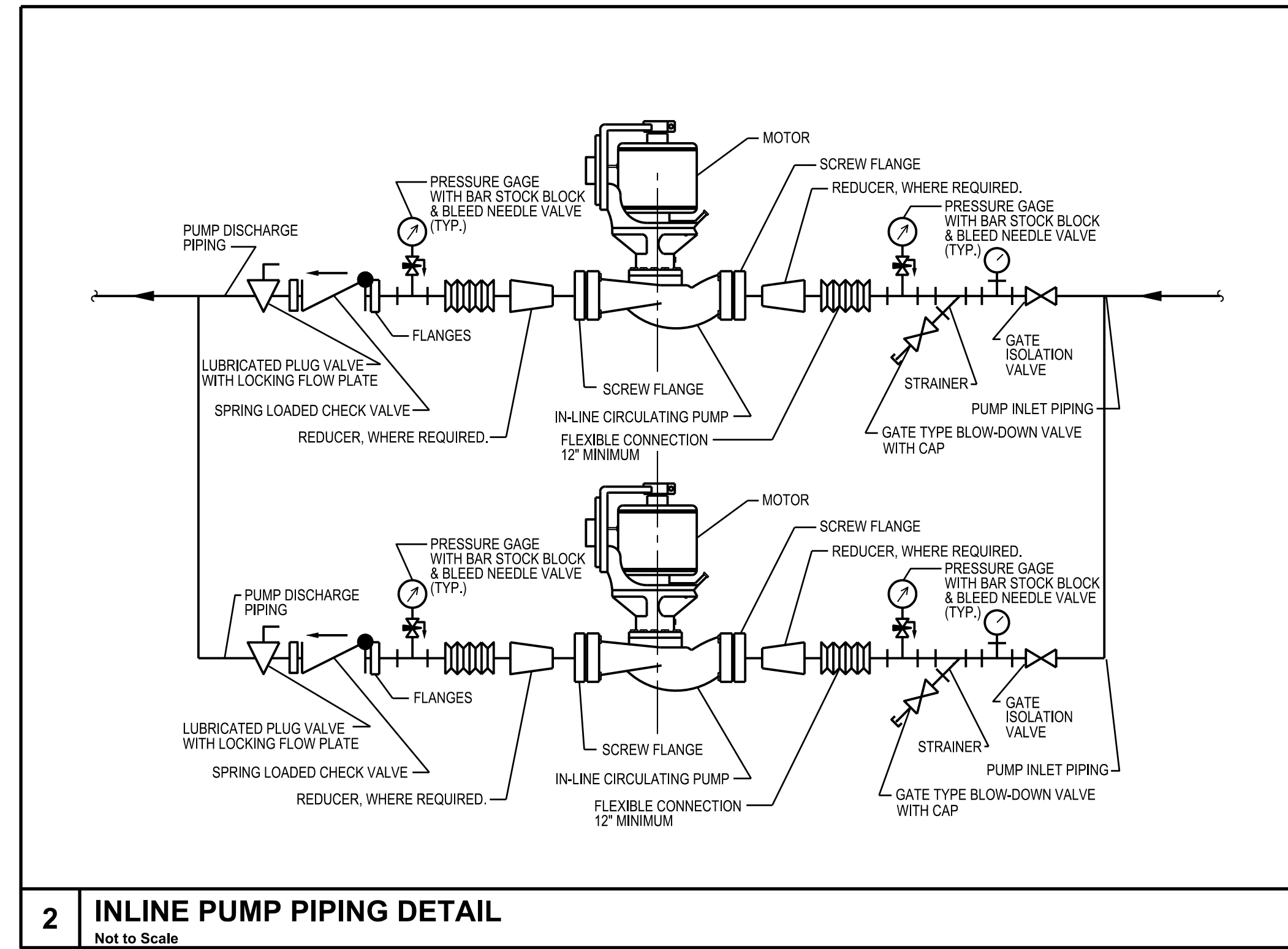
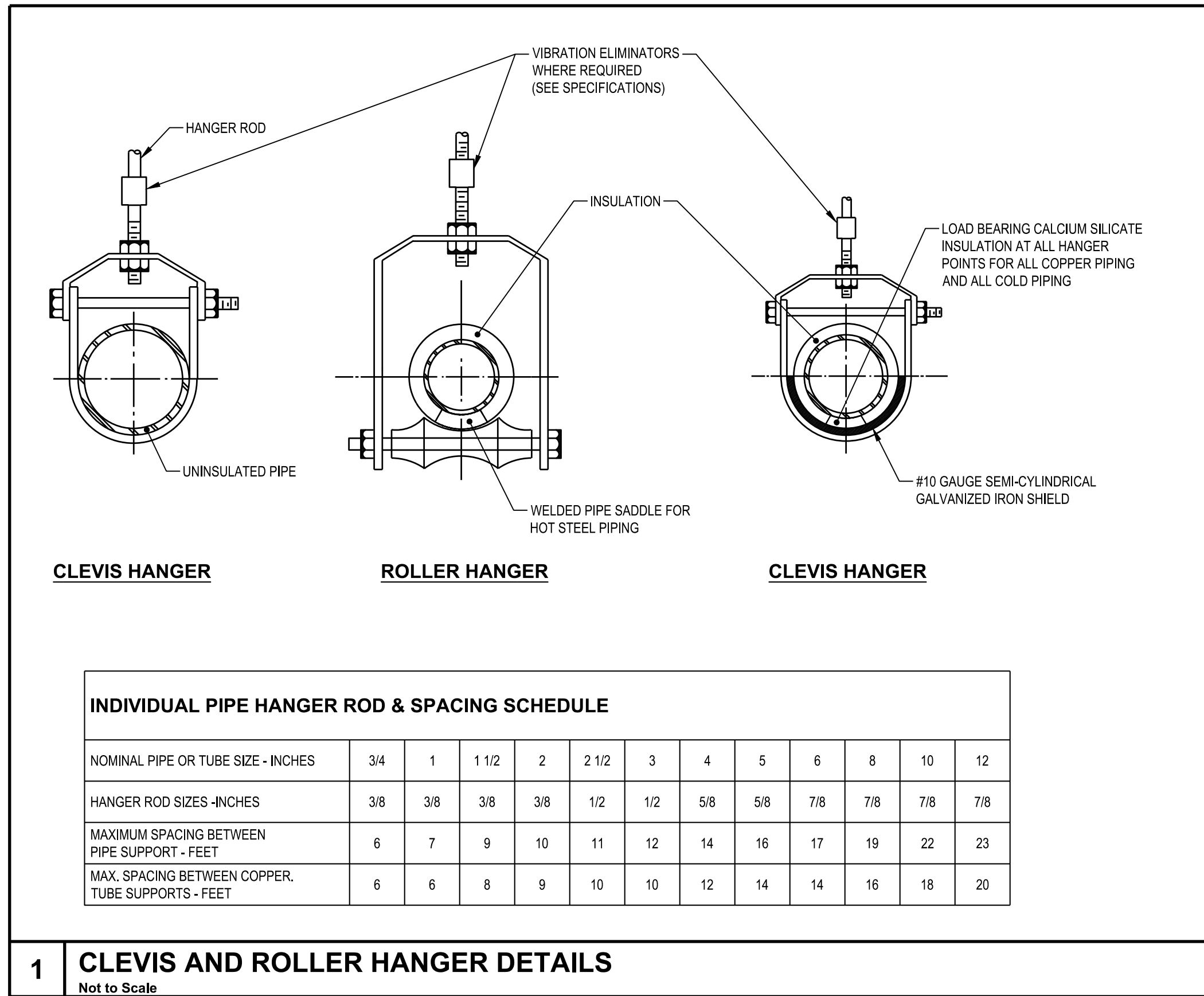
4 PIPE CONNECTIONS FOR EACH SET OF CONDENSER/GLYCOL REHEAT COIL



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Structural Consultants

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236 West 27th Street 1401
New York, NY 10001 / (212) 242-2955

PROJECT:
GOODMAN LOWER GALLERY
NEW HVAC EQUIPMENT
282 7TH AVENUE NEW YORK, NY 10001

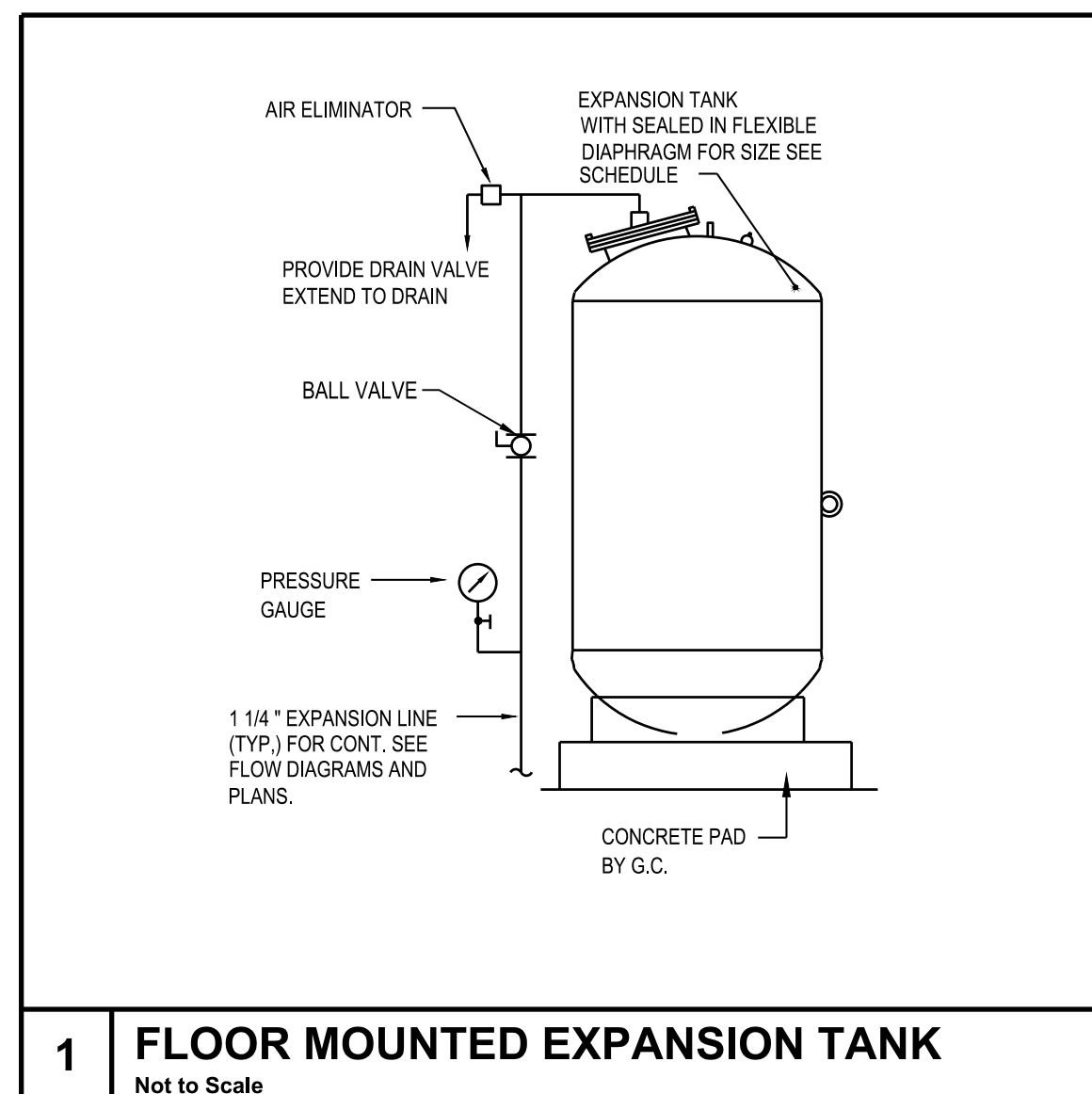
C1592
DRAWING TITLE:
MECHANICAL DETAILS 3

SEAL & SIGNATURE: _____ DATE: 12/20/2024
PROJECT No: 8969.78
DRAWING BY: ASB
CHK BY: DN
DWG No: M-503.00
SCALE: N.T.S. 11 OF 19

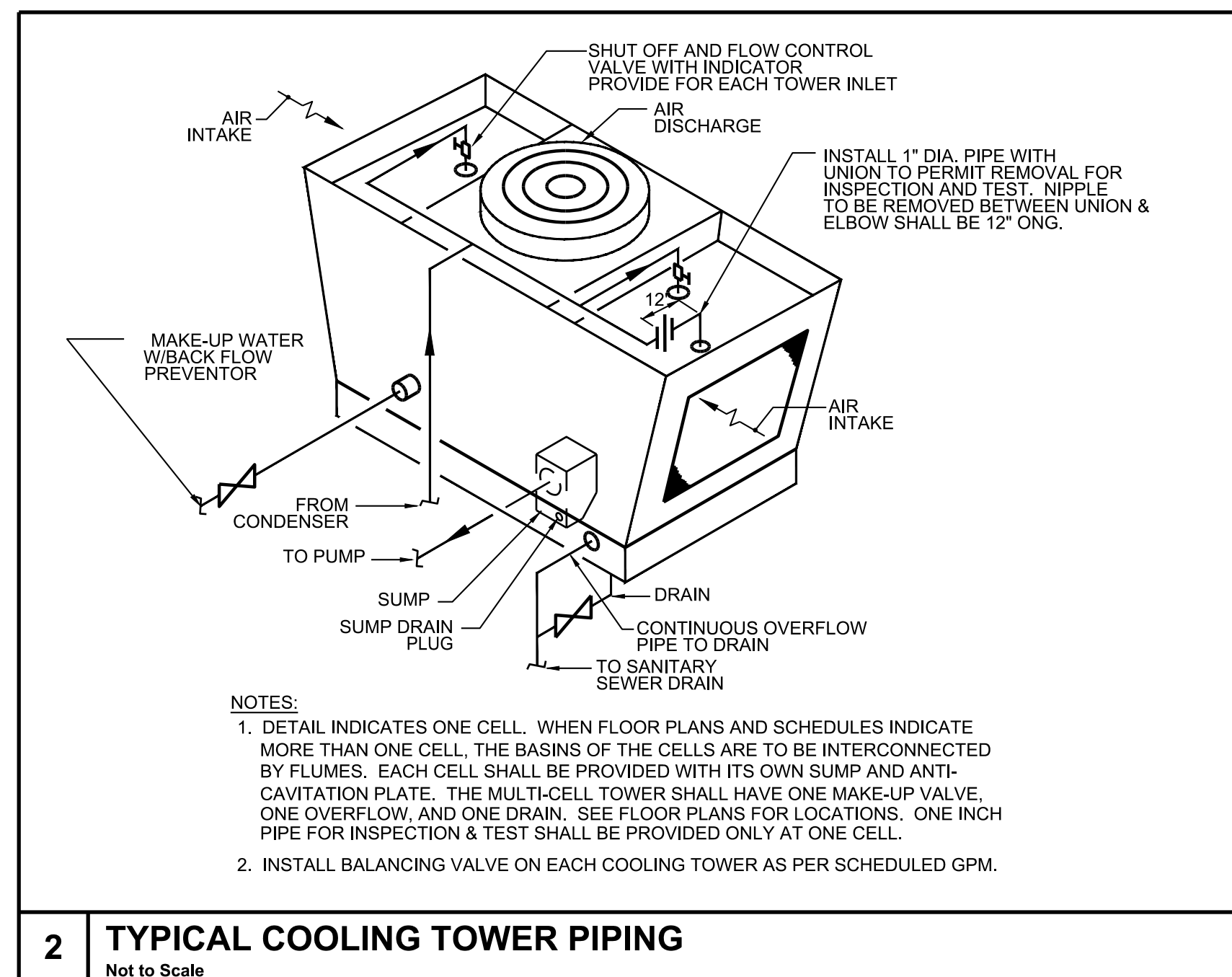
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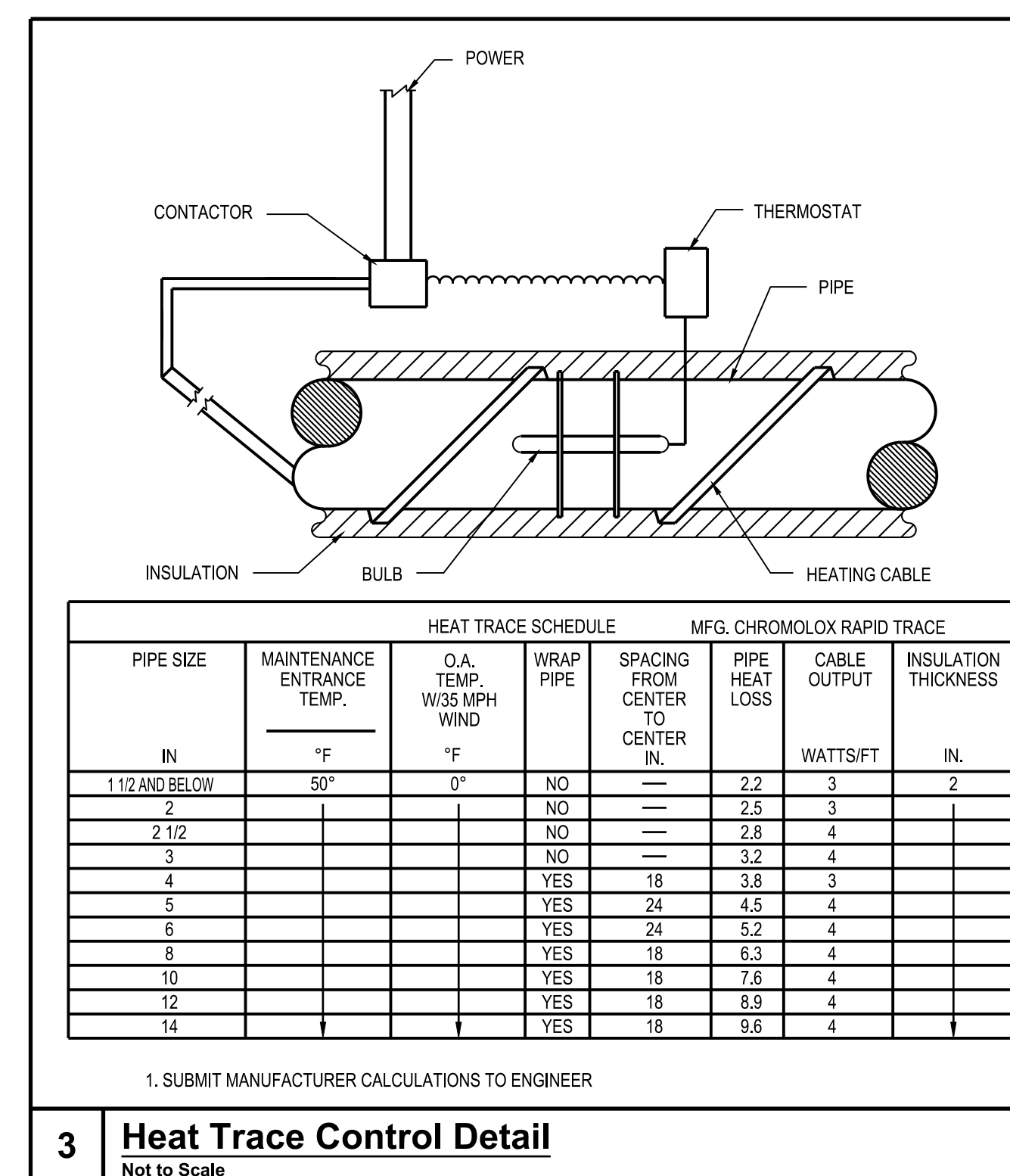




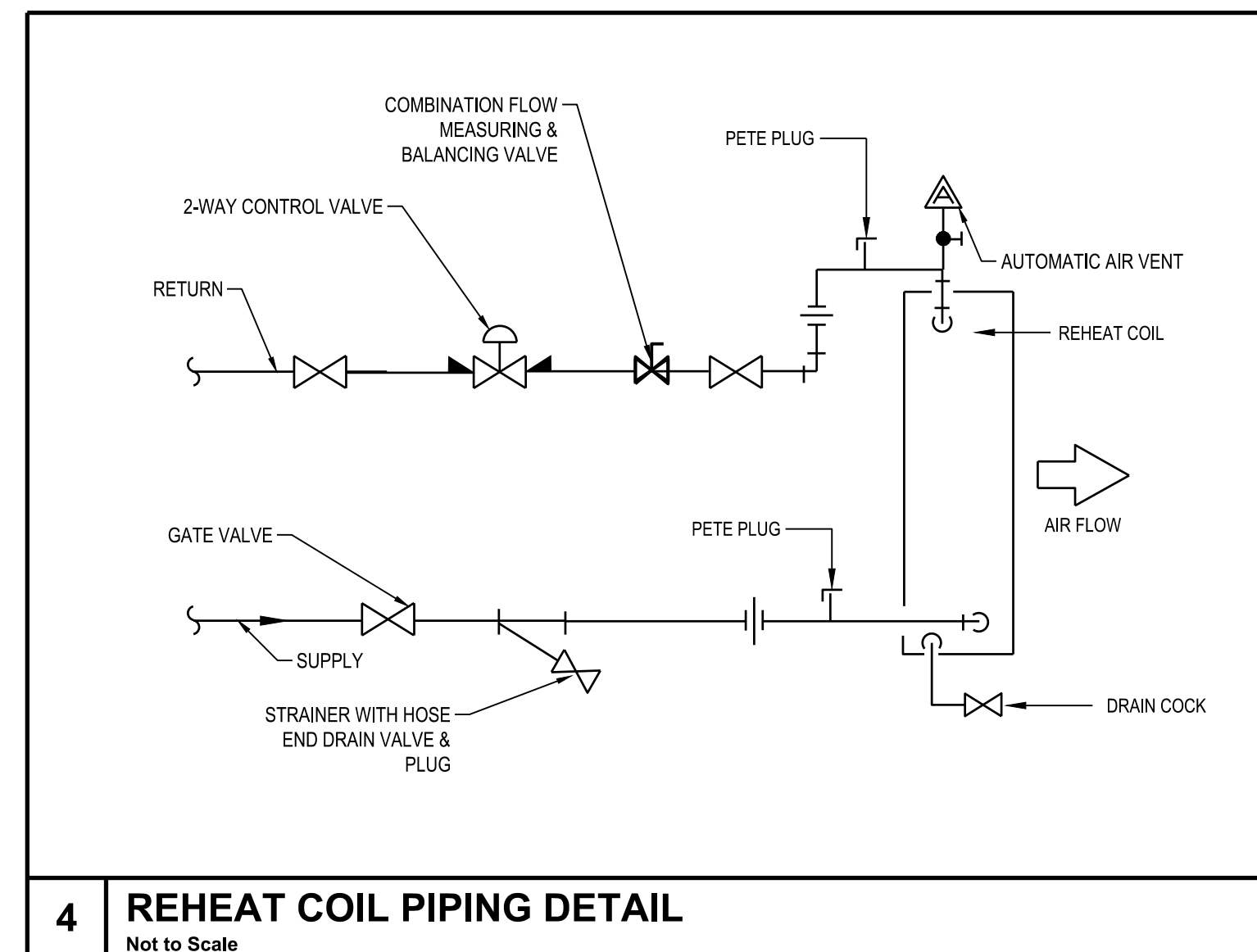
1 FLOOR MOUNTED EXPANSION TANK
Not to Scale



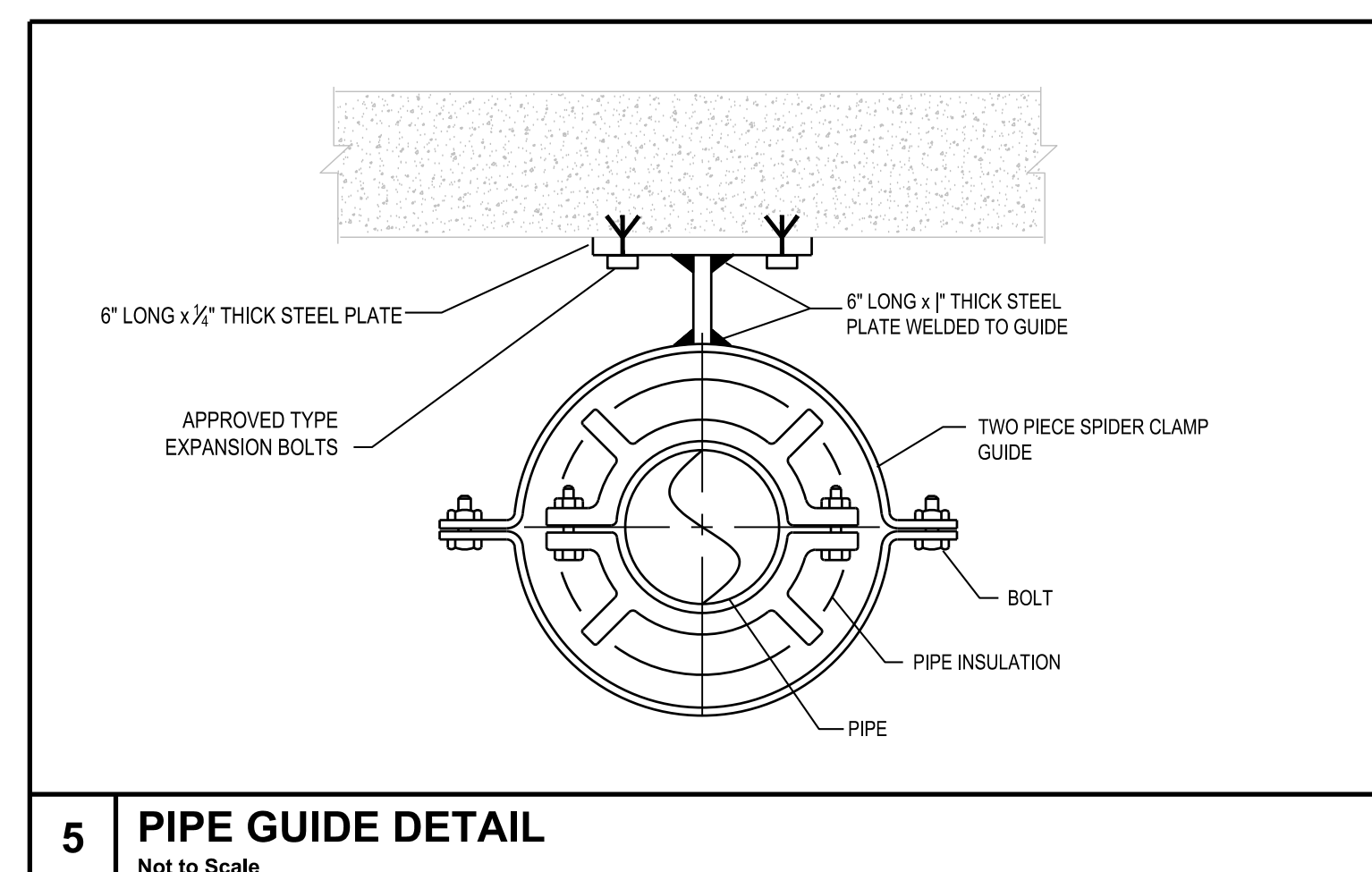
2 TYPICAL COOLING TOWER PIPING
Not to Scale



3 Heat Trace Control Detail
Not to Scale



4 REHEAT COIL PIPING DETAIL
Not to Scale



5 PIPE GUIDE DETAIL
Not to Scale

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LOCATION PLAN NOT TO SCALE

BLOCK: T16
LOT: 40
BIN: 1014236

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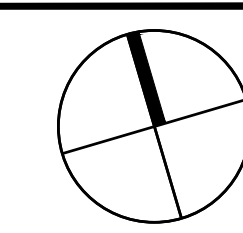
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New York, NY 10001 / (212) 242-2955

PROJECT:
GOODMAN LOWER GALLERY
NEW HVAC EQUIPMENT
282 7TH AVENUE NEW YORK, NY 10001

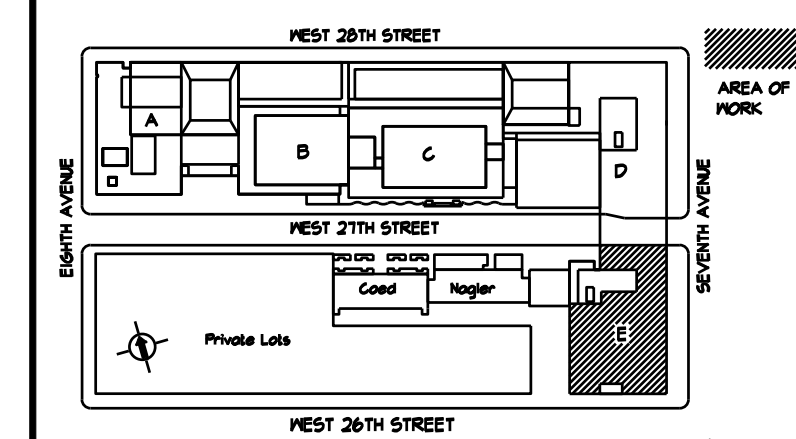
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MECHANICAL DETAILS 4

SEAL & SIGNATURE: _____ DATE: 12/20/2024
PROJECT No: 8969.78
DRAWING BY: ASB
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DWG No: M-504.00
SCALE: N.T.S. 12 OF 19



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LOCATION PLAN NOT TO SCALE BLOCK: T16 LOT: 40 BIN: 1014236

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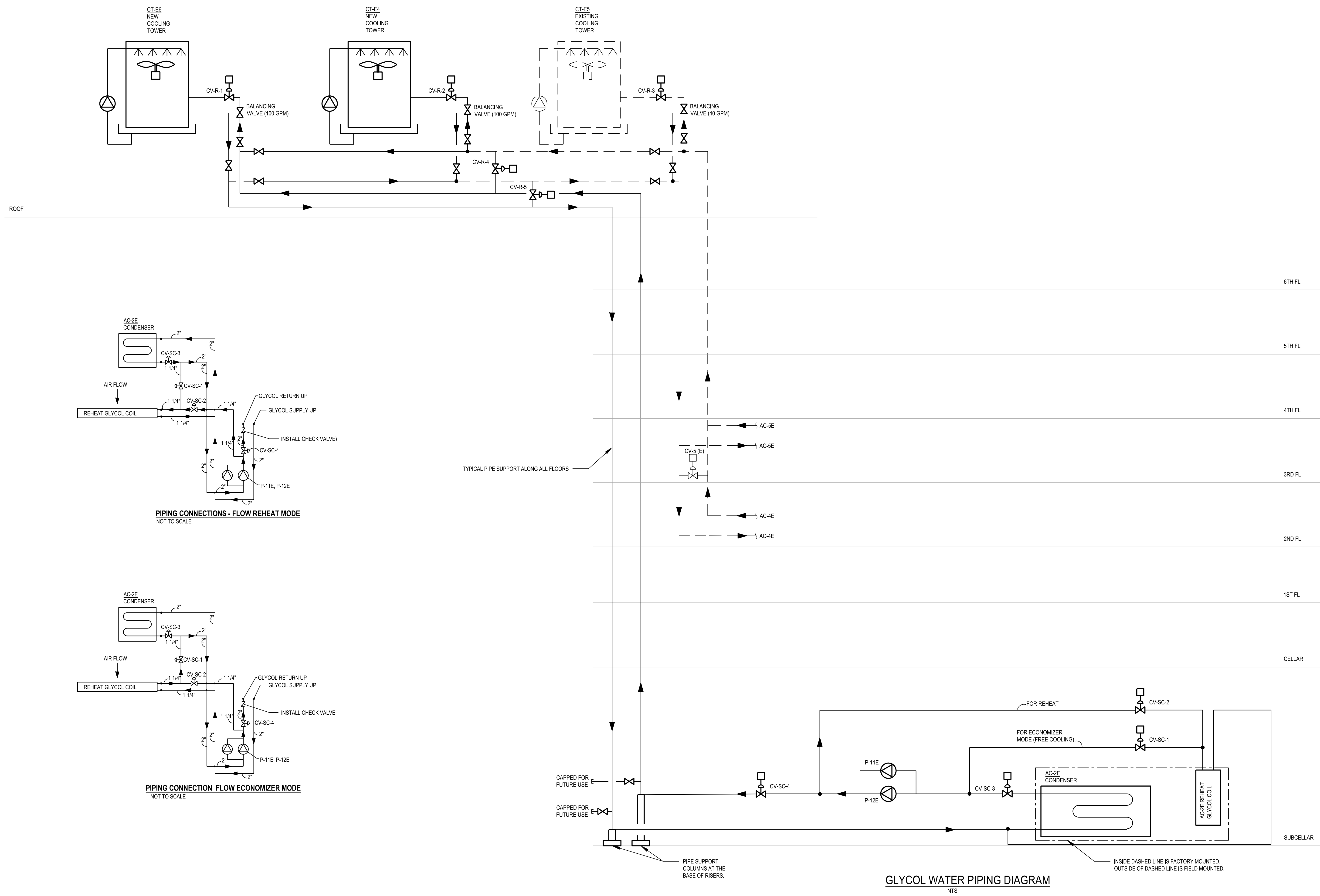
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PROJECT:
GOODMAN LOWER GALLERY
NEW HVAC EQUIPMENT
282 7TH AVENUE NEW YORK, NY 10001

C1592
DRAWING TITLE:
GLYCOL WATER
PIPING DIAGRAMS

SEAL & SIGNATURE: DATE: 12/20/2024
PROJECT No: 8969.78
DRAWING BY: MC
CHK BY: DN
DWG No:
M-601.00
SCALE: N.T.S. 13 OF 19

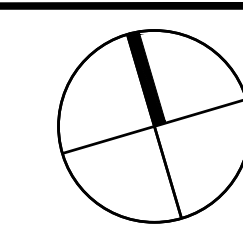


GLYCOL WATER PIPING DIAGRAM
NTS

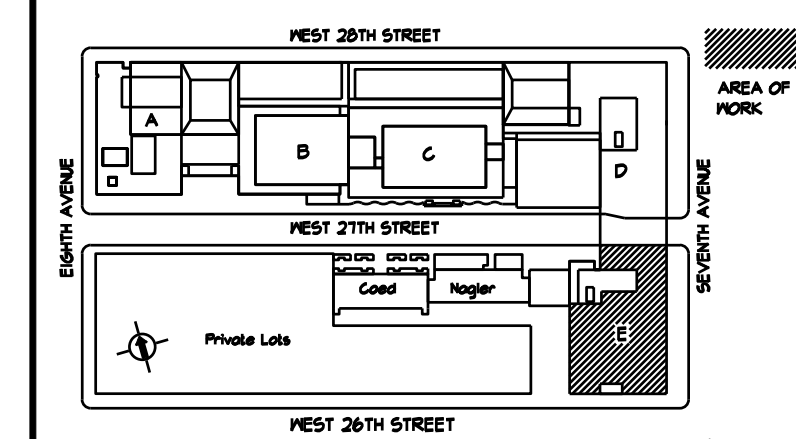
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LOCATION PLAN
NOT TO SCALE

BLOCK: T16
LOT: 40
BIN: 1014236

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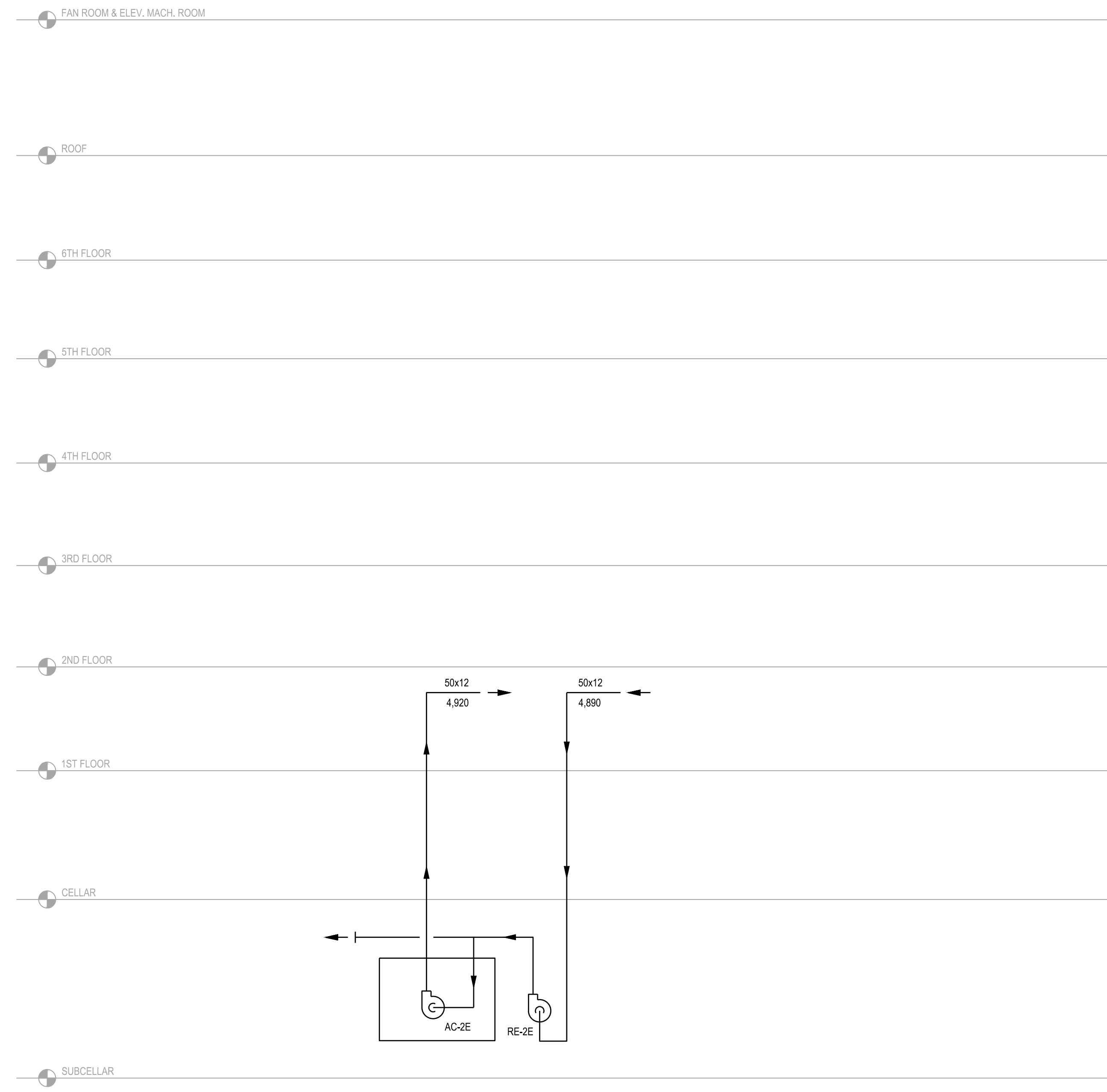
MGE Engineering D.P.C. / we engineer success
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AIR FLOW RISER DIAGRAM

PROJECT:
GOODMAN LOWER GALLERY
NEW HVAC EQUIPMENT
282 7TH AVENUE NEW YORK, NY 10001

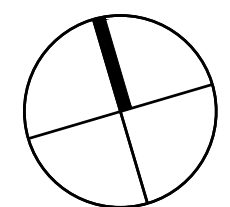
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DRAWING TITLE:
AIR FLOW RISER DIAGRAM

SEAL & SIGNATURE:	DATE: 12/20/2024
	PROJECT No: 896978
	DRAWING BY: ASB
	CHK BY: DN
	DWG No:
	M-602.00
SCALE: N.T.S.	14 OF 19

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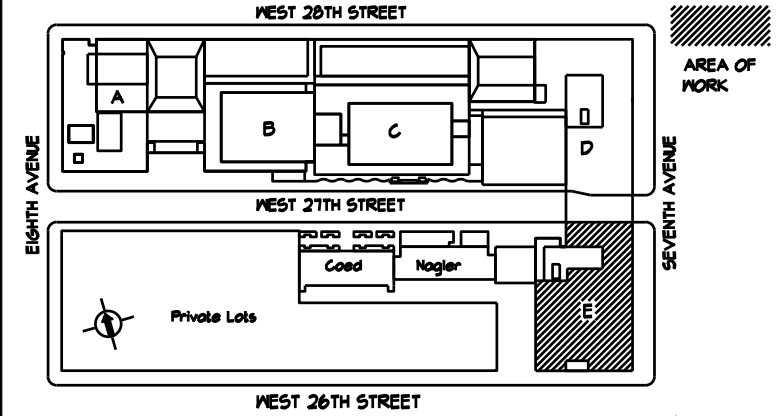
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12/20/2024 ISSUED FOR BID



LOCATION PLAN
NOT TO SCALE

BLOCK: T76
LOT: 40
BIN: 1014236

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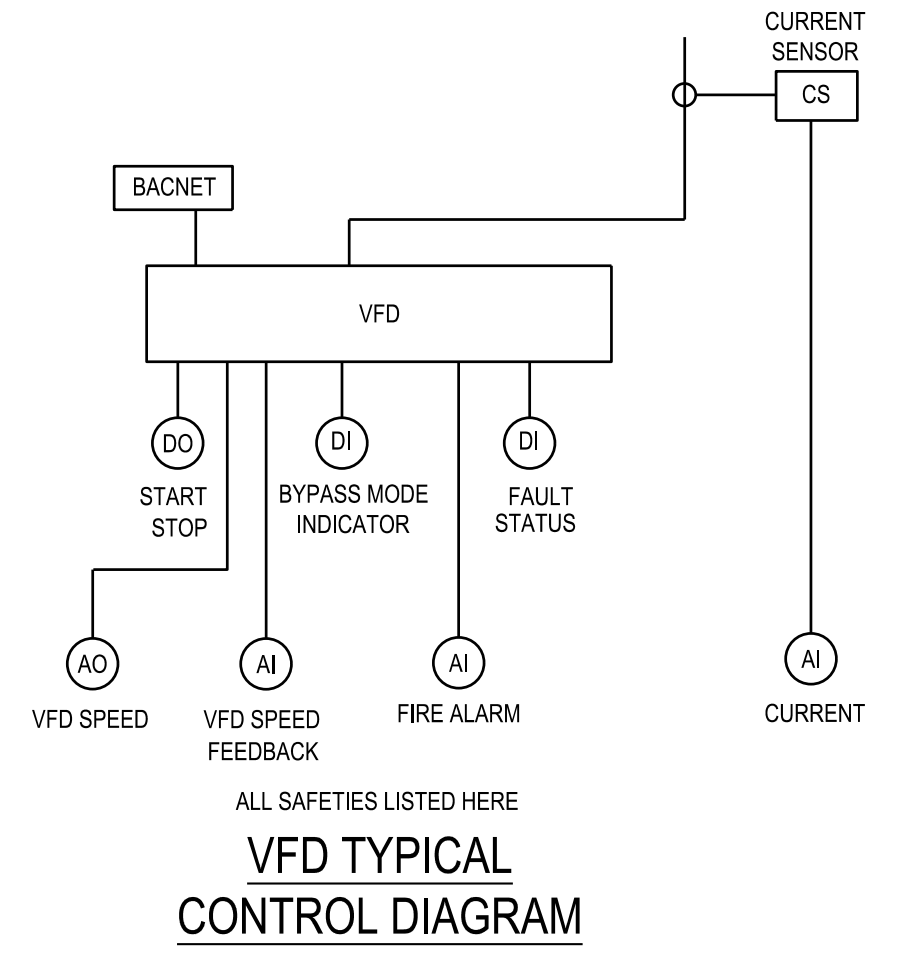
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PROJECT:
GOODMAN LOWER GALLERY
NEW HVAC EQUIPMENT
282 7TH AVENUE NEW YORK, NY 10001

C1592
DRAWING TITLE:
MECHANICAL CONTROL
DIAGRAMS

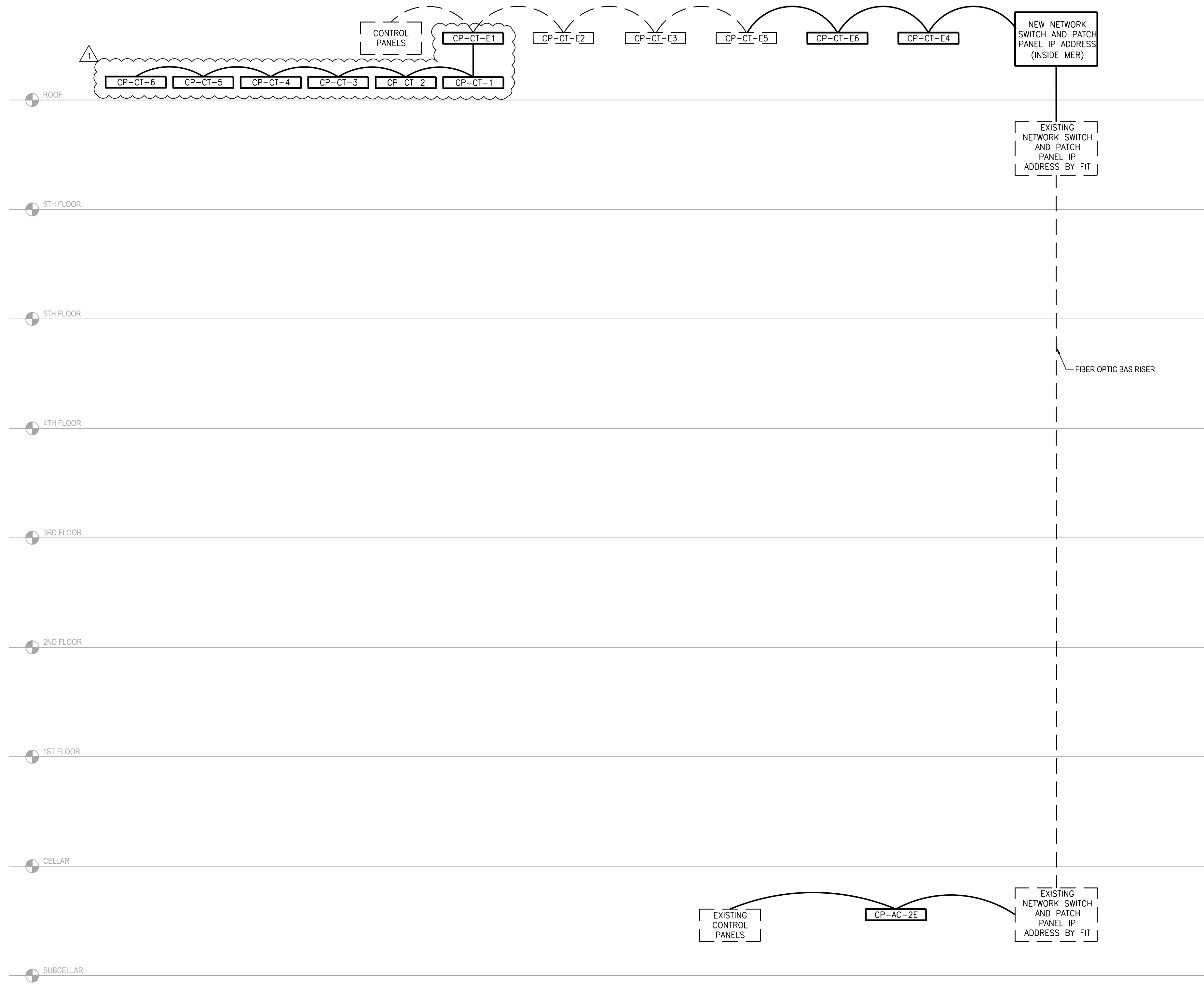
SEAL & SIGNATURE:	DATE: 12/20/2024
	PROJECT No: 896978
	DRAWING BY: MC
	CHK BY: DN
	DWG No:
	M-801.00
SCALE: N.T.S.	16 OF 19



- ALL SAFETIES LISTED HERE
- VFD TYPICAL CONTROL DIAGRAM**
- VFD MINIMUM REQUIREMENT FOR BMS VARIABLES.
1. PROVIDE THE FOLLOWING VARIABLES FROM THE VFD TO THE BACNET NETWORK:
- 1.1. PHASE VOLTAGE
 - 1.2. PHASE AMPS
 - 1.3. OUTPUT FREQUENCY
 - 1.4. INPUT POWER KVA
 - 1.5. OUTPUT POWER KVA
 - 1.6. BYPASS STATUS
 - 1.7. ALARM STATUS
 - 1.8. ALARM CODE
 - 1.9. INPUT VOLTAGE
 - 1.10. OUTPUT VOLTAGE

LEGEND

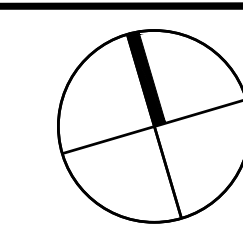
NC	NORMALLY CLOSED
NO	NORMALLY OPEN
CC	COOLING COIL
TT	TEMPERATURE TRANSMITTER
ES	END SWITCH
SD	SMOKE DETECTOR
H	HUMIDITY TRANSMITTER
CHWS/R	CHILLED WATER SUPPLY/RETURN
CV	CONTROL VALVE
AI	ANALOG INPUT
AO	ANALOG OUTPUT
DI	DIGITAL INPUT
DO	DIGITAL OUTPUT
AFM	AIR FLOW MEASURING STATION
PD	PRESSURE DIFFERENTIAL SENSOR
SP	STATIC PRESSURE SENSOR
VFD	VARIABLE FREQUENCY DRIVE
SS	START / STOP
VP	VELOCITY PRESSURE
CS	CURRENT SENSOR
DPS	DUAL PRESSURE SWITCH
MD	MOTORIZED DAMPER
CP	CONTROLLER/ CONTROL PANEL



BAS ARCHITECTURE

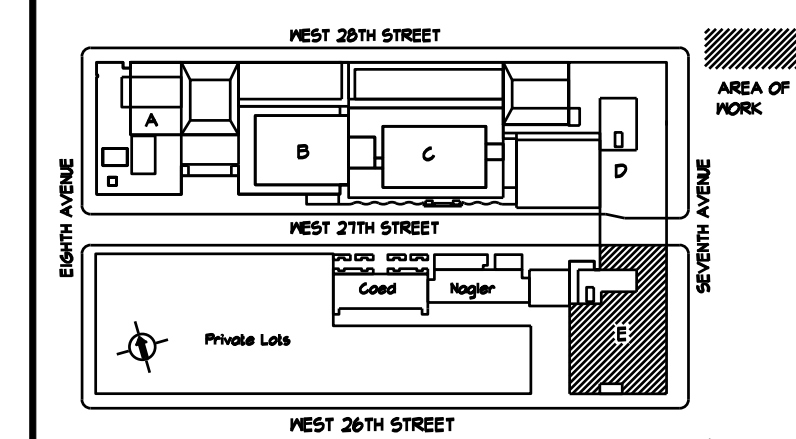
<p>NEW YORK CITY BUILDING DEPARTMENT APPROVAL NOTE</p> <p>THIS PLAN IS APPROVED ONLY FOR WORK INDICATED ON THE APPLICATION SPECIFICATION SHEET. ALL OTHER MATTERS SHOWN ARE NOT TO BE RELIED UPON, OR TO BE CONSIDERED AS EITHER BEING APPROVED OR IN ACCORDANCE WITH APPLICABLE CODES.</p>	<p>NEW YORK CITY ENERGY CONSERVATION CODE</p> <p>TO THE BEST OF MY KNOWLEDGE, BELIEF AND PROFESSIONAL JUDGMENT, THESE PLANS AND SPECIFICATIONS ARE IN COMPLIANCE WITH THE 2020 NEW YORK CITY ENERGY CONSERVATION CODE.</p>
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MGE Engineering D.P.C. / we engineer success
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P 212.643.9055 www.mgepc.com

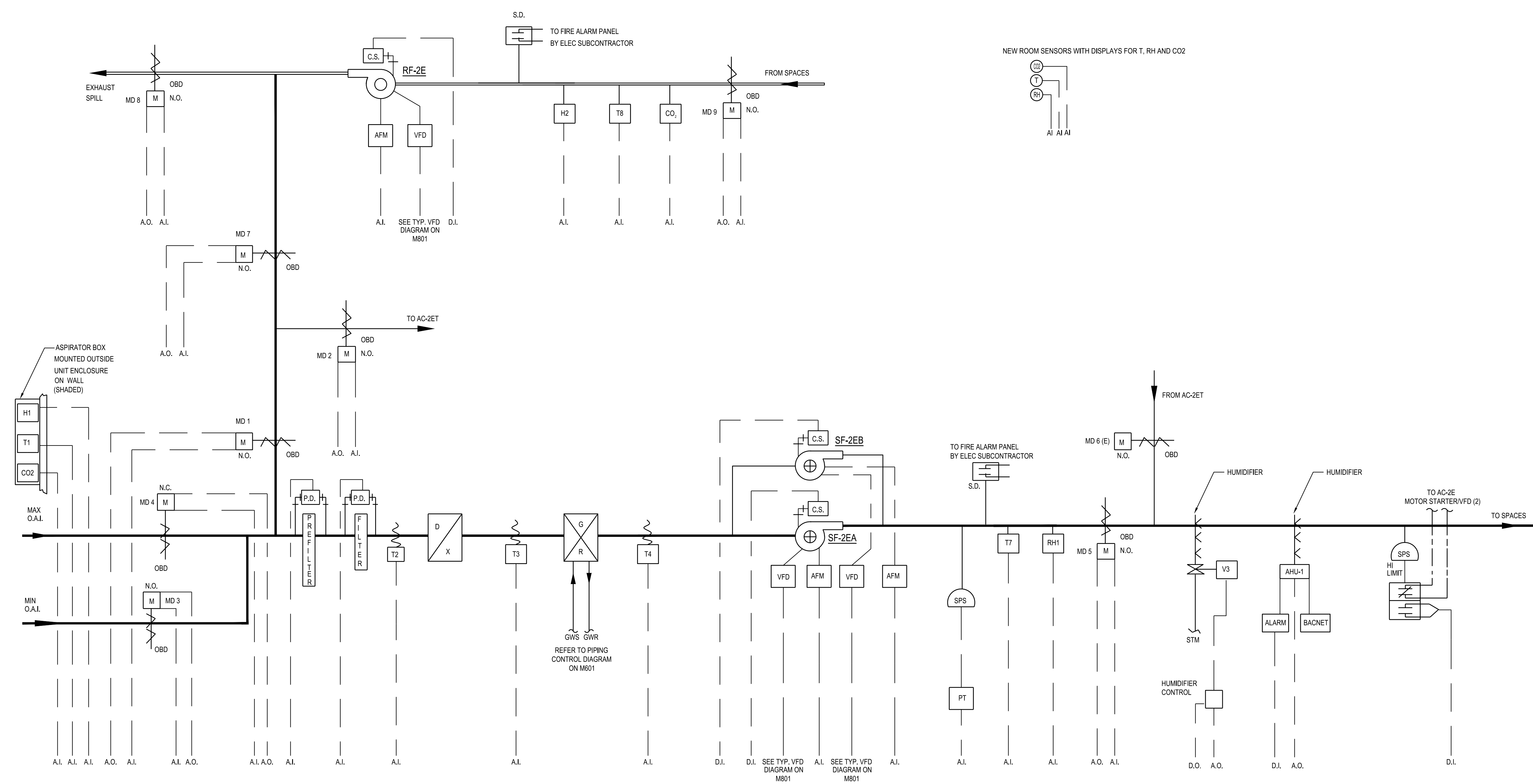
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PROJECT:
GOODMAN LOWER GALLERY
NEW HVAC EQUIPMENT
282 7TH AVENUE NEW YORK, NY 10001

C1592
DRAWING TITLE:
AC-2E MECHANICAL CONTROL
DIAGRAM

SEAL & SIGNATURE: DATE: 12/20/2024
PROJECT No: 896978
DRAWING BY: MC
CHK BY: DN
DWG No: M-802.00
SCALE: N.T.S. 17 OF 19



CONTROL DIAGRAM FOR AC-2E

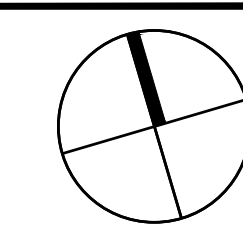
LEGEND

- DX COOLING COIL
- GLYCOL REHEAT COIL
- PRESSURE TRANSDUCER
- VARIABLE FREQUENCY DRIVE
- STATIC PRESSURE SENSOR
- PRESSURE DIFFERENTIAL SENSOR (AIR)
- CURRENT SENSOR
- MOTOR/ACTUATOR
- AIR FLOW MEASUREMENT STATION
- TEMPERATURE SENSOR
- HUMIDITY SENSOR
- CARBON DIOXIDE SENSOR
- CONTROL VALVE
- SMOKE DETECTOR
- END SWITCH
- MOTORIZED CONTROL DAMPER
- ELECTRIC LINE
- FIRE/SMOKE DAMPER
- FAN
- DI
- DO
- AI
- AO
- SIS
- OBD
- PBD
- LPS
- LPC
- ES
- AFM
- CC
- TT
- SD
- H
- CV
- PD
- SP
- VP
- GWS
- GWR

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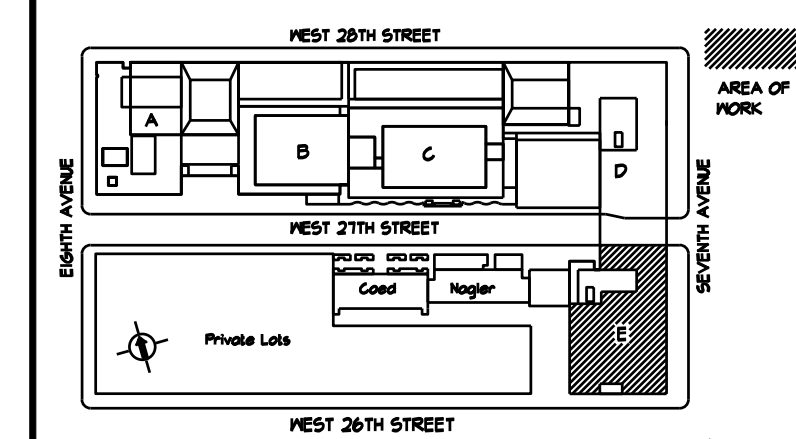
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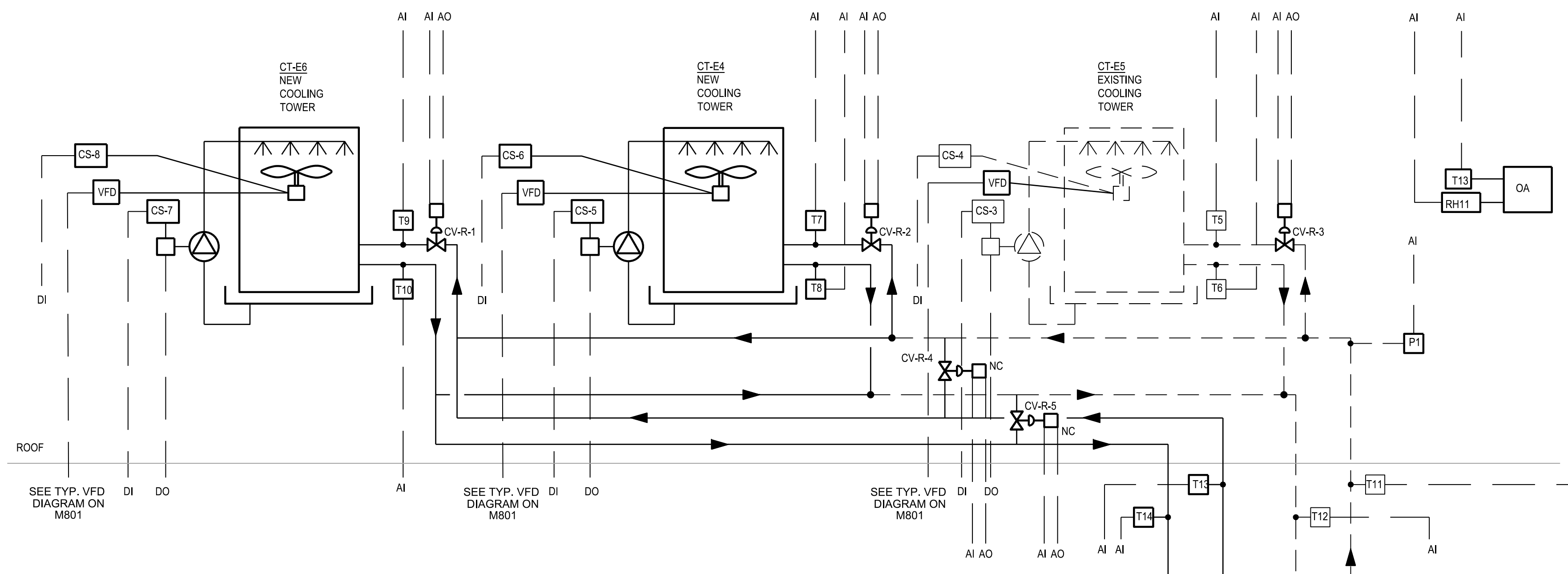
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New York, NY 10001 / (212) 242-2955

PROJECT:
GOODMAN LOWER GALLERY
NEW HVAC EQUIPMENT
282 7TH AVENUE NEW YORK, NY 10001

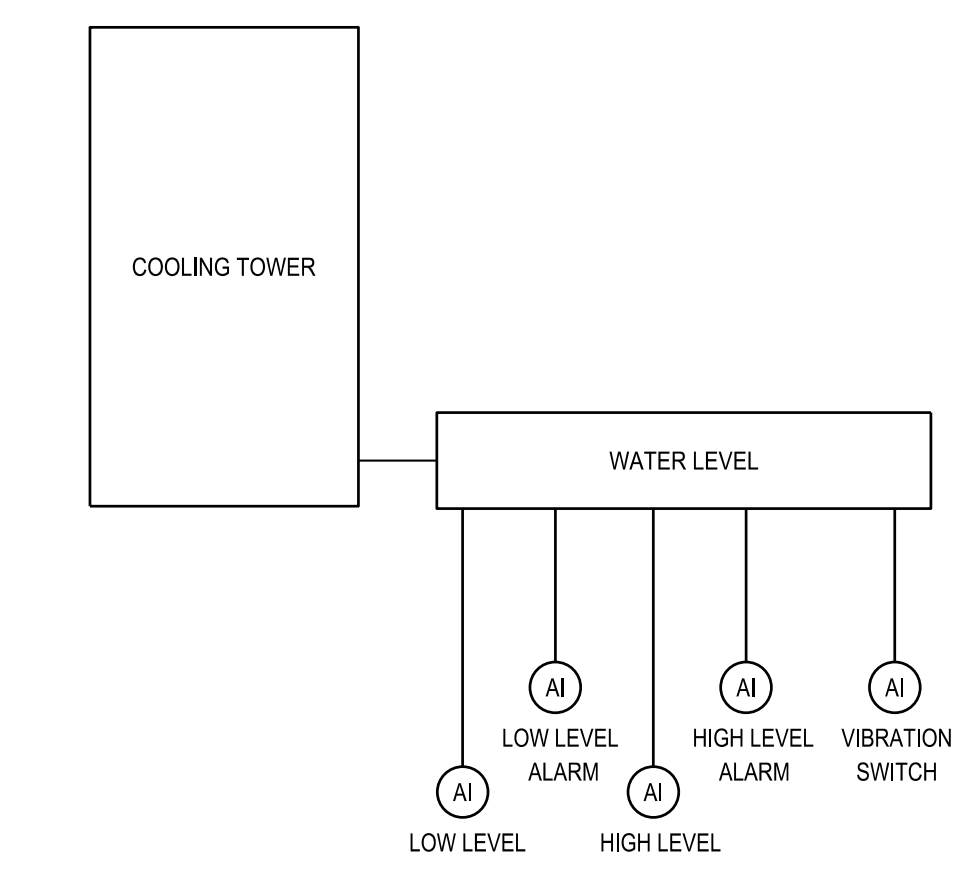
C1592
DRAWING TITLE:
GLYCOL WATER FLOW
CONTROL DIAGRAM

SEAL & SIGNATURE: DATE: 12/20/2024
PROJECT No: 896978
DRAWING BY: ASB
CHK BY: DN
DWG No:
M-803.00
SCALE: N.T.S. 18 OF 19

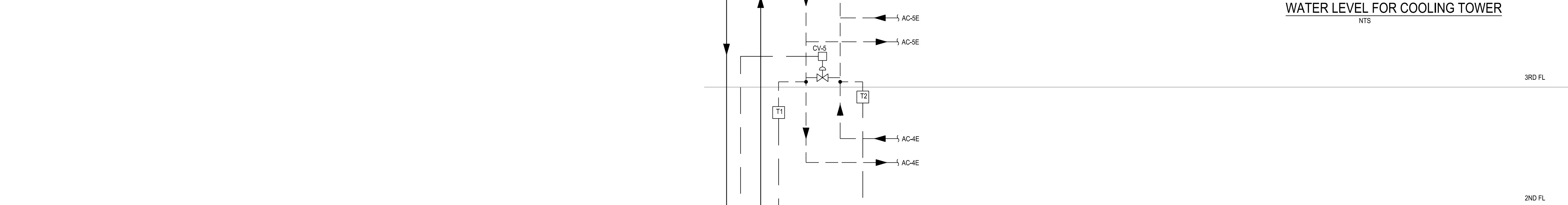


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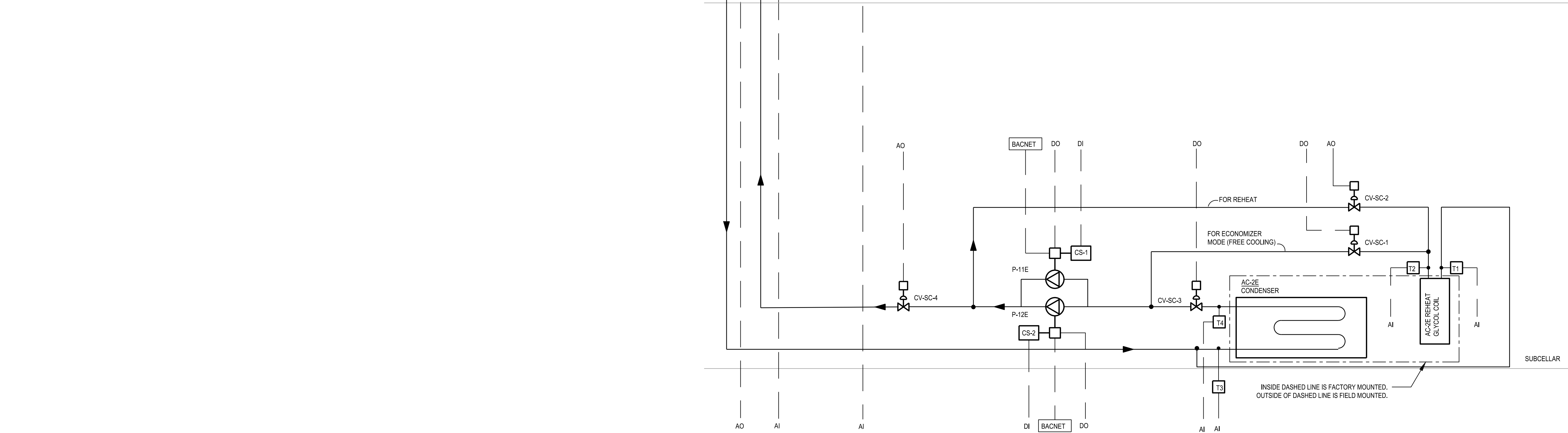
- NC NORMALLY CLOSED
- NO NORMALLY OPEN
- CT COOLING TOWER
- T TEMPERATURE SENSOR
- CS CURRENT SWITCH
- CV CONTROL VALVE
- RH RELATIVE HUMIDITY SENSOR
- VFD VARIABLE FREQUENCY DRIVE
- AI ANALOG INPUT
- AO ANALOG OUTPUT
- DI DIGITAL INPUT
- DO DIGITAL OUTPUT
- P PRESSURE SENSOR



WATER LEVEL FOR COOLING TOWER
NTS



3RD FL



2ND FL

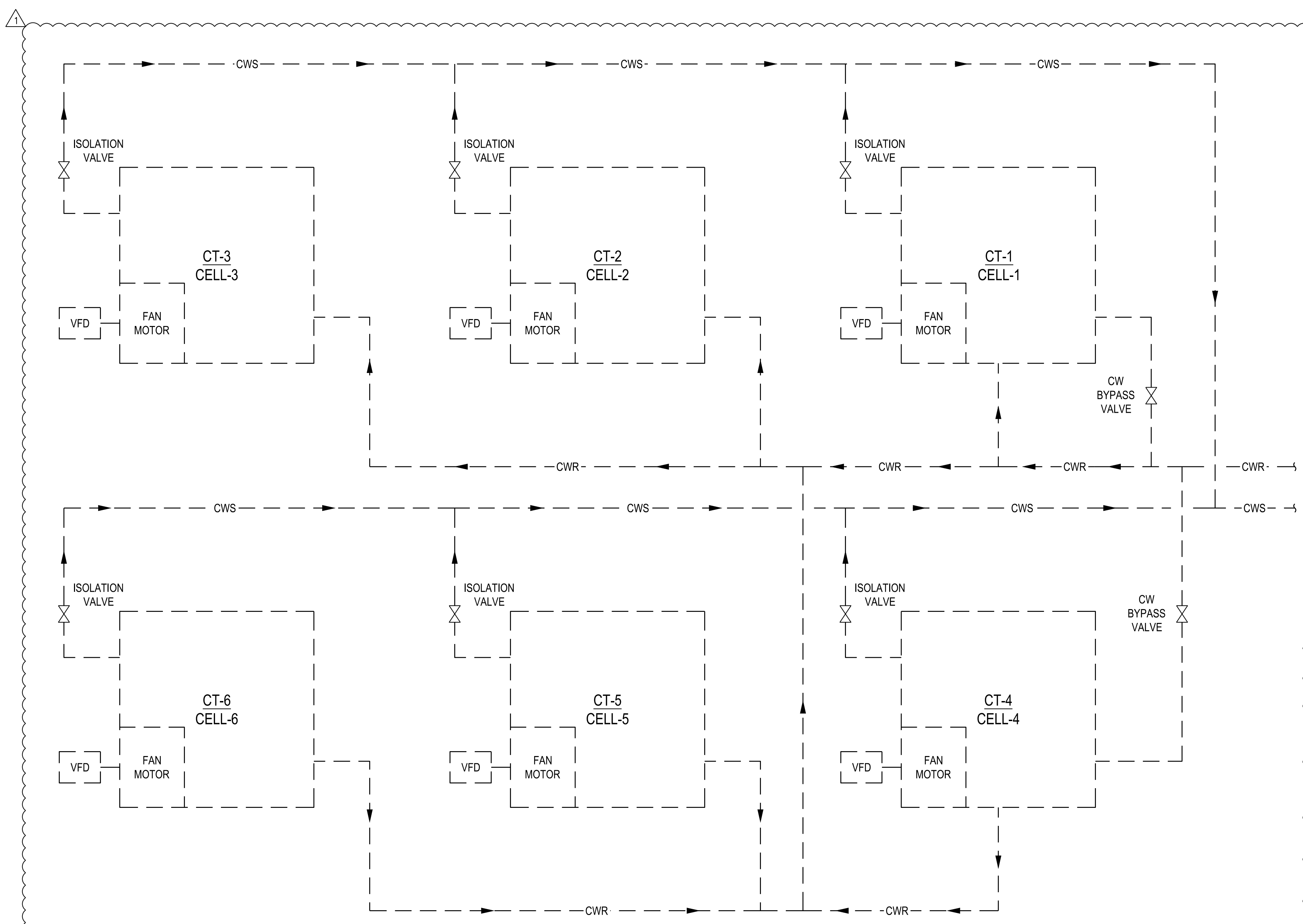
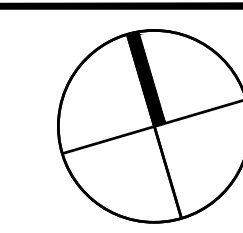
SUBCELLAR

GLYCOL WATER FLOW CONTROL DIAGRAM
NTS

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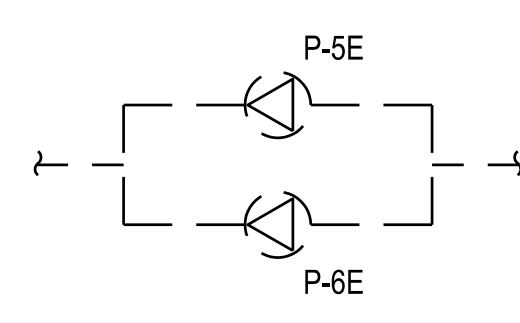




COOLING TOWER CONTROL DIAGRAM FOR CT-E1
NTS

NOTES

1. ALL COOLING TOWER CELL VFDS ARE LOCATED IN THE ROOF MECHANICAL ROOM. SEE DRAWINGS M-102 FOR EXACT LOCATIONS.
2. EDIT EXISTING SEQUENCE OF OPERATION TO MATCH NEW SEQUENCE OF OPERATION SHOWN ON THIS DRAWING.



COOLING TOWER CT-E1 SEQUENCE OF OPERATION

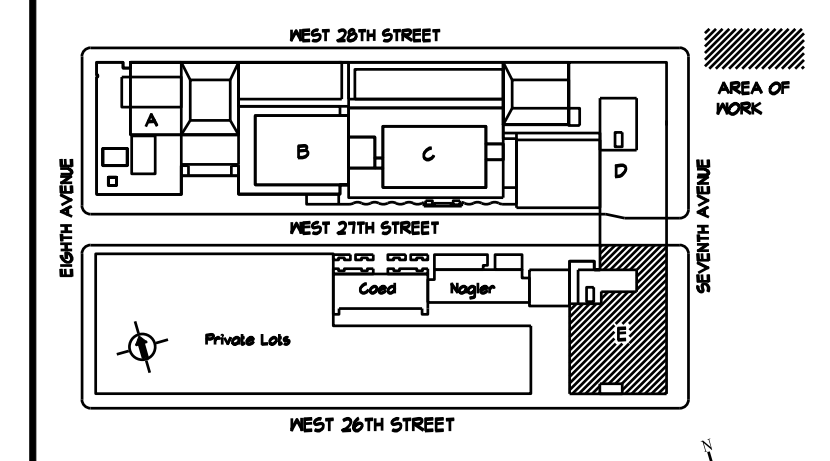
1. **WINTER/SUMMER**
 - IN THE SUMMER MODE THE #OF FUNCTIONING CT SHALL BE SELECTED TO "SIXCOOLINGTOWER".
 - WHEN ANY CHILLER IS STARTED, AND THE CW PUMPS IS CONFIRMED ON, ALL 6 THE COOLING TOWER SHALL BE STARTED AT 100%. THE CW VALVES SHALL BE OPEN. THE CT FAN VFD SPEED SHALL CHANGE TO MAINTAIN THE CW RETURN AT SETPOINT OF 75 DEG (ADJUSTABLE).
 - WHEN THE CT FAN VFDS ARE AT MINIMUM SPEED OF 30% (ADJUSTABLE) AND THE CW RETURN TEMPERATURE IS 1 DEG F (ADJUSTABLE) BELOW SETPOINT, ONE CT FAN VFD SHALL TURN OFF AND THE ISOLATION VALVE SHALL CLOSE.
 - WHEN THE CT FAN VFDS ARE AT MINIMUM SPEED OF 30% (ADJUSTABLE) AND THE CW RETURN TEMPERATURE IS 1 DEG F (ADJUSTABLE) ABOVE SETPOINT, ONE CT FAN VFD SHALL TURN ON AND THE ISOLATION VALVE SHALL OPEN.
2. **LEGIONELLA PREVENTION DURING WINTER MODE.**
 - IF THE CHILLER PLANT IS OFF FOR MORE THAN 48 HOURS (ADJUSTABLE), THE CONDENSER WATER PUMP P-1D SHALL START AFTER THE ISOLATION VALVES ARE CONFIRMED OPEN AND SHALL OPERATE FOR 4 HOURS (ADJUSTABLE) AND THEN SHALL TURN OFF. THIS SEQUENCE SHALL CONTINUE EVERY 48 HOURS (ADJUSTABLE).
3. **PUMP 5E AND 6E.**
 - THE PUMPS SHALL OPERATE ON A LEAD-LAG SEQUENCE EVERY TIME THE CHILLER PLANT IS ON. THE LEAD-LAG ALTERNATION SHALL TAKE PLACE ONLY WHEN THE CHILLER PLANT IS STARTED.
 - WHEN ONE PUMP FAILS, THE SECOND PUMP SHALL START.

ALTERNATE-1 NOTES:

- △ ALTERNATE-1 REPRESENTED BY TRIANGLE AND BUBBLE AS SHOWN.

rev. no.	date	revisions

12/20/2024 ISSUED FOR BID



LOCATION PLAN
NOT TO SCALE
BLOCK: T16
LOT: 40
BIN: 1014236

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PROJECT:
**GOODMAN LOWER GALLERY
 NEW HVAC EQUIPMENT
 282 7TH AVENUE NEW YORK, NY 10001**

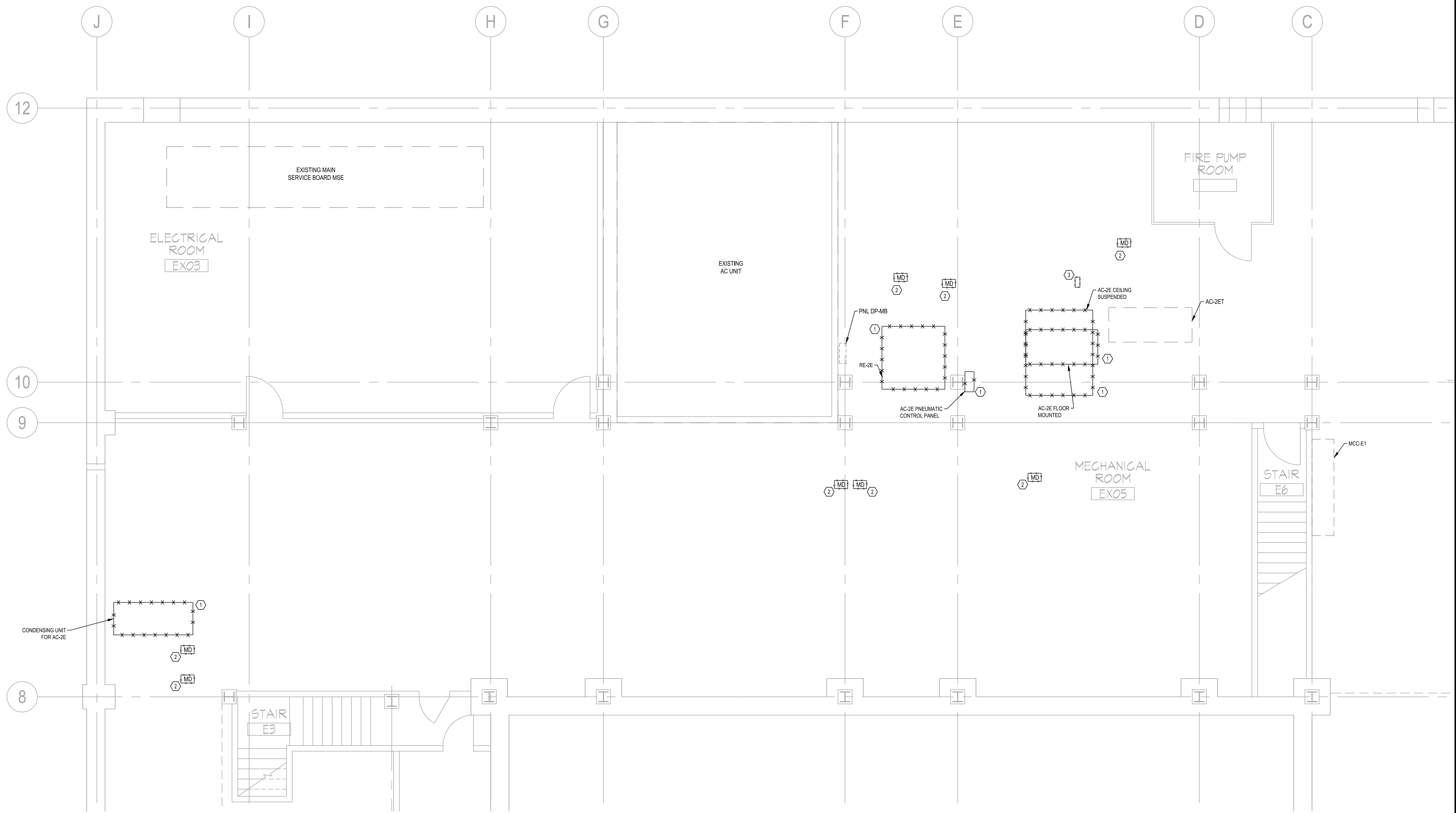
C1592
 DRAWING TITLE:
**COOLING TOWER
 CT-E1 CONTROL DIAGRAM
 ALTERNATE-1**

SEAL & SIGNATURE:	DATE: 12/20/2024
	PROJECT No: 896978
	DRAWING BY: ASB
	CHK BY: DN
	DWG No:
	M-804.00
SCALE: N.T.S.	19 OF 19

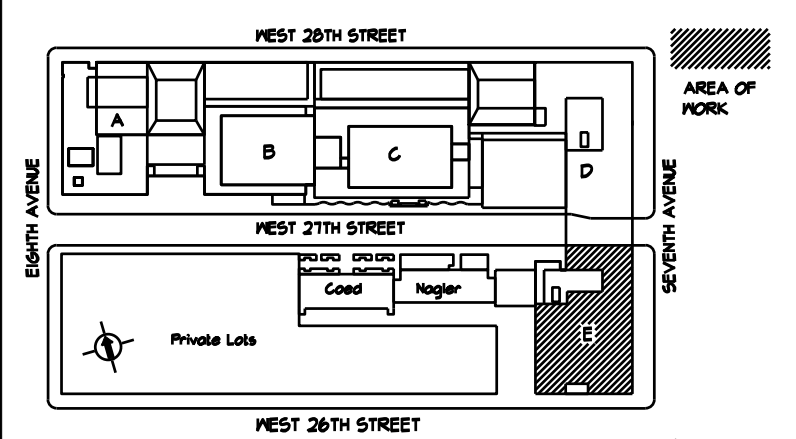
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LOCATION PLAN NOT TO SCALE
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PROJECT:
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 282 7TH AVENUE NEW YORK, NY 10001**

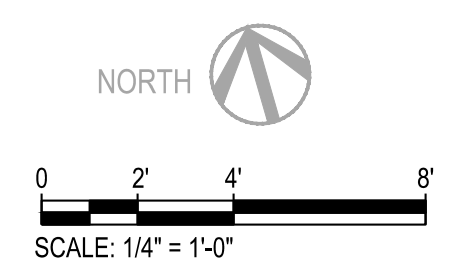
C1592
 DRAWING TITLE:
**SUBCELLAR ELECTRICAL
 DEMOLITION PLAN**

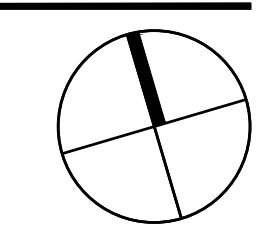
SEAL & SIGNATURE:	DATE: 12/20/2024
	PROJECT No: 896978
	DRAWING BY: DG
	CHK BY: WM
	DWG No:
	E-011.00
SCALE: 1/4" = 1'-0"	2 OF 10

- GENERAL NOTES:**
- REFER TO THE E-000 SERIES FOR NOTES AND ADDITIONAL INFORMATION
 - REFER TO THE E-700 SERIES FOR PANEL SCHEDULES.
 - REFER TO THE E-800 SERIES FOR THE ELECTRICAL ONE-LINE DIAGRAM, RISER DIAGRAM, AND WIRE SIZES
- KEY NOTES:**
- EXISTING MECHANICAL EQUIPMENT TO BE REMOVED, ASSOCIATED CIRCUITRY (WIRING & CONDUIT) AND CONTROLS (ACTUATORS, ETC.) SHALL BE REMOVED BACK TO THE SOURCE (VIF), CONTRACTOR SHALL INCLUDE SCOPE TO CIRCUIT TRACE EXISTING CIRCUITRY.
 - EXISTING MOTORIZED DAMPERS TO BE REMOVED, ASSOCIATED CIRCUITRY (WIRING & CONDUIT) AND CONTROLS (ACTUATORS, ETC.) SHALL BE REMOVED BACK TO THE SOURCE (VIF), CONTRACTOR SHALL INCLUDE SCOPE TO CIRCUIT TRACE EXISTING CIRCUITRY. REFER TO THE MECHANICAL DRAWINGS FOR ADDITIONAL INFORMATION.
 - EXISTING DUCT HEATER TO BE REMOVED, ASSOCIATED CIRCUITRY (WIRING & CONDUIT) AND CONTROLS (ACTUATORS, ETC.) SHALL BE REMOVED BACK TO THE SOURCE (VIF), CONTRACTOR SHALL INCLUDE SCOPE TO CIRCUIT TRACE EXISTING CIRCUITRY. REFER TO THE MECHANICAL DRAWINGS FOR ADDITIONAL INFORMATION.

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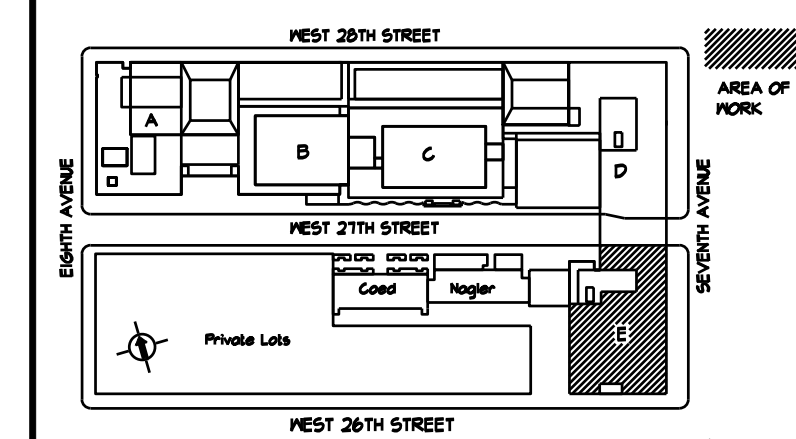
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LOCATION PLAN NOT TO SCALE BLOCK: T16 LOT: 40 BIN: 1014236

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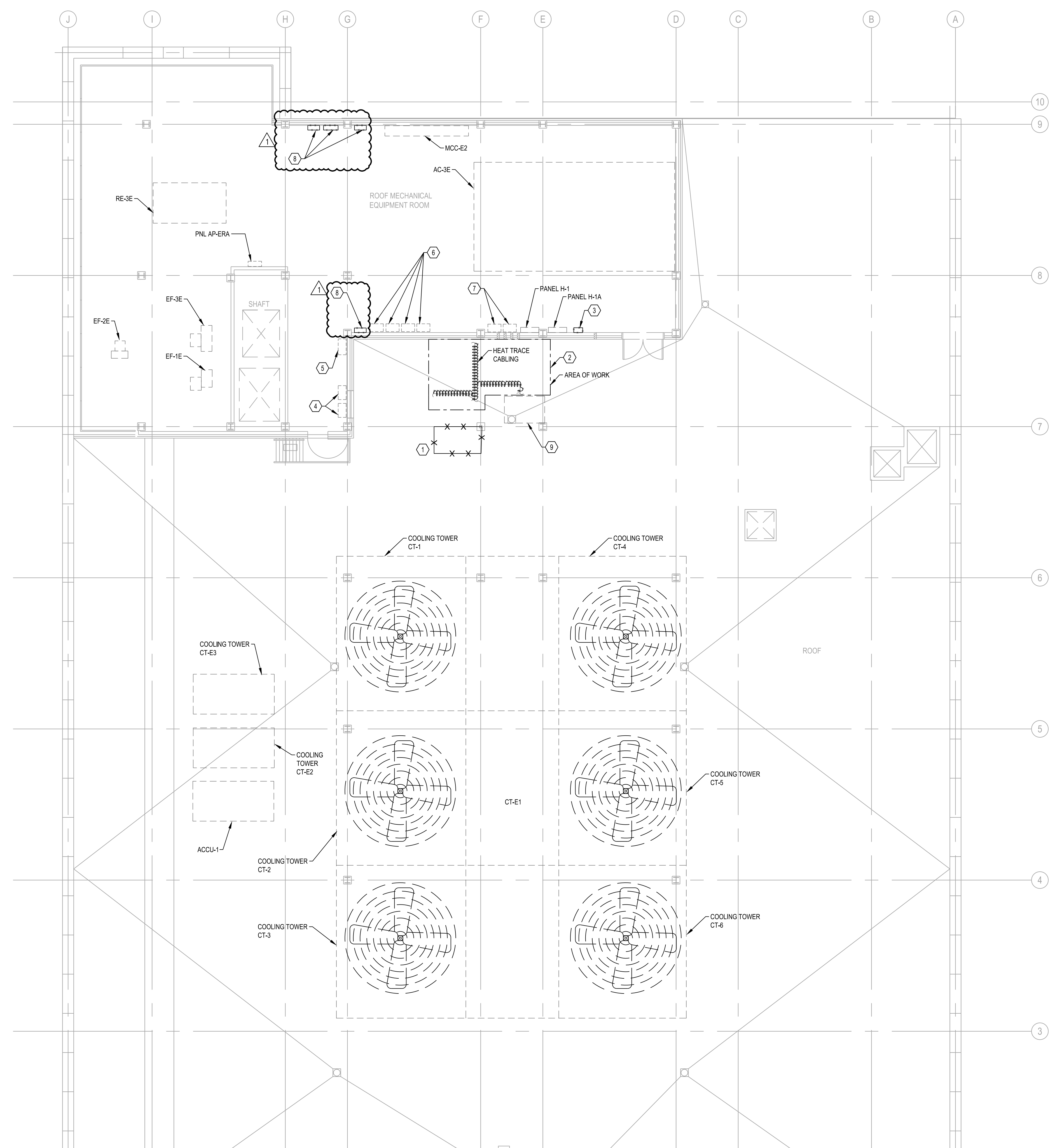
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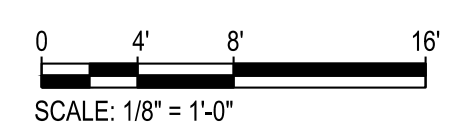
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- ALTERNATE-1 NOTES:**
- 1 ALTERNATE-1 REPRESENTED BY TRIANGLE AND BUBBLE AS SHOWN.
- GENERAL NOTES:**
1. REFER TO THE E-000 SERIES FOR NOTES AND ADDITIONAL INFORMATION.
 2. REFER TO THE E-700 SERIES FOR PANEL SCHEDULES.
 3. REFER TO THE E-600 SERIES FOR THE ELECTRICAL ONE-LINE DIAGRAM, RISER DIAGRAM, AND WIRE SIZES.
- KEY NOTES:**
- 1 EXISTING COOLING TOWER TO BE REMOVED. ASSOCIATED CIRCUITRY (WIRING & CONDUIT) AND CONTROLS SHALL BE REMOVED BACK TO THE SOURCE. THE DEMOLITION OF THIS EXISTING COOLING TOWER SHALL TAKE PLACE AFTER THE NEW COOLING TOWER IS FULLY FUNCTIONAL. REFER TO DRAWING E-102 FOR PHASING NOTES ADDITIONAL INFORMATION.
 - 2 EXISTING HEAT TRACE CABLING TO BE REMOVED BACK TO THE HEAT TRACE CONTROLLER WHEN THE COOLING TOWER IS BEING REMOVED.
 - 3 EXISTING STARTER FOR COOLING TOWER CT-E5 FAN TO BE REMOVED (EXISTING SPRAY PUMP STARTER SHALL REMAIN). WIRING SHALL BE REMOVED BACK TO SOURCE, BUT CONDUIT SHALL BE UTILIZED FOR FUTURE USE. SEE E-100 SERIES FOR ADDITIONAL INFORMATION.
 - 4 EXISTING VFD'S FOR CT-E2 AND CT-E3
 - 5 EXISTING HEAT TRACE CONTROL PANEL FOR CT-E1
 - 6 EXISTING VFD'S FOR CT-4, CT-5, CT-6, AND CT-1
 - 7 EXISTING VFD'S FOR COOLING TOWERS CT-2 AND CT-3
 - 8 EXISTING CONTROL PANEL TO BE REMOVED
 - 9 EXISTING COOLING TOWER CT-E5 TO REMAIN

1 ROOF MECHANICAL PLAN
1/8" = 1'-0"



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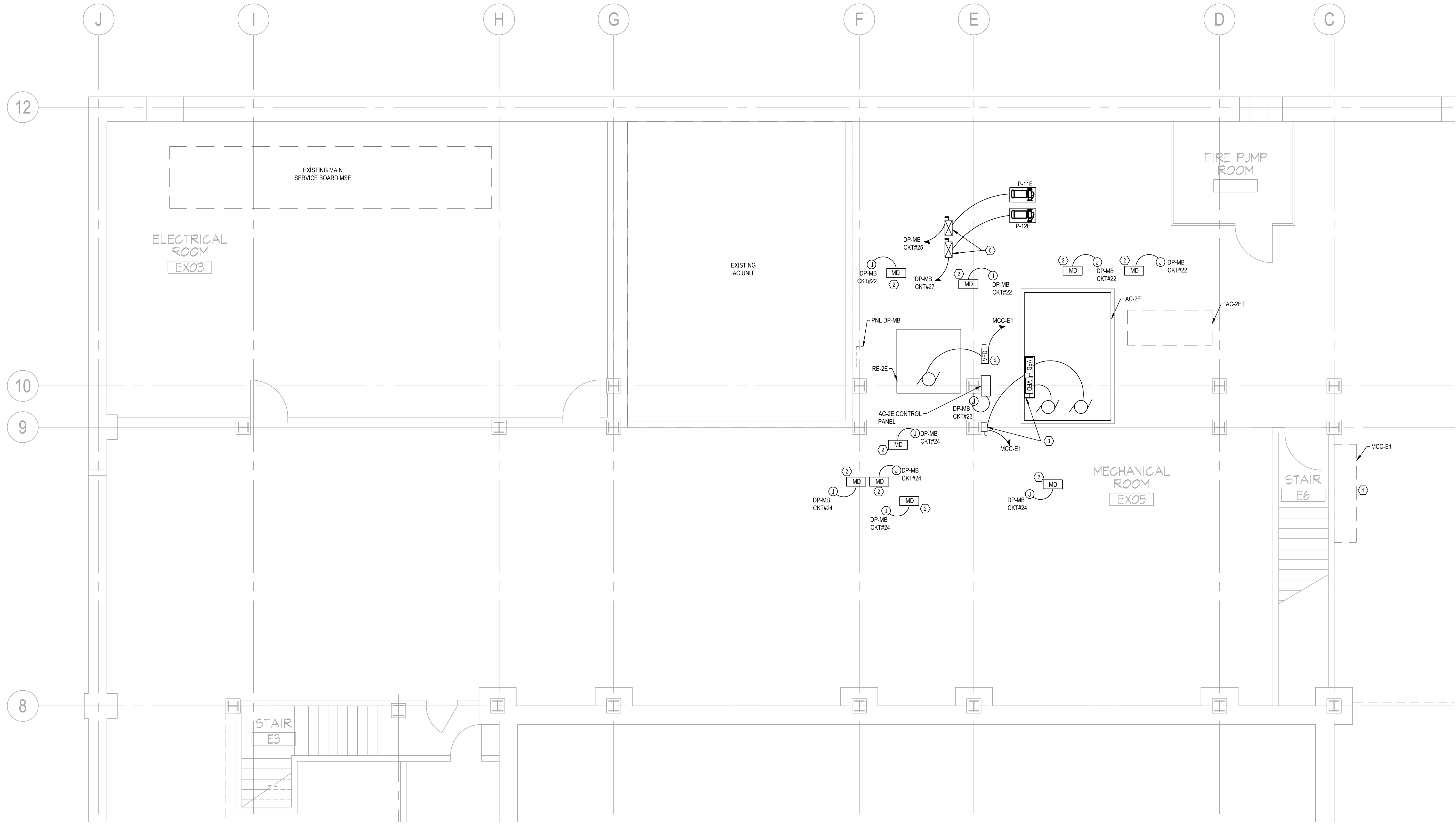
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PROJECT:
**GOODMAN LOWER GALLERY
NEW HVAC EQUIPMENT
282 7TH AVENUE NEW YORK, NY 10001**

C1592
DRAWING TITLE:
**ROOF ELECTRICAL
DEMOLITION PLAN**

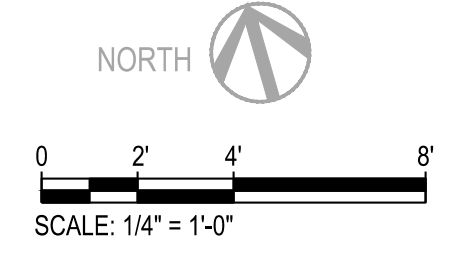
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	PROJECT No: 896978
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	CHK BY: WM
	DWG No:
	E-012.00
	SCALE: 1/8" = 1'-0"
	3 OF 10



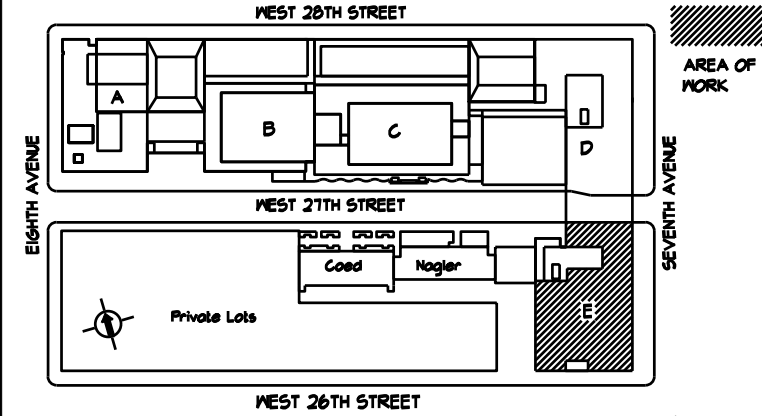
- GENERAL NOTES:**
- REFER TO THE E-600 SERIES FOR NOTES AND ADDITIONAL INFORMATION.
 - REFER TO THE E-700 SERIES FOR PANEL SCHEDULES.
 - REFER TO THE E-600 SERIES FOR THE ELECTRICAL ONE-LINE DIAGRAM, RISER DIAGRAM, AND WIRE SIZES.
- KEY NOTES:**
- REFER TO THE E-400 SERIES FOR AN ELEVATION OF MCC-E1 AND ADDITIONAL INFORMATION REGARDING THE NEW WORK INVOLVING THIS MCC.
 - INSTALL NEW MOTORIZED DAMPER IN THIS LOCATION. REFER TO E-700 SERIES AND MECHANICAL DRAWINGS FOR ADDITIONAL INFORMATION.
 - CONTRACTOR SHALL INSTALL A NEW 40AS DISCONNECT SWITCH TO FEED THE SINGLE POINT OF CONNECTION FOR AC-2E.
 - CONTRACTOR SHALL INSTALL NEW 30AS VFD ON KINDORF TO FEED THE RETURN FAN RE-2E.
 - CONTRACTOR SHALL INSTALL TWO 30AS DISCONNECTING STARTERS ON KINDORF TO FEED PUMPS P-11E AND P-12E.

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LOCATION PLAN NOT TO SCALE
 BLOCK: T76
 LOT: 40
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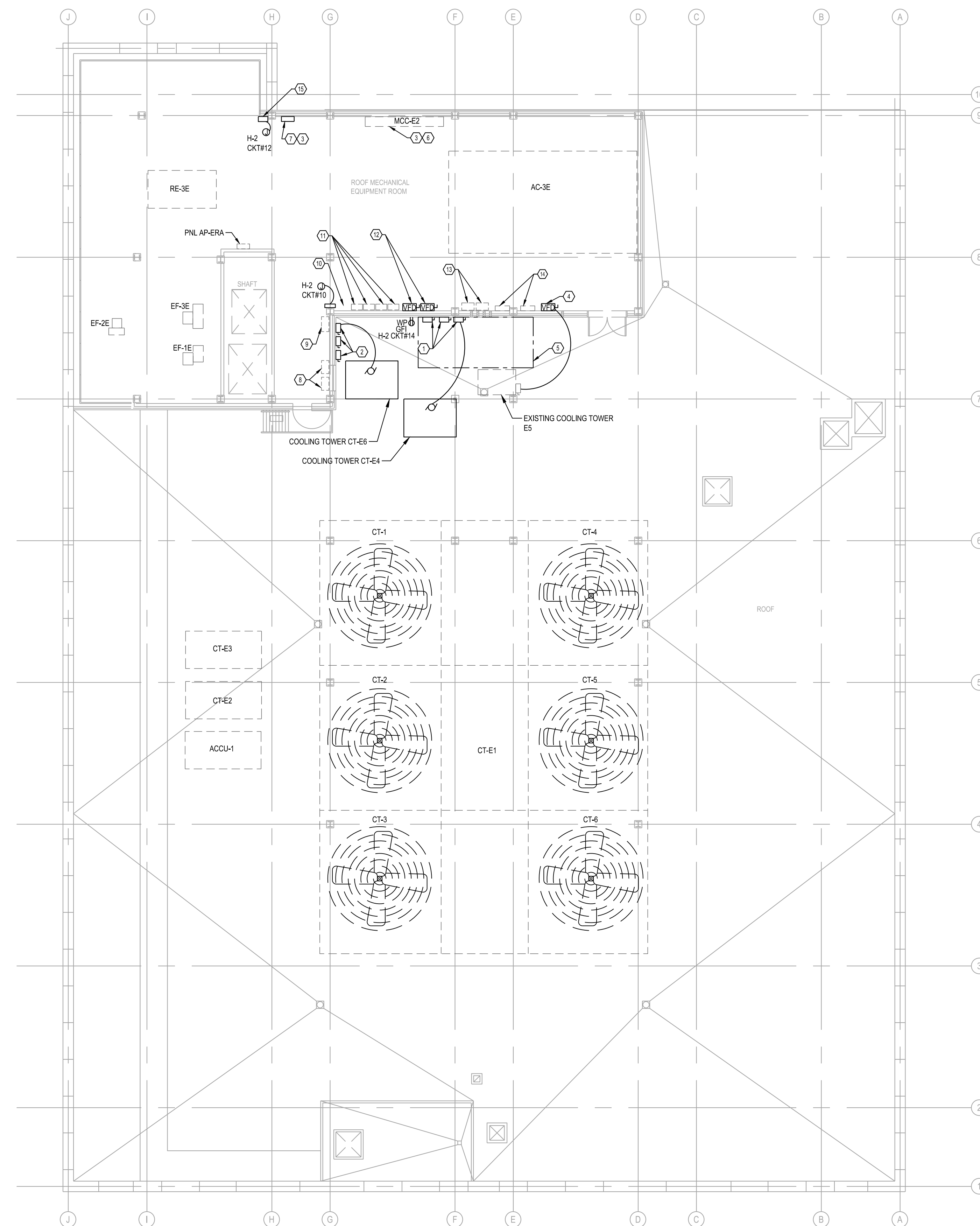
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PROJECT:
**GOODMAN LOWER GALLERY
 NEW HVAC EQUIPMENT
 282 7TH AVENUE NEW YORK, NY 10001**

C1592
 DRAWING TITLE:
**SUBCELLAR ELECTRICAL
 DEMOLITION PLAN**

SEAL & SIGNATURE:	DATE: 12/20/2024
	PROJECT No: 896978
	DRAWING BY: DG
	CHK BY: WM
	DWG No:
	E-101.00
SCALE: 1/8" = 1'-0"	4 OF 10



GENERAL NOTES:

1. REFER TO THE E-000 SERIES FOR NOTES AND ADDITIONAL INFORMATION.
2. REFER TO THE E-700 SERIES FOR PANEL SCHEDULES.
3. REFER TO THE E-600 SERIES FOR ELECTRICAL ONE-LINE DIAGRAM, RISER DIAGRAM, AND WIRE SIZES.

COOLING TOWER PHASING NOTES:

PHASE 1: PROVIDE THE THREE NEW 60A FUSES IN MCC-E2'S SPARE BUCKET TO FEED THE NEW PANEL H-2 (PROVIDE FUSE REDUCERS AS REQUIRED). PANEL H-2 WILL FEED COOLING TOWER CT-E6, ETC. FULLY INSTALL AND MAKE ALL FINAL NECESSARY CONNECTIONS FOR CT-E6. START UP REPORT SHALL BE SUBMITTED TO THE ENGINEER.

PHASE 2: ONCE THE NEW COOLING TOWER CT-E6 IS FULLY OPERATIONAL, DEMOLISH THE EXISTING COOLING TOWER CT-E4. CONTRACTOR SHALL REMOVE WIRING AND CONDUIT BACK TO THE SOURCE. CONTRACTOR SHALL ALSO REMOVE THE EXISTING FUSES IN MCC-E2 FEEDING THE EXISTING COOLING TOWER CT-E4 COMPONENTS, AND LOCK AND TAG OUT THESE BREAKERS FOR FUTURE USE. HEAT TRACE CABLE SHALL ALSO BE REMOVED BACK TO THE SOURCE. DURING THIS PROCESS, REFER TO DRAWING E-012 FOR ADDITIONAL INFORMATION.

PHASE 3: NEXT, PROVIDE THREE NEW 30A FUSES IN MCC-E2 TO FEED NEW CT-E4 FAN IN THE EXISTING BUCKET THAT FED THE OLD CT-E4 FAN MOTOR (PROVIDE FUSE REDUCERS AS REQUIRED). PROVIDE THREE 30A FUSES IN MCC-E2 TO FEED THE NEW CT-E4 SPRAY PUMP, IN THE EXISTING BUCKET THAT FED THE OLD CT-E4 SPRAY PUMP. LASTLY, PROVIDE A 20A/3P BREAKER IN THE NEW PANEL H-2 TO FEED THE NEW CT-E4 HEATER. FULLY INSTALL AND MAKE ALL NECESSARY FINAL CONNECTIONS FOR THE NEW COOLING TOWER CT-E4. START UP REPORT SHALL BE SUBMITTED TO THE ENGINEER.

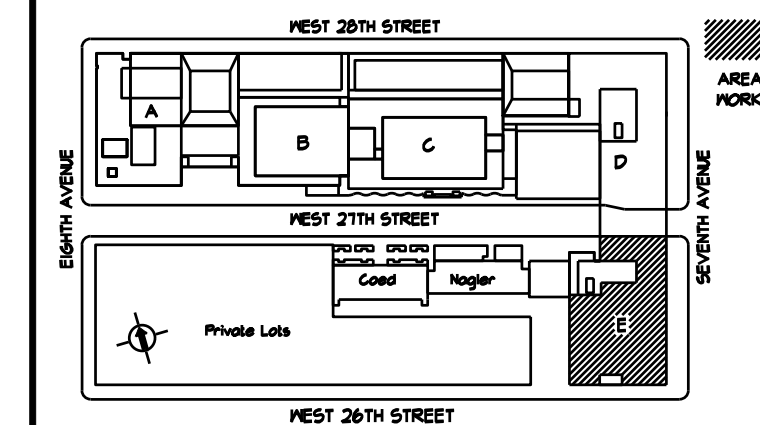
PHASE 4: ONCE BOTH COOLING TOWERS ARE FULLY OPERATIONAL CONTRACTOR SHALL INSTALL NEW HEAT TRACE CONTROLLER AND HEAT TRACE CABLE.

KEY NOTES:

1. CONTRACTOR SHALL INSTALL THREE 208V, 3PH 30AS NEMA-3R LOCAL DISCONNECT SWITCHES HERE FOR THE COOLING TOWER CT-E4 SPRAY PUMP (MCC-E2), HEATER (PNL H-2 CKT#13, 15, 17), AND FOR THE FAN (MCC-E2). THE 30AS DISCONNECTING VFD (CONTROLLING THE FAN MOTOR) WILL BE INSTALLED INSIDE THE MECHANICAL ROOM AS SHOWN ON THIS PLAN. CONTRACTOR SHALL UPDATE PANEL DIRECTORY AND MCC LABELS AS NECESSARY.
2. CONTRACTOR SHALL INSTALL THREE 208V, 3PH 30AS NEMA-3R LOCAL DISCONNECT SWITCHES HERE FOR THE COOLING TOWER CT-E6 SPRAY PUMP (PNL H-2 CKT#2, 4, 6), HEATER (PNL H-1 CKT#7, 9, 11), AND FOR THE FAN (PNL H-1 CKT#1, 3, 5). THE 30AS DISCONNECTING VFD (CONTROLLING THE FAN MOTOR) WILL BE INSTALLED INSIDE THE MECHANICAL ROOM AS SHOWN ON THIS PLAN.
3. NEW PANEL H-2 FEEDING COOLING TOWER CT-E6 SHALL BE FED FROM THE 3 NEW 60A FUSES THAT WILL BE INSTALLED IN THE SPARE BUCKET IN MCC-E2. REFER TO E-400 AND E-700 SERIES FOR ADDITIONAL INFORMATION.
4. CONTRACTOR SHALL REPLACE THE STARTER FOR EXISTING COOLING TOWER CT-E5 FAN WITH A NEW 30AS VFD. CONTRACTOR SHALL CIRCUIT TRACE EXISTING CIRCUIT AND PROVIDE NEW 3#10-1#10G-1°C WIRING AND CONDUIT TO THE LINE SIDE OF THE NEW VFD AS REQUIRED.
5. THIS IS AN AREA OF WORK WHERE THE CONTRACTOR SHALL INSTALL NEW HEAT TRACE CABLING WHERE THE OLD CABLING WAS DEMOLISHED. CONTRACTOR SHALL ALSO INSTALL A NEW HEAT TRACE CONTROLLER FOR THIS NEW HEAT TRACE CABLE. SEE DWG E-012 FOR ADDITIONAL INFORMATION.
6. AFTER THE REMOVAL OF THE FUSES IN THE EXISTING BUCKETS FEEDING THE EXISTING CT-E4 FAN AND SPRAY PUMP, CONTRACTOR SHALL SUPPLY THREE NEW 30A/3P BREAKERS IN EACH BUCKET TO FEED THE NEW COOLING TOWER E4 SPRAY PUMP AND FAN. REFER TO E-700 AND E-400 SERIES FOR ADDITIONAL INFORMATION.
7. CONTRACTOR SHALL PROVIDE A 20A/3P BREAKER IN THE NEW PANEL H-2 TO FEED THE NEW CT-E4 HEATER.
8. EXISTING VFD'S FOR CT-E2 AND CT-E3
9. EXISTING HEAT TRACE CONTROL PANEL FOR CT-E1
10. NEW COOLING TOWER CT-E4 AND CT-E6 CONTROL PANEL
11. EXISTING VFD'S FOR CT-4, CT-5, CT-6, AND CT-1
12. NEW 30AS VFD'S FOR NEW COOLING TOWERS CT-E4 AND CT-E6 FANS. CONTRACTOR SHALL ALSO INSTALL STARTERS ABOVE THE VFD'S FOR THE NEW COOLING TOWER CT-E4 AND CT-E6 SPRAY PUMPS. REFER TO ELECTRICAL ONE-LINE DIAGRAM AND MECHANICAL DRAWINGS FOR ADDITIONAL INFORMATION.
13. EXISTING VFD'S FOR COOLING TOWERS CT-2 AND CT-3
14. EXISTING PANEL H-1 AND H-1A
15. NEW SUPERVISORY CONTROL PANEL. SEE MECHANICAL DRAWINGS FOR ADDITIONAL INFORMATION

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LOCATION PLAN
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BLOCK: T16
LOT: 40
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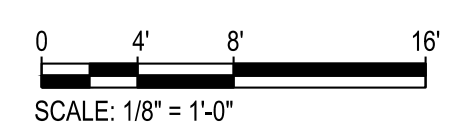
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PROJECT:
GOODMAN LOWER GALLERY
NEW HVAC EQUIPMENT
282 7TH AVENUE NEW YORK, NY 10001

C1592
DRAWING TITLE:
ROOF ELECTRICAL POWER PLAN

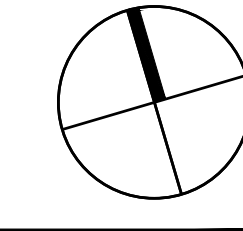
SEAL & SIGNATURE:	DATE:	12/20/2024
	PROJECT No:	896978
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	DWG No:	
		E-102.00
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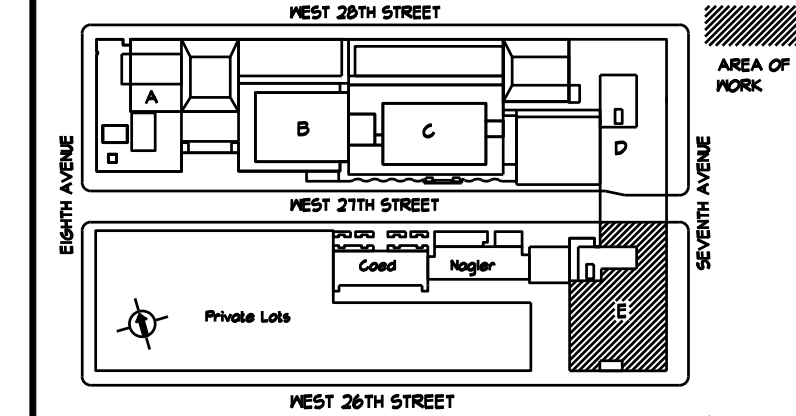
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PROJECT:
GOODMAN LOWER GALLERY
NEW HVAC EQUIPMENT
282 7TH AVENUE NEW YORK, NY 10001

C1592
DRAWING TITLE:
ELECTRICAL
MCC ELEVATIONS

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	DRAWING BY: DG
	CHK BY: WM
	DWG No:
	E-401.00
SCALE: N.T.S.	6 OF 10

- GENERAL NOTES:
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 - REFER TO THE E-700 SERIES FOR PANEL SCHEDULES.
 - REFER TO THE E-600 SERIES FOR ELECTRICAL ONE-LINE DIAGRAM AND WIRE SIZES.

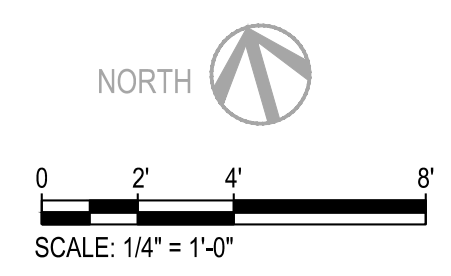
- WORK NOTES:
- EXISTING CIRCUIT BREAKER AND CONTROLS FEEDING AC-2E TO BE REMOVED. CONTRACTOR SHALL PROVIDE A NEW 40A, 3-POLE MCCB IN MCC-1E TO FEED NEW AC-2E WITH 3&8-1#10G-34" C SIZED WIRE.
 - EXISTING CIRCUIT BREAKER AND CONTROLS FEEDING RE-2E TO BE REMOVED. CONTRACTOR SHALL PROVIDE A NEW 30A, 3-POLE MCCB IN MCC-1E TO FEED NEW RE-2E WITH 3&8-1#10G-34" C SIZED WIRE.
 - CONTRACTOR SHALL PROVIDE THREE NEW 60A FUSES IN THIS EXISTING SPARE BUCKET TO FEED THE NEW PANEL H-2.
 - CONTRACTOR SHALL PROVIDE THREE NEW 30A FUSES IN THIS EXISTING SPARE BUCKET TO FEED THE NEW CT-E4 FAN.
 - CONTRACTOR SHALL PROVIDE THREE NEW 30A FUSES IN THIS EXISTING SPARE BUCKET TO FEED THE NEW CT-E4 SPRAY PUMP.



MCC-E1 - LOCATED IN THE SUB-CELLAR



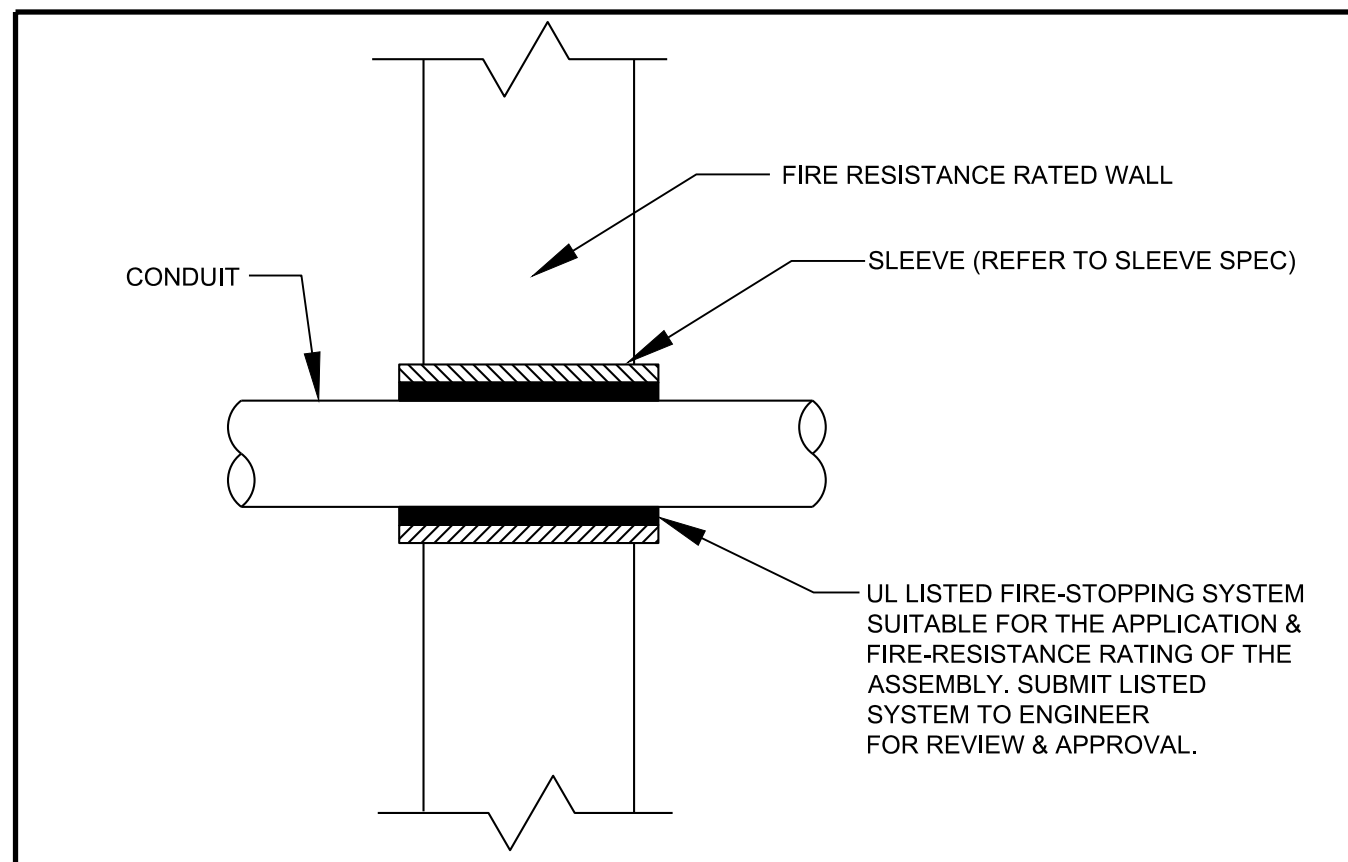
MCC-E2 - LOCATED IN THE ROOF MECHANICAL ROOM



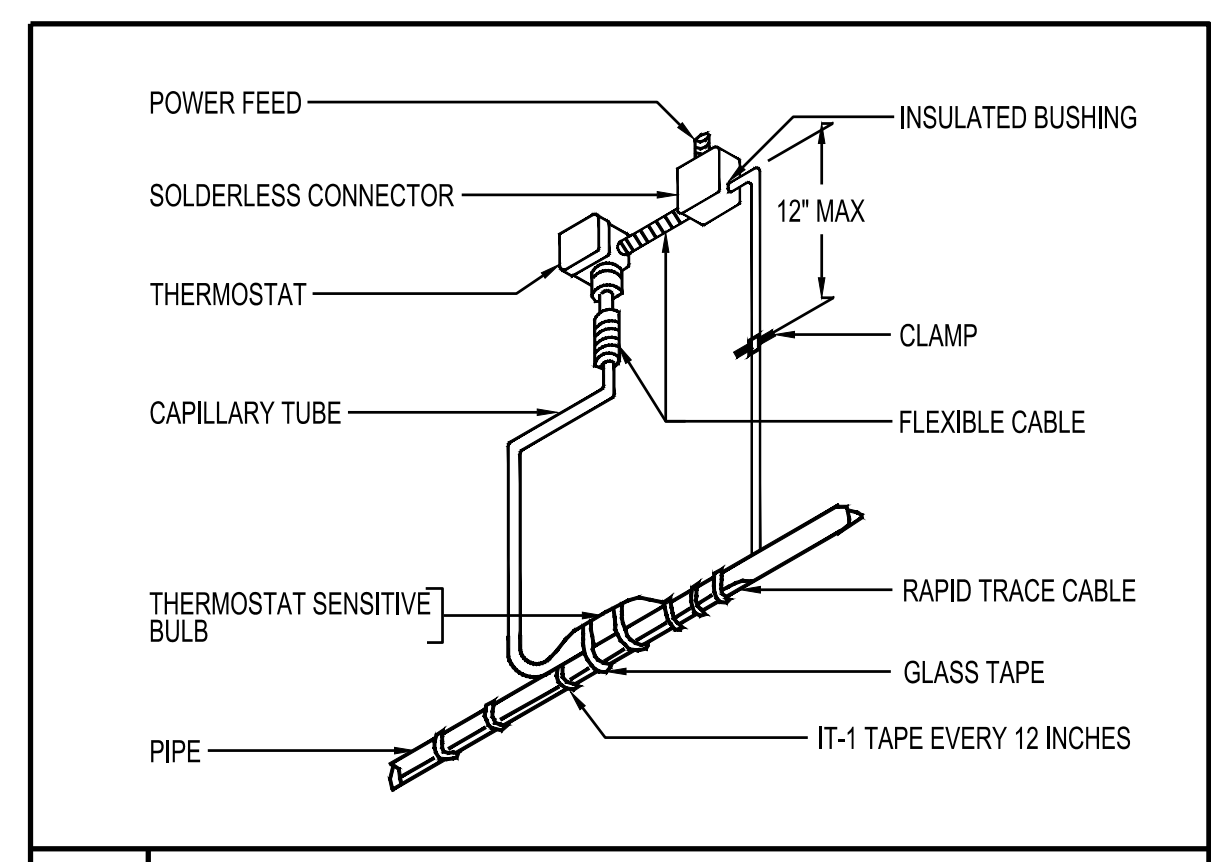
NEW YORK CITY BUILDING DEPARTMENT APPROVAL NOTE
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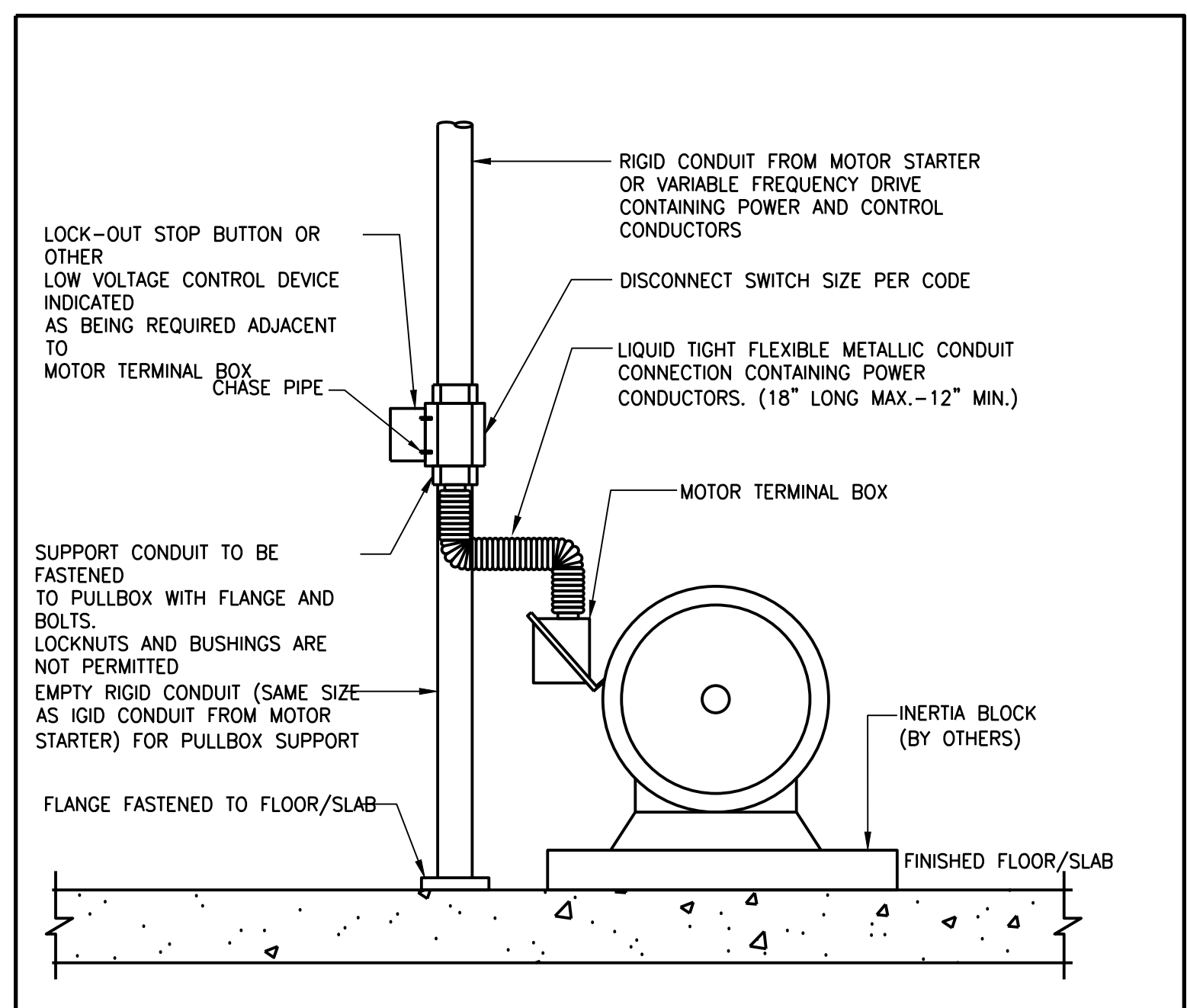




Conduit Penetration Thru Fire Rated Wall / Partition
Not to Scale

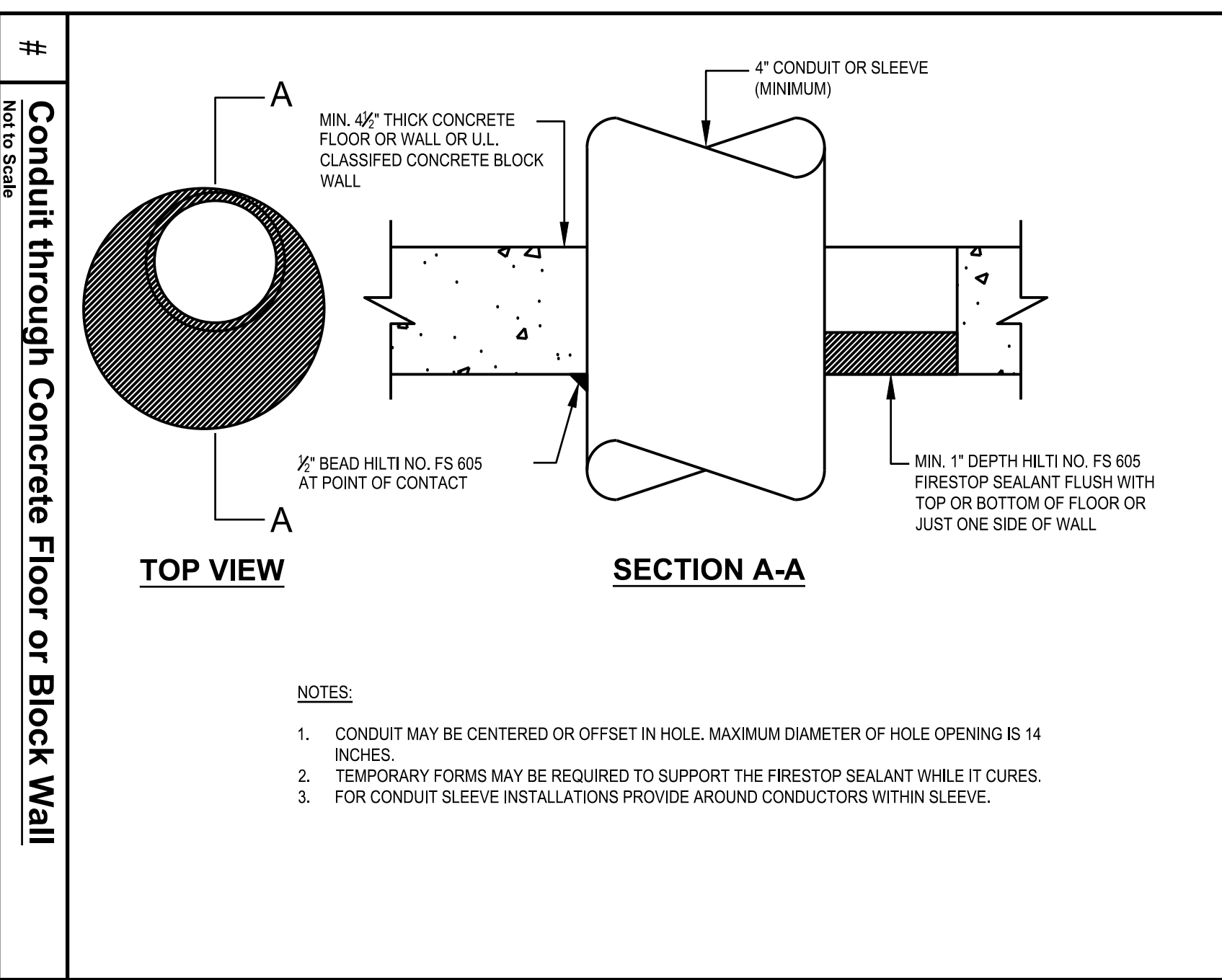


Heat Tracing Cable Installation
Not to Scale



NOTE:
1. MOTOR SHALL BE FURNISHED AND INSTALLED BY OTHERS AND WIRED BY ELECTRICAL CONTRACTOR.

Floor Mounted Motor Connection
Not to Scale



NOTES:
1. CONDUIT MAY BE CENTERED OR OFFSET IN HOLE. MAXIMUM DIAMETER OF HOLE OPENING IS 14 INCHES.
2. TEMPORARY FORMS MAY BE REQUIRED TO SUPPORT THE FIRESTOP SEALANT WHILE IT CURES.
3. FOR CONDUIT SLEEVE INSTALLATIONS PROVIDE AROUND CONDUCTORS WITHIN SLEEVE.

Conduit through Concrete Floor or Block Wall
Not to Scale

rev. no. date revisions

12/20/2024 ISSUED FOR BID

LOCATION PLAN NOT TO SCALE

BLOCK: T76
LOT: 40
BIN: 104236

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New York, NY 10001 / (212) 242-2955

PROJECT:
GOODMAN LOWER GALLERY
NEW HVAC EQUIPMENT
282 7TH AVENUE NEW YORK, NY 10001

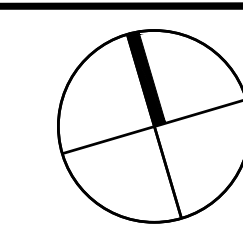
C1592
DRAWING TITLE:
ELECTRICAL DETAILS

SEAL & SIGNATURE:	DATE: 12/20/2024
	PROJECT No: 896978
	DRAWING BY: DG
	CHK BY: WM
	DWG No:
	E-501.00
SCALE: NTS	7 OF 10

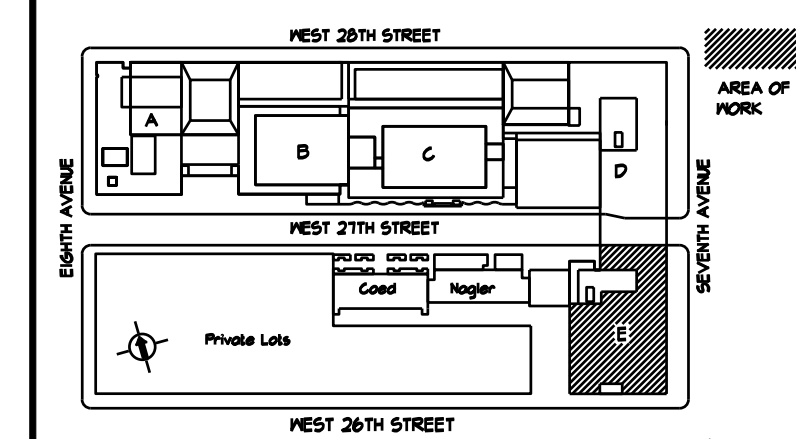
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REV. NO.	DATE	REVISIONS
12/20/2024	ISSUED FOR BID	



LOCATION PLAN NOT TO SCALE
 BLOCK: T16
 LOT: 40
 BIN: 1014236

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 New York, NY 10001 / (212) 242-2955

PROJECT:
 GOODMAN LOWER GALLERY
 NEW HVAC EQUIPMENT
 282 7TH AVENUE NEW YORK, NY 10001

C1592
 DRAWING TITLE:
 ELECTRICAL ONE-LINE
 DIAGRAM

SEAL & SIGNATURE:	DATE: 12/20/2024
	PROJECT No: 896978
	DRAWING BY: DG
	CHK BY: WM
	DWG No:
	E-601.00
SCALE: NTS	8 OF 10

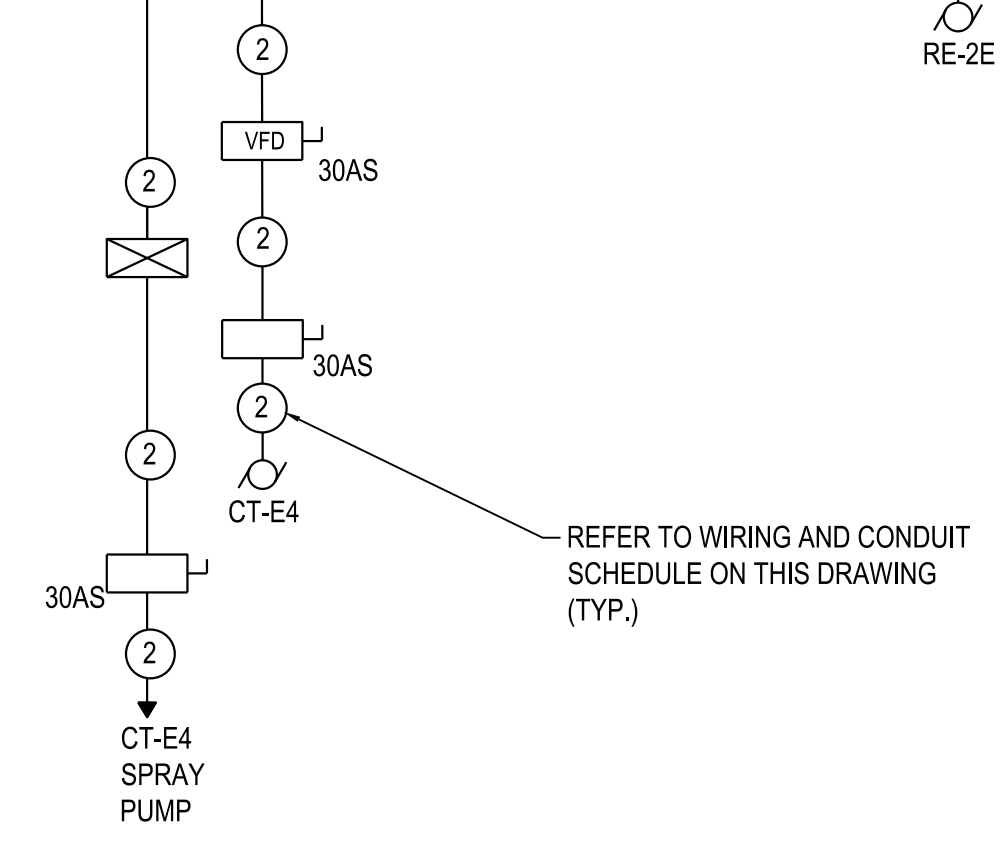
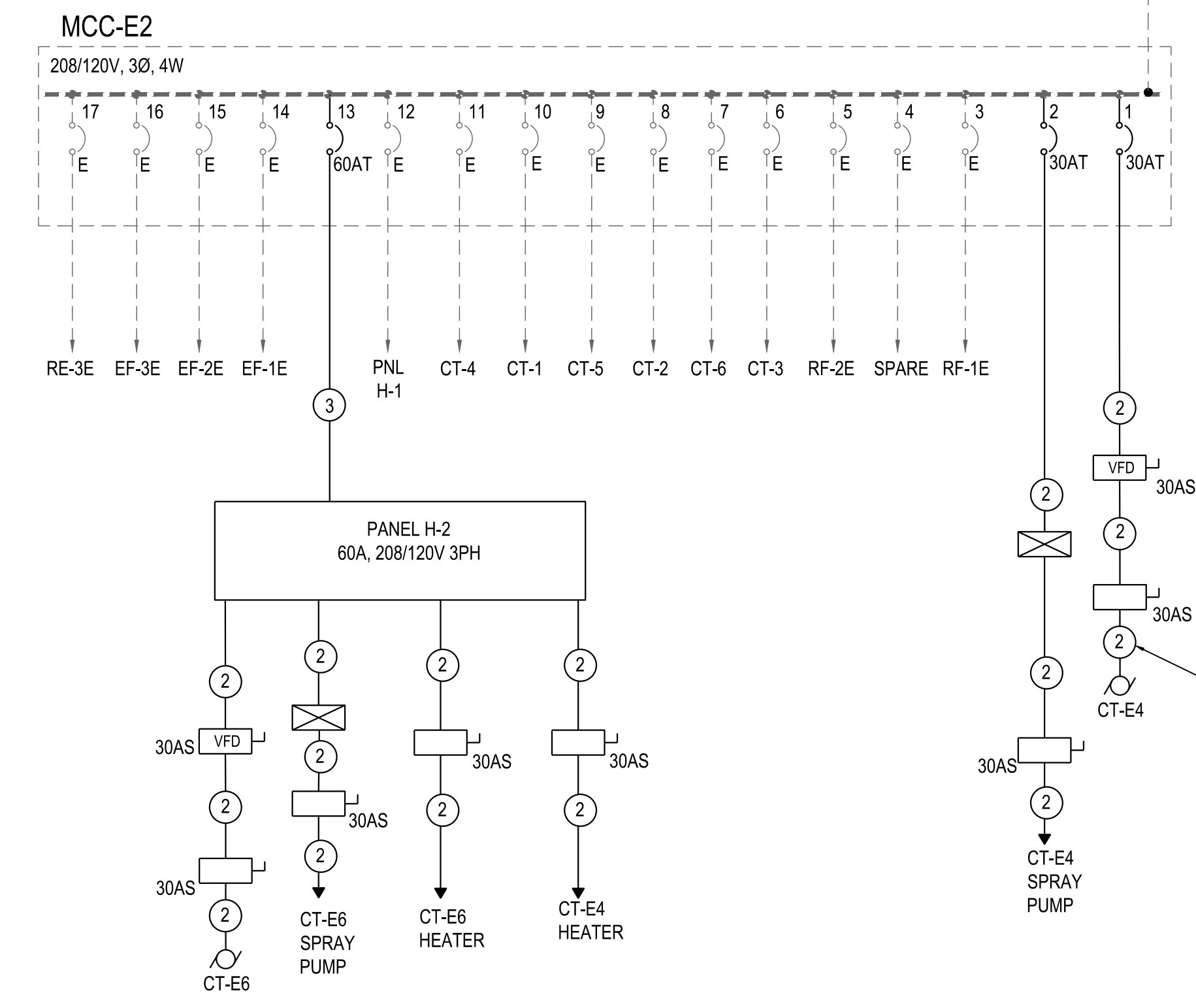
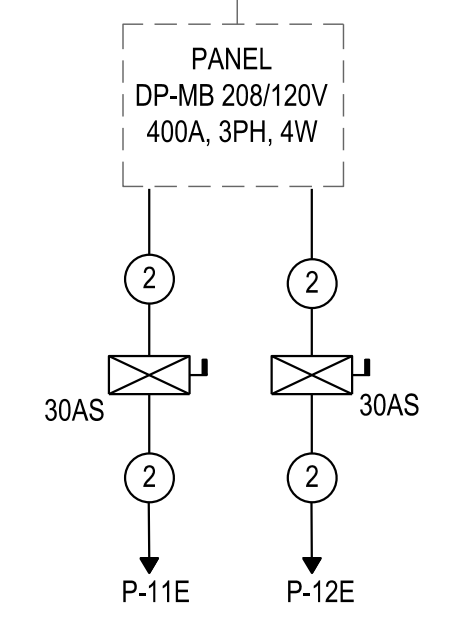
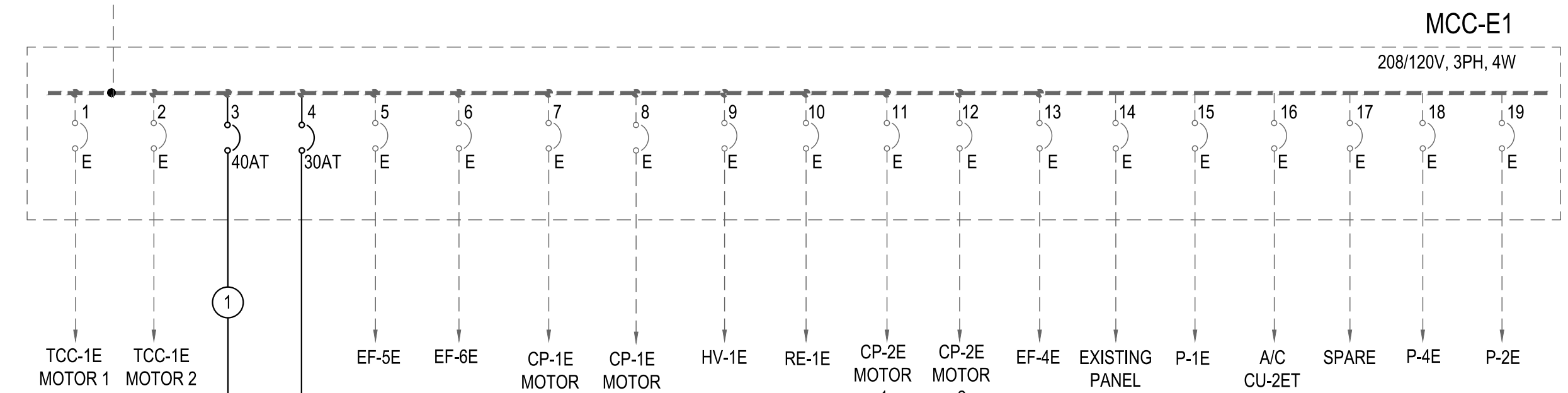
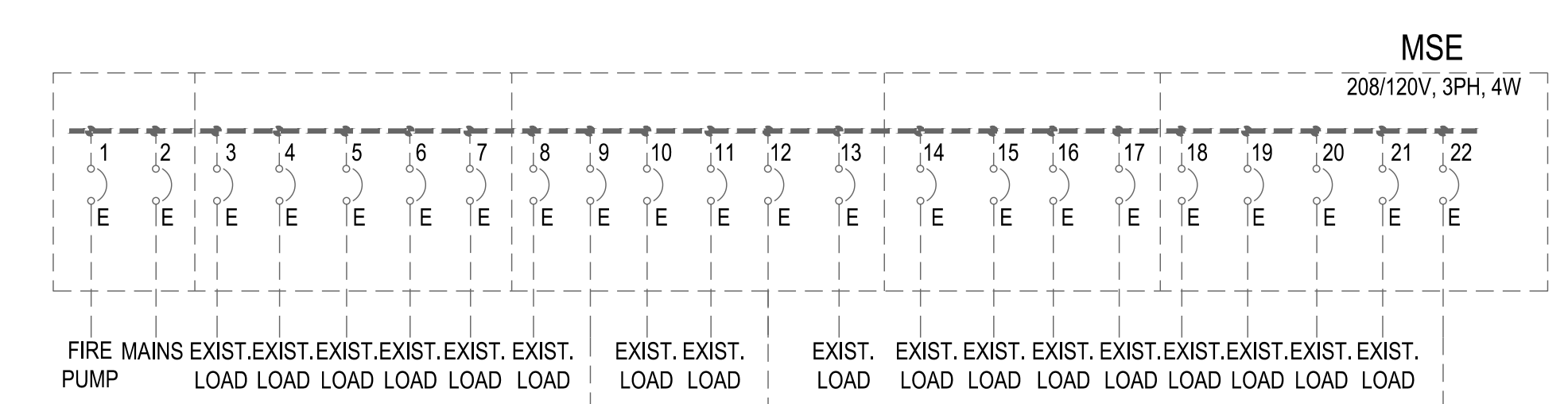
- GENERAL NOTES:
- REFER TO THE E-000 SERIES FOR SYMBOL LIST, ABBREVIATIONS, NOTES, ETC.
 - REFER TO THE E-700 SERIES FOR PANEL SCHEDULES AND ADDITIONAL INFORMATION
 - REFER TO DRAWING E-602 FOR THE ELECTRICAL RISER DIAGRAM.
 - REFER TO THE COOLING TOWER PHASING NOTES ON DWG E-102 FOR ADDITIONAL INFORMATION
 - FOR ADDITIONAL INFORMATION REGARDING THE STARTERS REFER TO THE MECHANICAL DRAWINGS

LEGEND

—	INDICATES NEW
- - -	INDICATES EXISTING TO REMAIN

WIRING AND CONDUIT SCHEDULE

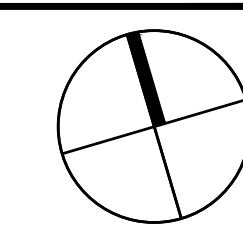
①	3#8 + 1#10G IN 3/4" C
②	3#10 + 1#10G IN 3/4" C
③	3#4 + 1#10G IN 1" C



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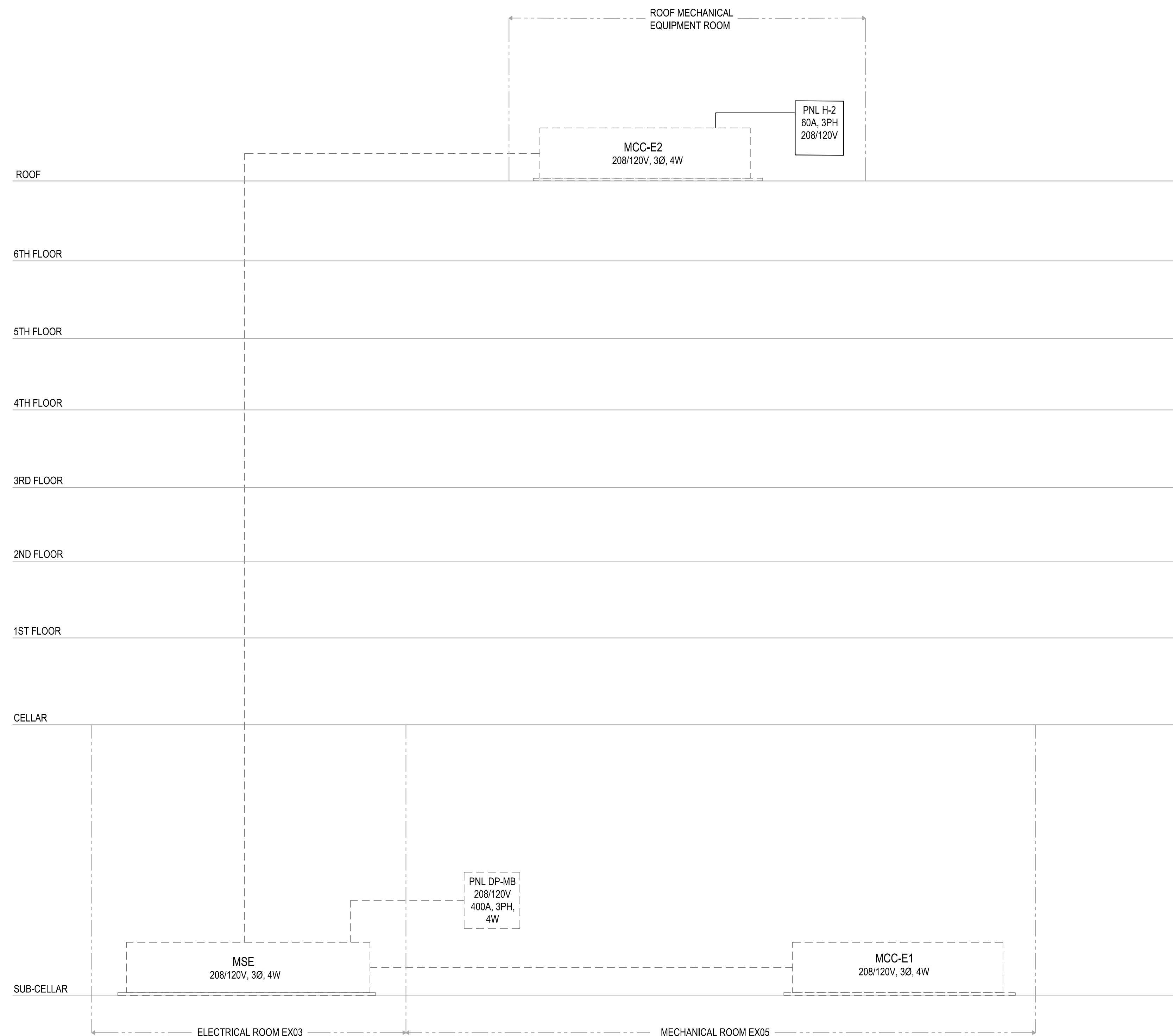




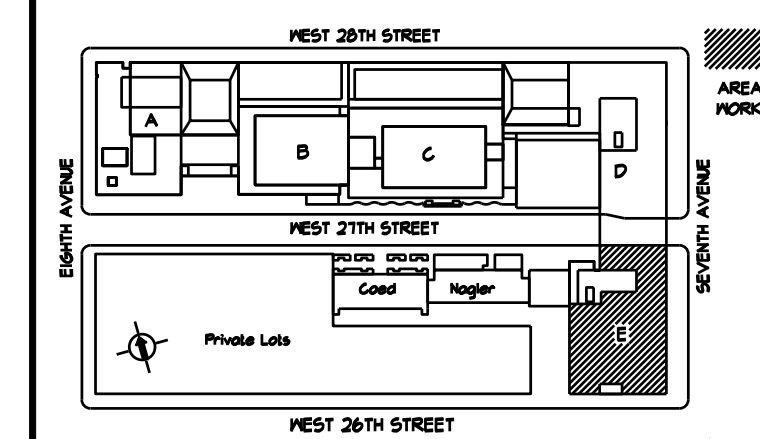
GENERAL NOTES:

1. REFER TO THE E-000 SERIES FOR SYMBOL LIST, ABBREVIATIONS, NOTES, ETC.
2. REFER TO THE E-700 SERIES FOR PANEL SCHEDULES AND ADDITIONAL INFORMATION.
3. REFER TO DRAWING E-601 FOR THE ELECTRICAL ONE-LINE DIAGRAM, WIRE SIZES, BRANCH CIRCUITS, ETC.

LEGEND	
—	INDICATES NEW
- - -	INDICATES EXISTING TO REMAIN



REV. NO.	DATE	REVISIONS
12/20/2024	ISSUED FOR BID	



LOCATION PLAN
NOT TO SCALE

BLOCK: T16
LOT: 40
BIN: 1014236

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PROJECT:
GOODMAN LOWER GALLERY
NEW HVAC EQUIPMENT
282 7TH AVENUE NEW YORK, NY 10001

C1592
DRAWING TITLE:
ELECTRICAL RISER
DIAGRAM

SEAL & SIGNATURE:	DATE: 12/20/2024
	PROJECT No: 896978
	DRAWING BY: DG
	CHK BY: WM
	DWG No:
	E-602.00
SCALE: NTS	9 OF 10

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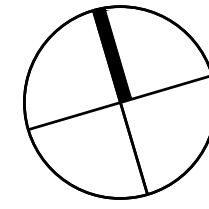


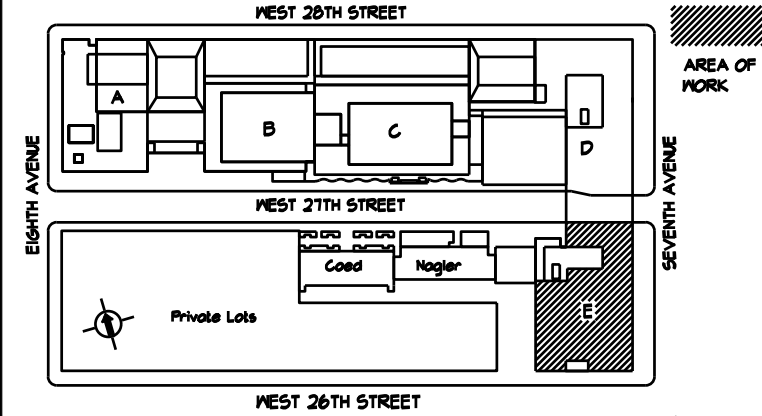
Table for MCC-E2 panel in ROOF MECH. ROOM. Includes panel details, location, and a circuit schedule table with columns for circuit number, protective device, feeder, load, and connected load.

GENERAL NOTES:

- 1. REFER TO THE E-000 SERIES FOR NOTES AND ADDITIONAL INFORMATION
2. REFER TO THE E-600 SERIES FOR ELECTRICAL ONE-LINE DIAGRAM AND WIRE SIZES.

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12/20/2024 ISSUED FOR BID



LOCATION PLAN NOT TO SCALE BLOCK: T16 LOT: 40 BIN: 1014236

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PROJECT: GOODMAN LOWER GALLERY NEW HVAC EQUIPMENT 282 7TH AVENUE NEW YORK, NY 10001

C1592 DRAWING TITLE: PANEL SCHEDULES

SEAL & SIGNATURE: DATE: 12/20/2024 PROJECT No: 896978 DRAWING BY: DG CHK BY: WM DWG No: E-701.00 SCALE: 1/8" = 1'-0" 10 OF 10

Table for MCC-E1 panel in SUB-CELLAR. Includes panel details, location, and a circuit schedule table with columns for circuit number, protective device, feeder, load, and connected load.

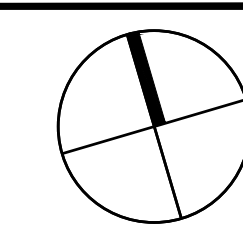
Table for DP-MB panel in SUBCELLAR. Includes panel details, location, and a circuit schedule table with columns for load, trip, and breaker type.

Table for H-2 panel in ROOF MECH. ROOM. Includes panel details, location, and a circuit schedule table with columns for load, trip, and breaker type.

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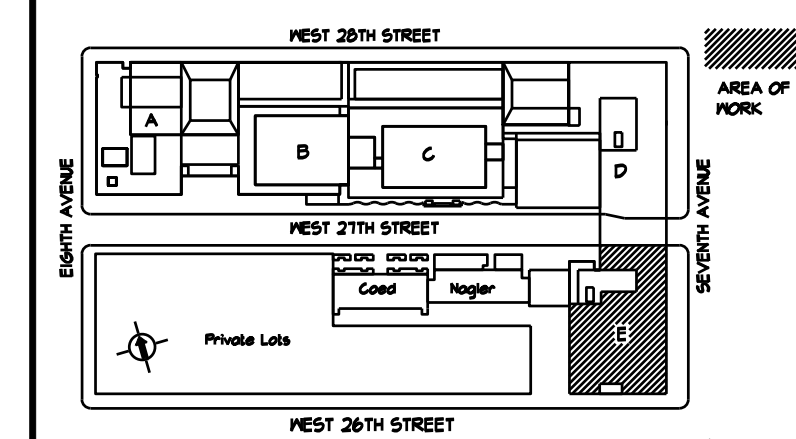
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LOCATION PLAN NOT TO SCALE BLOCK: T76 LOT: 40 BIN: 1014236

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PROJECT:
GOODMAN LOWER GALLERY
NEW HVAC EQUIPMENT
282 7TH AVENUE NEW YORK, NY 10001

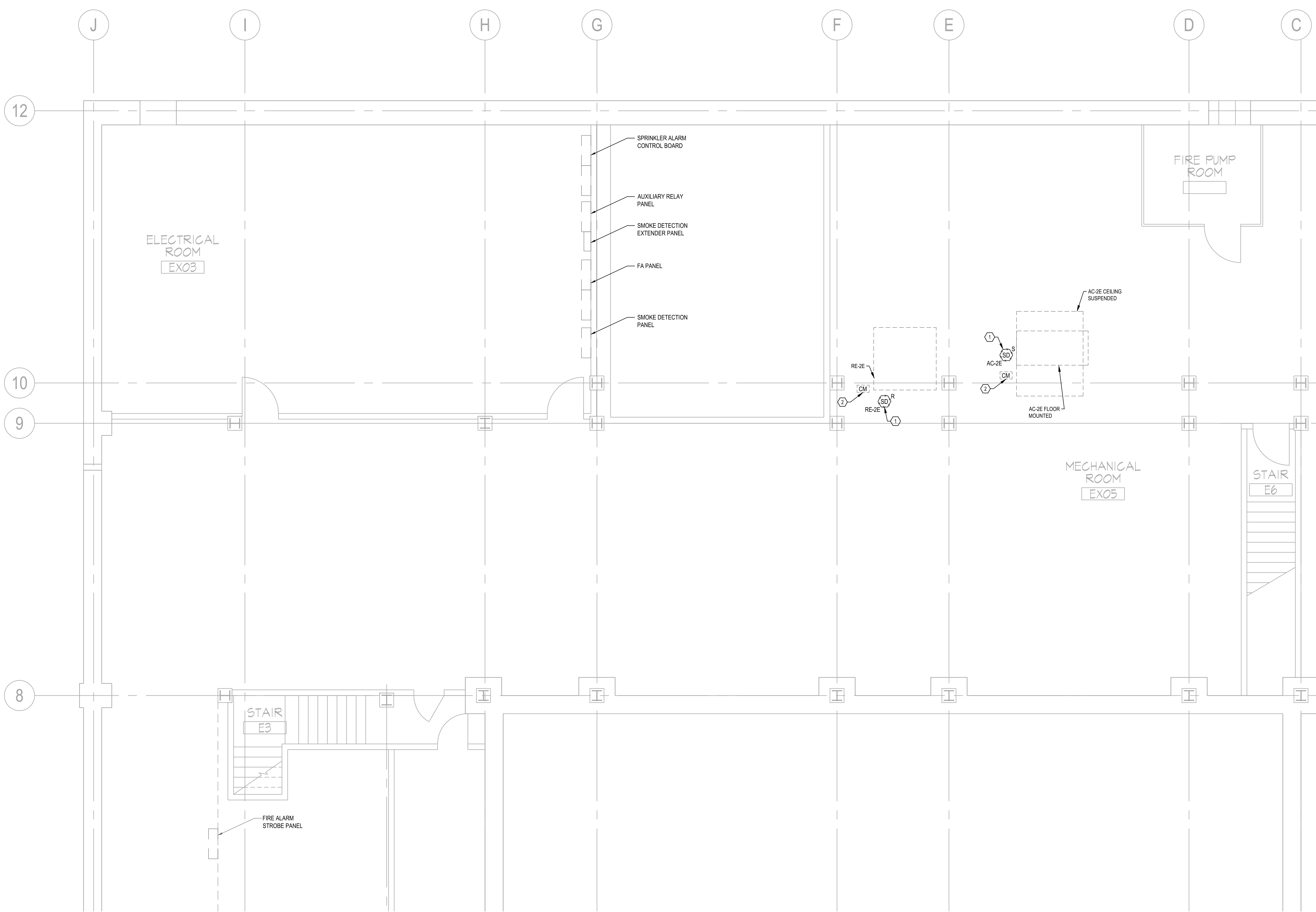
C1592
DRAWING TITLE:
SUBCELLAR FIRE ALARM
DEMOLITION PLAN

SEAL & SIGNATURE: DATE: 12/20/2024

PROJECT No: 896978
DRAWING BY: DG
CHK BY: WM
DWG No:

FA-011.00

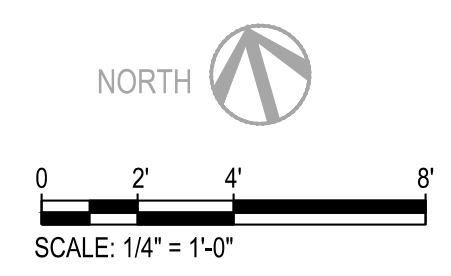
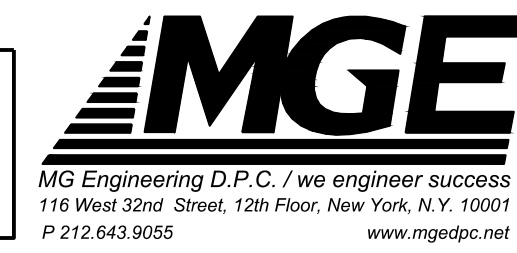
SCALE: 1/4" = 1'-0" 2 OF 3

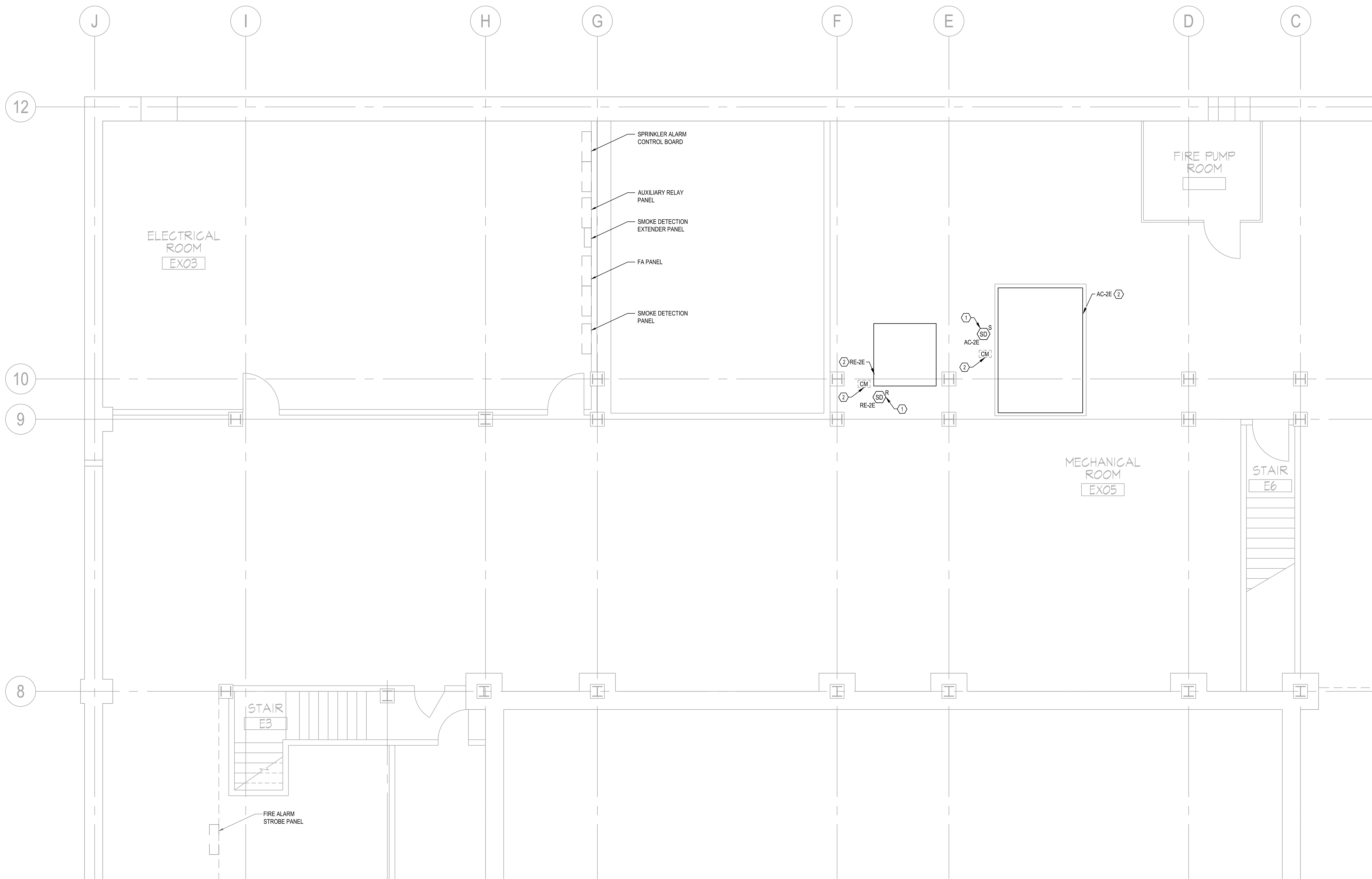


- GENERAL NOTES:
- REFER TO THE E-000 SERIES FOR NOTES, MATRIX, ABBREVIATIONS, ETC.
- KEY NOTES:
- EXISTING DUCT DETECTORS TO BE REMOVED. CONTRACTOR SHALL TRACE CIRCUITRY BACK TO THE SOURCE, ASSOCIATED CONDUIT TO REMAIN AND BE PROTECTED FOR FUTURE USE, BUT WIRING SHALL BE REMOVED AND REPLACED.
 - EXISTING FAN SHUTDOWN CONTROL MODULES TO REMAIN. REFER TO DRAWING FA-101 FOR ADDITIONAL INFORMATION

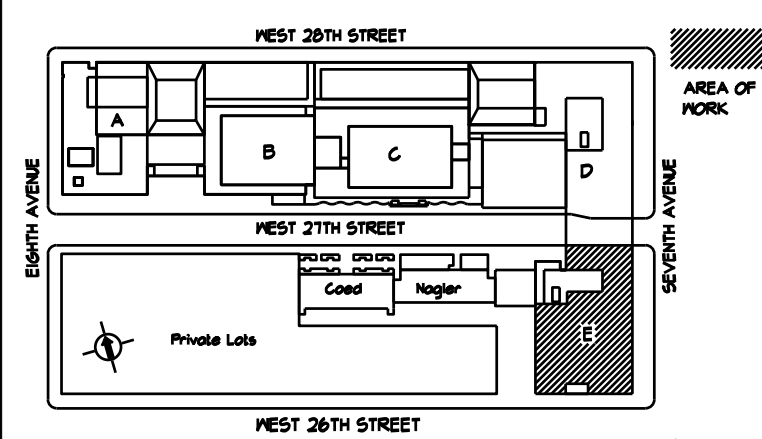
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rev. no.	date	revisions
12/20/2024	ISSUED FOR BID	



LOCATION PLAN
NOT TO SCALE

BLOCK: T76
LOT: 40
BIN: 1014236

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New York, NY 10001 / (212) 242-2955

PROJECT:
GOODMAN LOWER GALLERY
NEW HVAC EQUIPMENT
282 7TH AVENUE NEW YORK, NY 10001

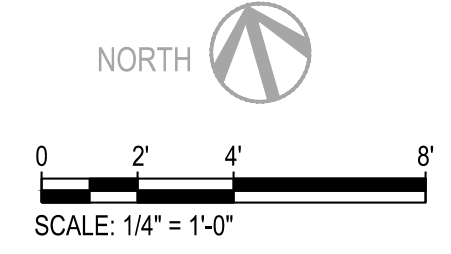
C1592
DRAWING TITLE:
SUBCELLAR FIRE ALARM
PLAN

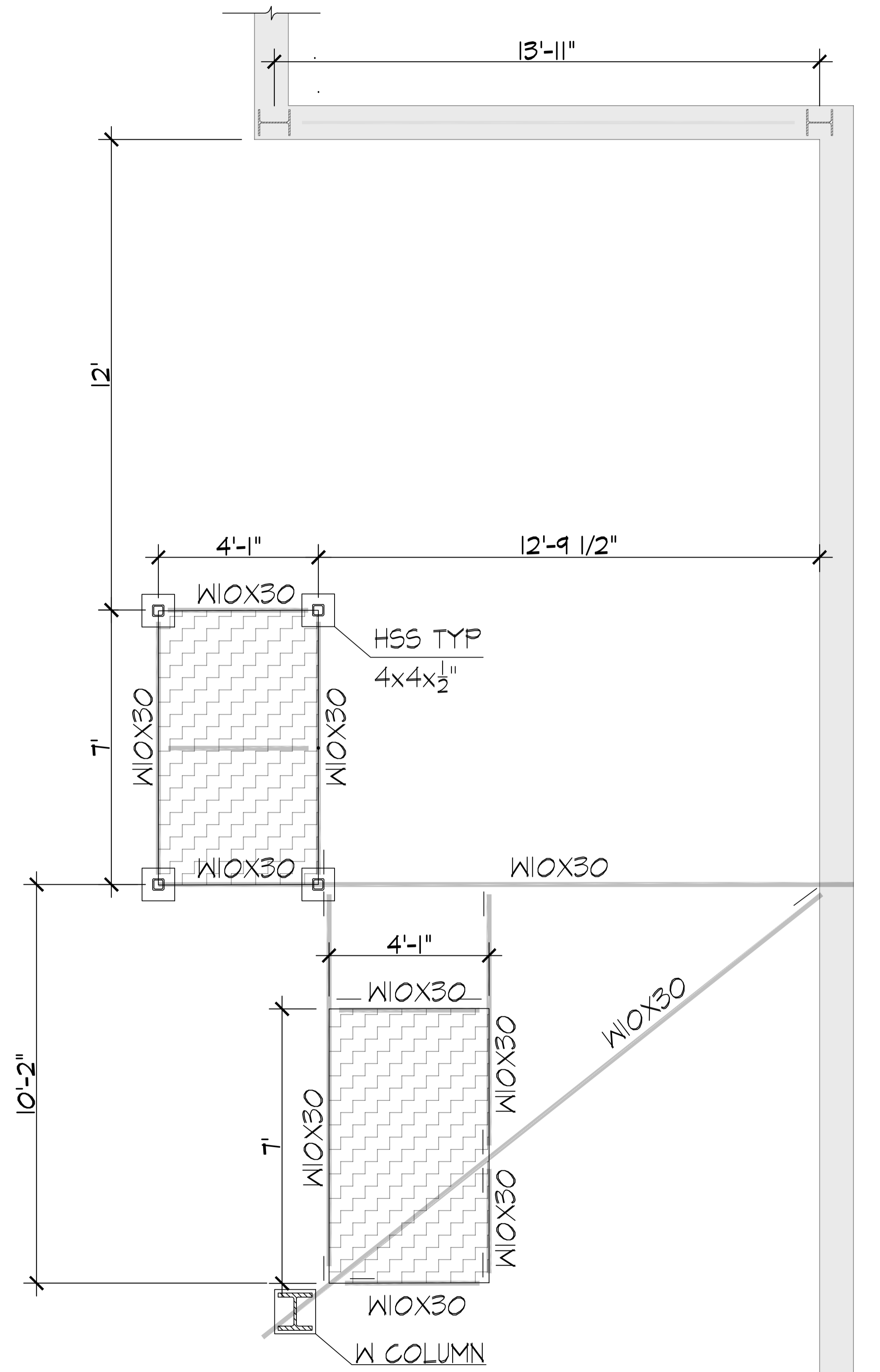
SEAL & SIGNATURE:	DATE: 12/20/2024
	PROJECT No: 896978
	DRAWING BY: DG
	CHK BY: WM
	DWG No:
	FA-101.00
	SCALE: 1/4" = 1'-0" 3 OF 3

- GENERAL NOTES:**
- REFER TO THE E-000 SERIES FOR NOTES, MATRIX, ABBREVIATIONS, ETC.
- KEY NOTES:**
- NEW DUCT DETECTORS SHALL UTILIZE THE EXISTING CONDUIT. CONTRACTOR SHALL PROVIDE NEW WIRE AND EXTEND CONDUIT AS REQUIRED. SEE E-011 FOR ADDITIONAL INFORMATION.
 - CONTRACTOR SHALL TAG AND TEMPORARILY DISCONNECT FIRE ALARM CONTROL MODULES ASSOCIATED WITH FAN SHUTDOWN FUNCTIONALITY. THE WIRING AND MODULES SHALL BE SAVED AND PROTECTED AFTER DISCONNECTION FOR REUSE BY THE NEW EQUIPMENT. CONTRACTOR SHALL EXTEND WIRING AND CONDUIT AS NEEDED.

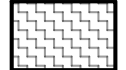

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KEY:

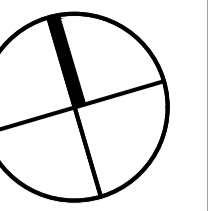
-  EXISTING UNIT
-  EX. STEEL FRAME

1 PLAN VIEW OF EXISTING STEEL FRAME
A-100 1/4" = 1'-0"

- NOTES:
1. GC TO VERIFY ALL FIELD DIMENSIONS & REPORT ANY DISCREPANCIES
 2. STEEL SHOP DRAWINGS TO BE PROVIDED FOR APPROVAL BY PE.

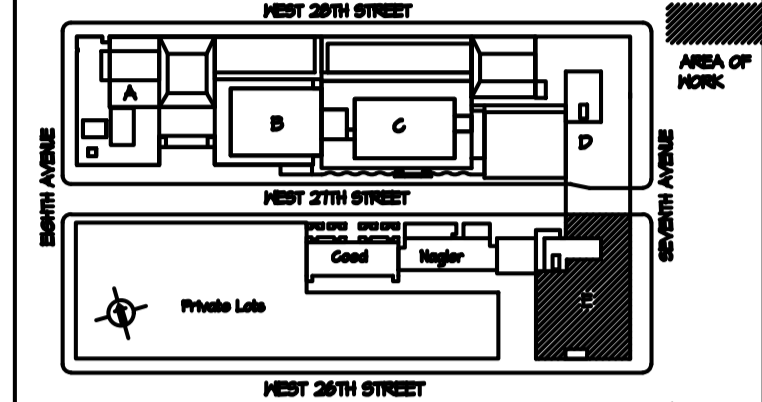
NEW YORK CITY BUILDING DEPARTMENT APPROVAL NOTE
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12/20/2024 ISSUED FOR BID



LOCATION PLAN NOT TO SCALE
BLOCK: 776
LOT: 40
BIN: 1014236

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New York, NY 10001 / (212) 242-2955

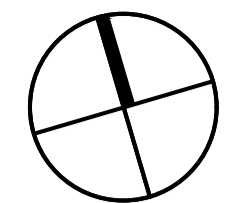
SEAL & SIGNATURE:



PROJECT:
GOODMAN LOWER GALLERY
NEW HVAC EQUIPMENT
282 7TH AVENUE NY, NY 10001
C1592

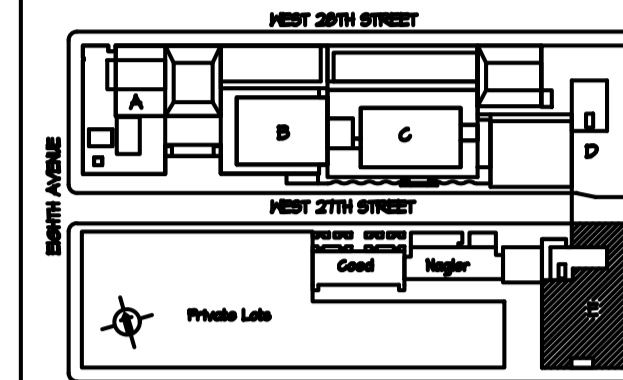
DRAWING TITLE:
EXISTING STEEL FRAME

DATE: 12/20/2024
PROJECT No: 8969.78
DRAWING BY: R.M.
CHK BY: F.I.
DWG No:
A-100.00
SCALE: AS NOTED 2 OF 4



rev. no. date revisions

12/20/2024 ISSUED FOR BID



LOCATION PLAN
NOT TO SCALE

BLOCK: 776
LOT: 40
BIN: 1014236

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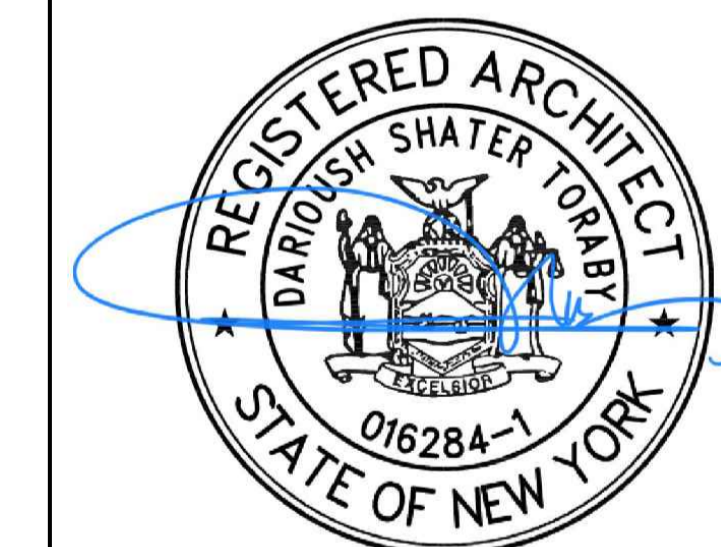
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SEAL & SIGNATURE:



PROJECT:
GOODMAN LOWER GALLERY
NEW HVAC EQUIPMENT
282 7TH AVENUE NY, NY 10001
C1592

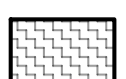



DRAWING TITLE:
PROPOSED STEEL FRAME

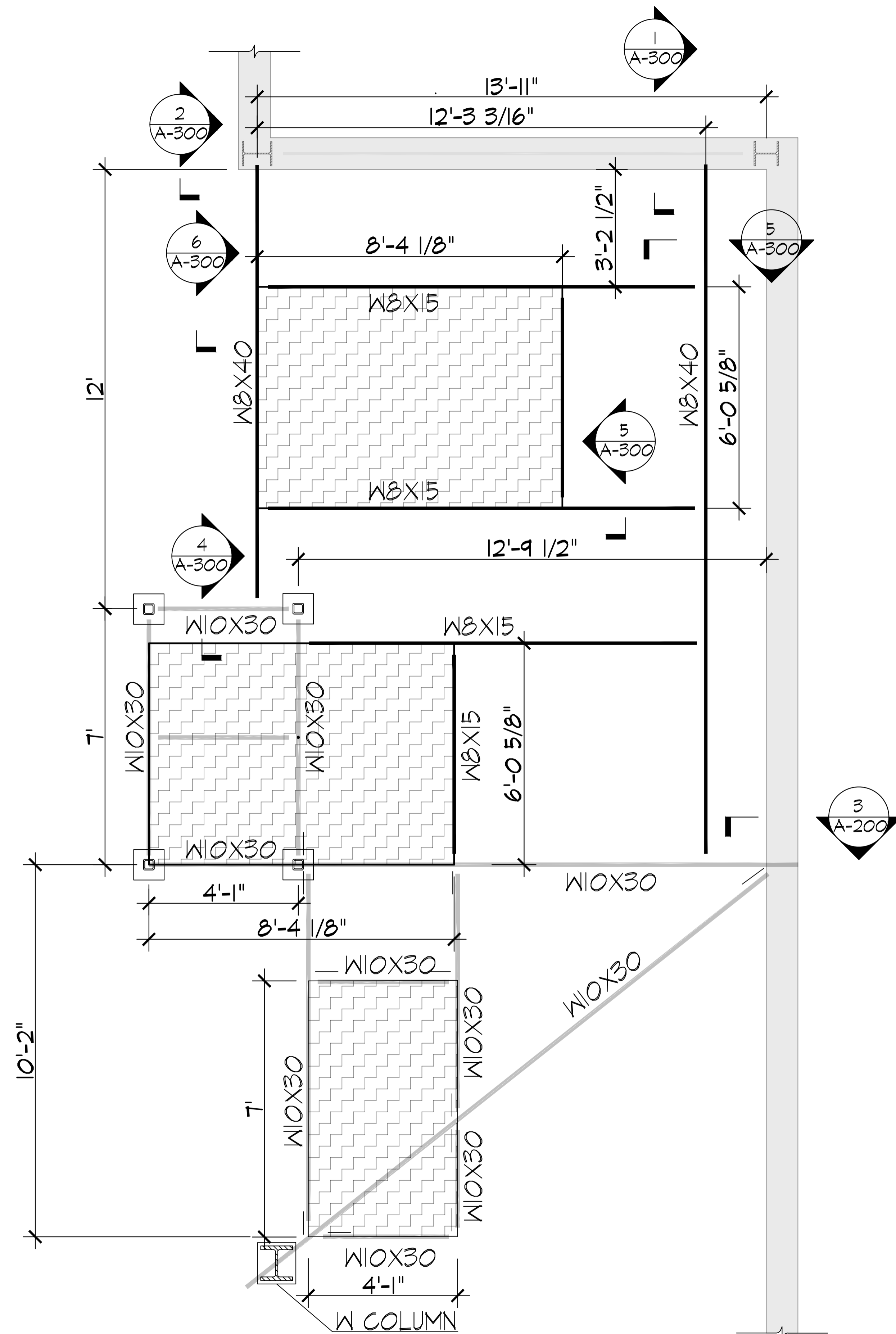
DATE: 12/20/2024
PROJECT No: 8969.78
DRAWING BY: R.M.
CHK BY: F.I.
DWG No:

A-200.00

SCALE: AS NOTED 3 OF 4

KEY:

-  PROPOSED UNIT
-  PROPOSED STEEL FRAME
-  HSS 4X4X⁵/₁₆" POST TYP.
-  EX. STEEL FRAME



1 PLAN VIEW OF PROPOSED STEEL FRAME
A-100 1/4" = 1'-0"

- NOTES:
1. GC TO VERIFY ALL FIELD DIMENSIONS & REPORT ANY DISCREPANCIES
 2. STEEL SHOP DRAWINGS TO BE PROVIDED FOR APPROVAL BY PE.

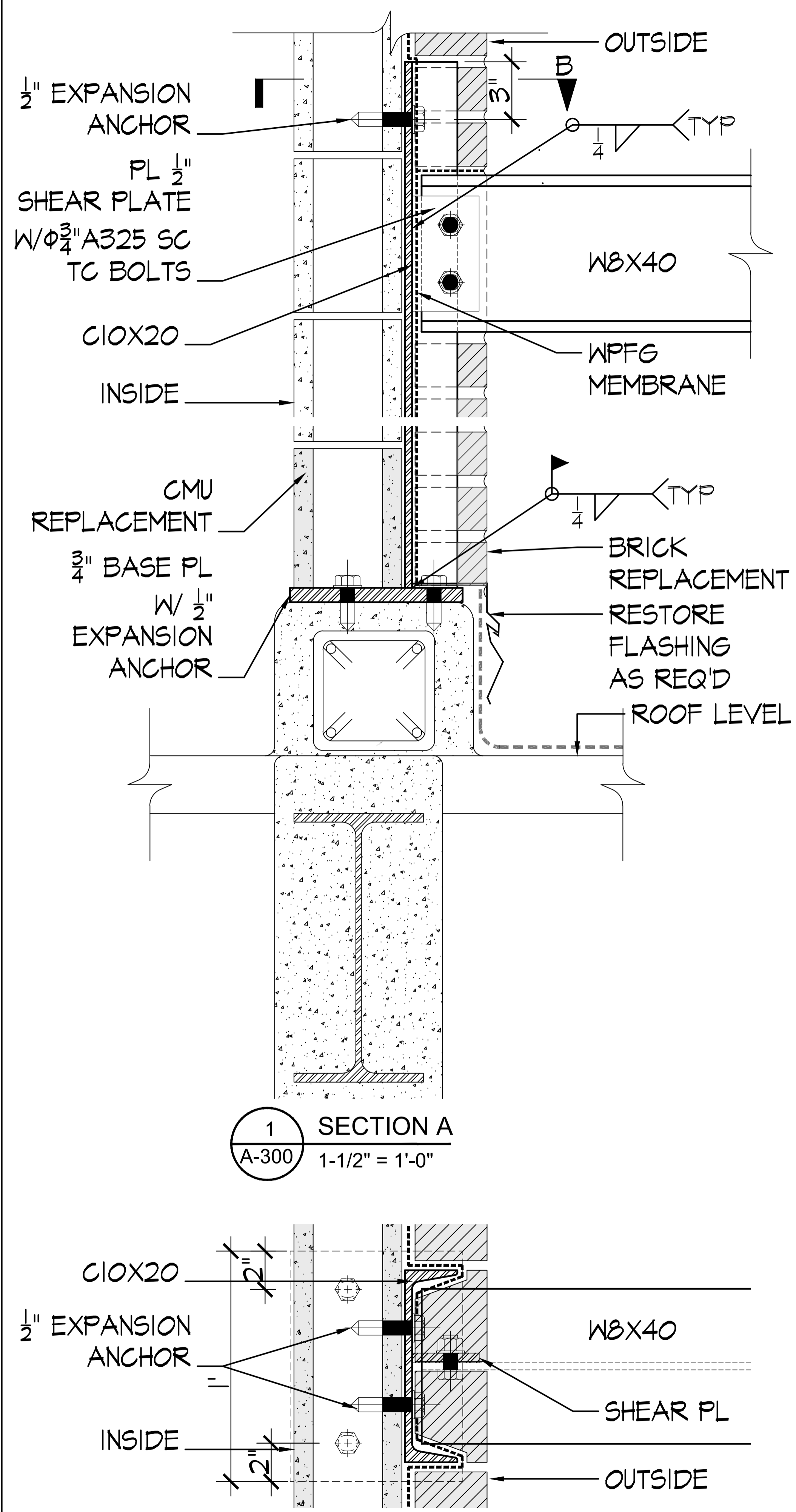
NEW YORK CITY BUILDING DEPARTMENT APPROVAL NOTE

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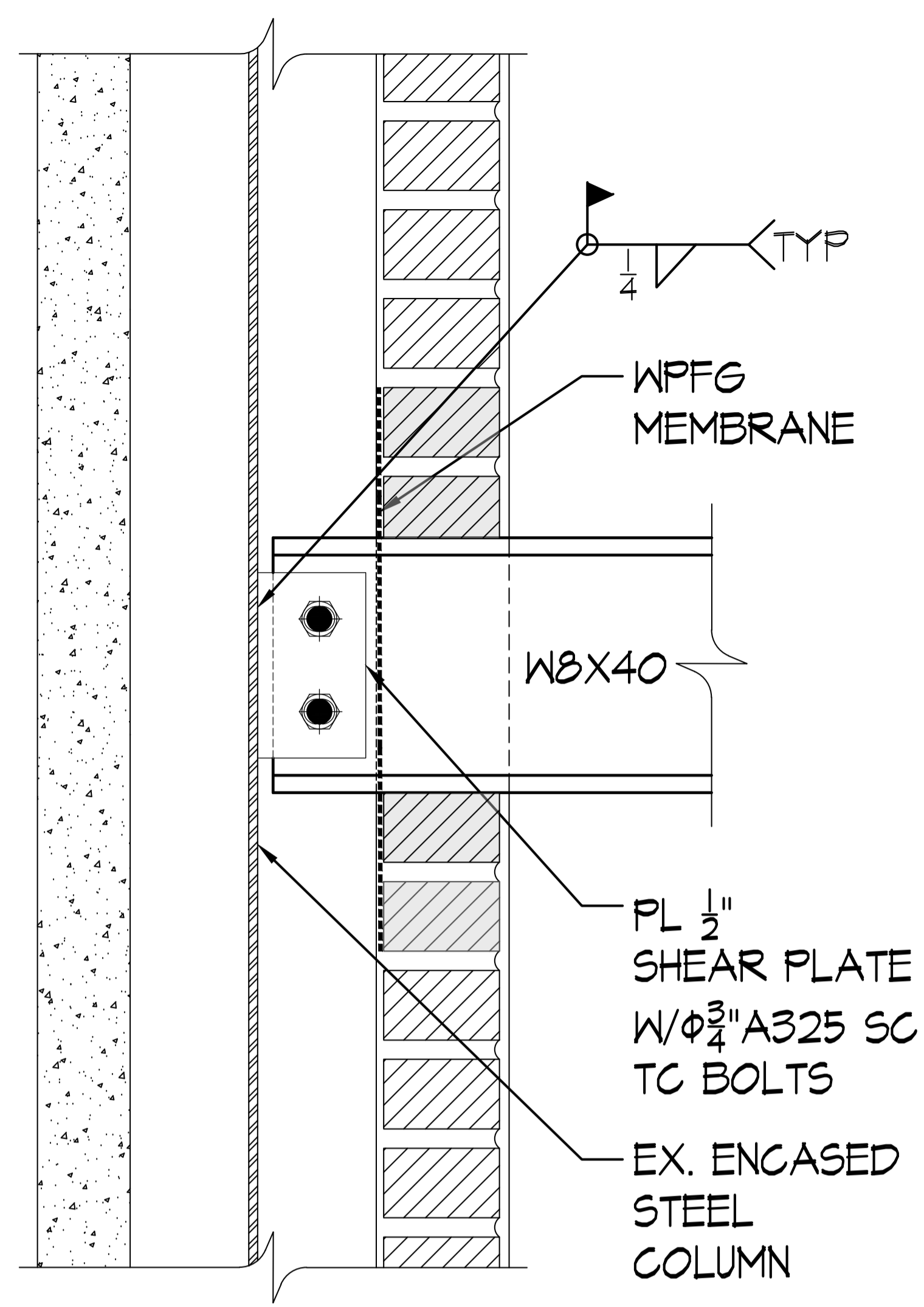
NEW YORK CITY ENERGY CONSERVATION CODE

TO THE BEST OF MY KNOWLEDGE, BELIEF AND PROFESSIONAL JUDGMENT, THESE PLANS AND SPECIFICATIONS ARE IN COMPLIANCE WITH THE 2020 NEW YORK CITY ENERGY CONSERVATION CODE.

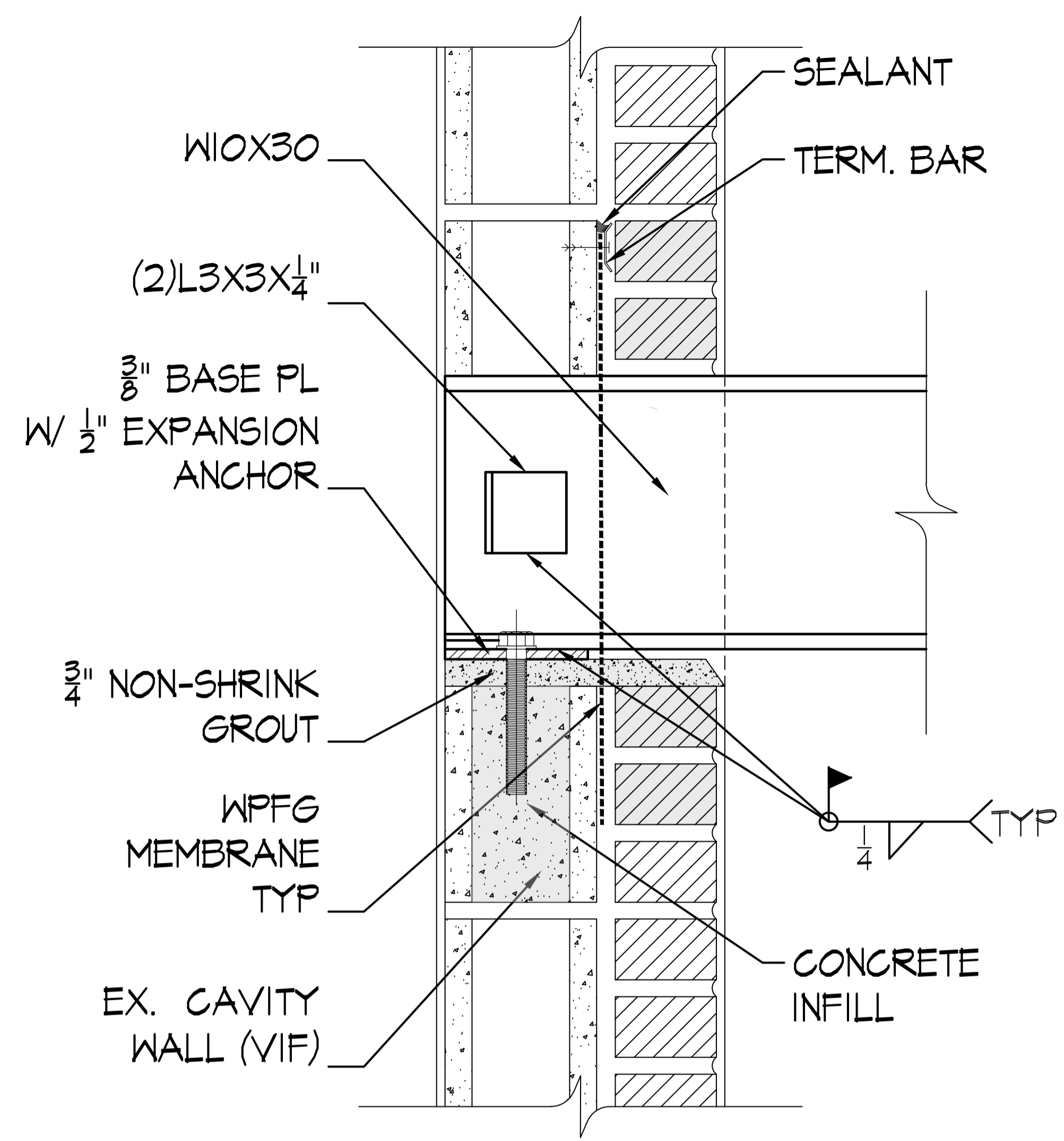




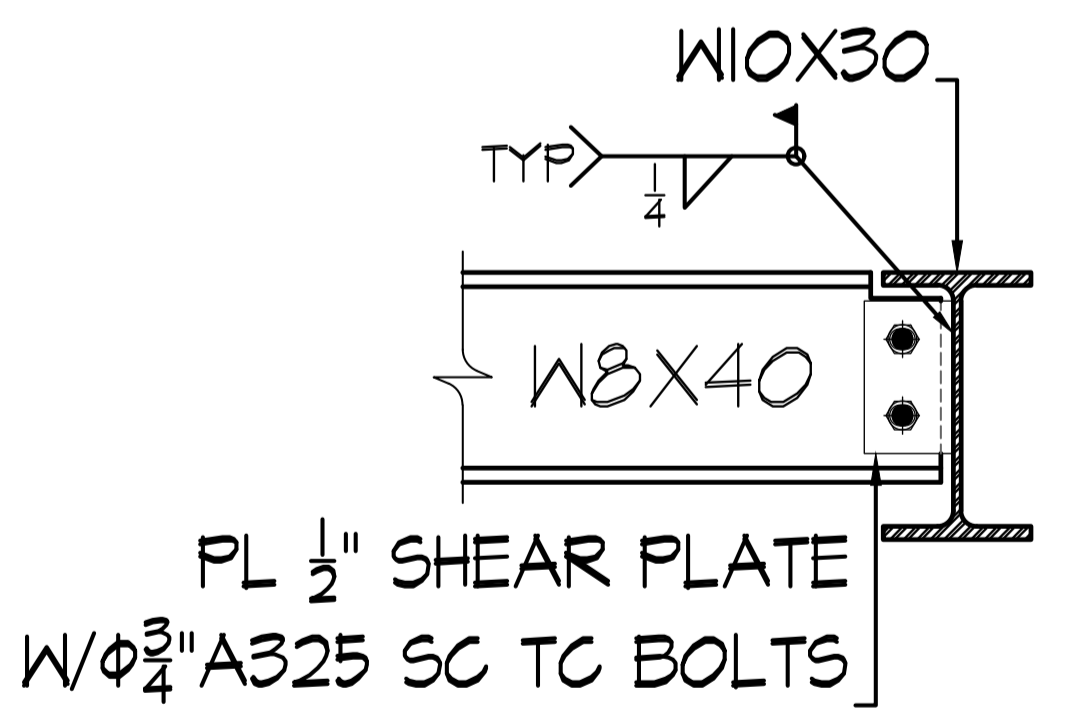
1 SECTION A
A-300 1-1/2" = 1'-0"



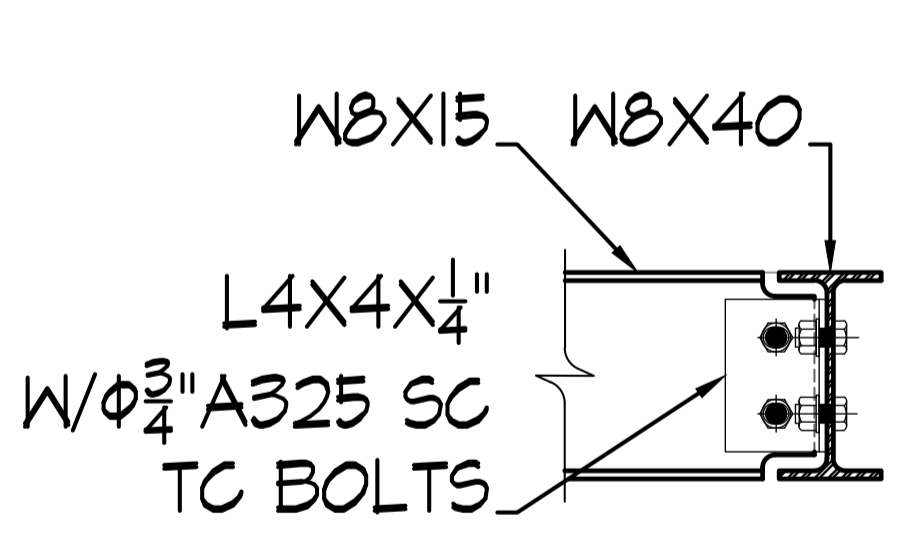
2 SECTION C
A-300 3/4" = 1'-0"



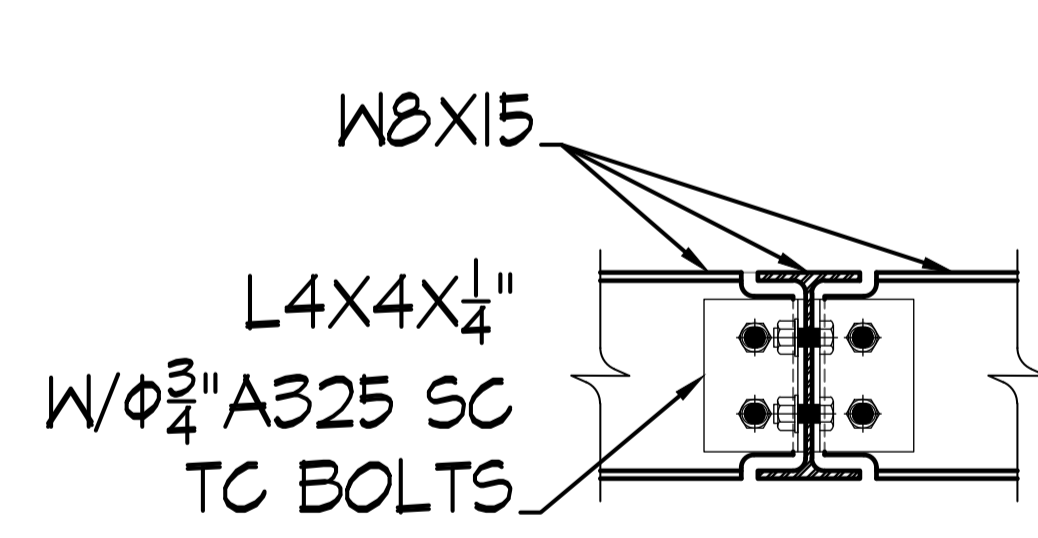
3 SECTION D
A-300 3/4" = 1'-0"



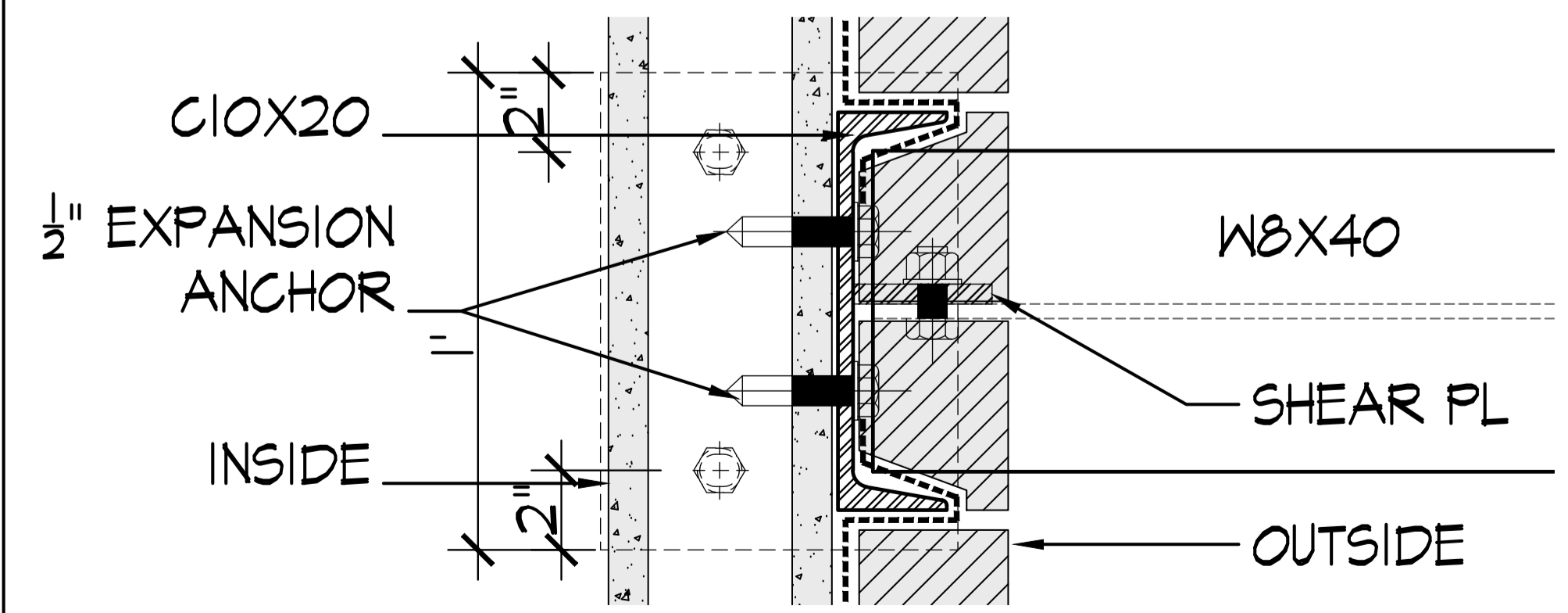
4 SECTION E
A-300 3/4" = 1'-0"



5 SECTION F
A-300 3/4" = 1'-0"



6 SECTION G
A-300 3/4" = 1'-0"



SECTION B

rev. no. date revisions

12/20/2024 ISSUED FOR BID

LOCATION PLAN NOT TO SCALE BLOCK: 776 LOT: 40 BIN: 1014236

Fashion Institute of Technology
227 West 27th Street
New York, NY 10001

MEP Consultants
MGE
MGE Engineering D.P.C. / we engineer success
116 West 32nd Street, 12th Floor, New York, N.Y. 10001
P 212 643 9055 www.mgepc.com

Environmental Consultants
EPM, Inc.
983 Marcus Ave, Suite 109
Lake Success, NY 11042 / (516) 328-1194

Structural Consultants
Darius Toraby Architects P.C.
236 West 27th Street 1401
New York, NY 10001 / (212) 242-2955

SEAL & SIGNATURE:

PROJECT:
GOODMAN LOWER GALLERY
NEW HVAC EQUIPMENT
282 7TH AVENUE NY, NY 10001
C1592

DRAWING TITLE:
CONNECTION DETAILS

DATE: 12/20/2024
PROJECT No: 8969.78
DRAWING BY: R.M.
CHK BY: F.I.
DWG No:
A-300.00

SCALE: AS NOTED 4 OF 4

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