FASHION INSTITUTE OF TECHNOLOGY
WEST COURTYARD & POMERANTZ CENTER 4TH FL
AIR HANDLER UNITS REPLACEMENT REBID
REQUEST FOR QUOTATION NUMBER C1532R

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NOTICE TO BIDDERS

SECTION I: NOTICE TO BIDDERS

FASHION INSTITUTE OF TECHNOLOGY
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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 **August 18, 2022, 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 &
WEST COURTYARD & POMERANTZ CENTER 4TH FL
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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?
- ☐ You have read and agree to comply and sign Exhibits E, F, G, and H upon award of contract. In addition to the foregoing requirements you are responsible for compliance with any additional safety directives that may be forthcoming by Executive Order or other authorized Federal, State, or local authority, between the date of issuance of this addendum the date of award.

ATTACHMENT B - CONTRACTOR REFERENCE SHEET
FASHION INSTITUTE OF TECHNOLOGY
WEST COURTYARD & POMERANTZ CENTER 4TH FL
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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
WEST COURTYARD & POMERANTZ CENTER 4TH FL
AIR HANDLER UNITS REPLACEMENT REBID
REQUEST FOR QUOTATION NUMBER C1532R

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 West Courtyard Roof and Pomerantz Center Air Handling Units replacement Project. Contractor may begin survey and procurement of materials immediately following award. A detailed scope of work is outlined in specification Section 01 12 00 "Basis of Design".

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
- 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 **August 2, 2022 at 10:00 A.M.** at the Fashion Institute of Technology, Feldman Building "C Building" Lobby, located at 27th Street (between 7th and 8th Avenues). **Failure to attend shall be grounds for rejection of your Bid. All attendees must wear a mask while at the site inspection. Please also bring a business card.**

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 **August 9, 2022 on or before 3:00 P.M**. Answers shall be provided in the form of and Addendum and be posted on the FIT purchasing department website. Reference Bid number **C1532R.**

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 **August 18, 2022, 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 **August 18, 2022, 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# **2022008666)**

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.

XIV. EXECUTIVE ORDERS/COVID-19

Contractors and Subcontractor shall comply with Governor Cuomo's Executive Order 202 & 202.16, the COVID-19 Contractor Guidance for Construction Jobsites, FIT's No Damages for Delay Clause, and the Interim Guidance Letter for Contractors. In addition to the foregoing requirements, you are responsible for compliance with any additional safety directives that may be forthcoming by Executive Order between the date of issuance of this addendum the date of award.

In the event the Contractor's performance under this agreement is delayed or interfered with arising out of or connected to the COVID19 pandemic, including but not limited to worker availability, government-mandated suspension of work or any other emergency action associated with protecting the health and safety of the workforce, which leads to a site closure, delay or suspension of the work, Contractor or any subcontractors hereby acknowledge their only remedy under this agreement is to request an extension of time for the performance of the unfinished work as herein provided; under no circumstances will Contractor or any subcontractors or vendors be entitled to any increase in the subcontract price or additional compensation for any alleged costs, expenses or damages as a consequence of such delays or interference, including but not limited to: i) General Condition Costs (e.g.: site clean-up, home and field office expenses, telecommunications equipment or use , and/or supervisory costs including but not limited to Project Manager, Project Engineer, Superintendent and Foremen, etc.), ii) escalation (increases in material costs, transportation charges or any alleged wage or salary increases) or iii) any alleged inefficiencies or loss of productivity. NOTE: The above examples are not intended to be an exhaustive list of all the alleged costs, expenses or damages excluded by this clause. It is offered only as an example of some costs within each category.

Owner shall review the Contractors request for delay and, if acceptable, shall extend the time of performance by Change Order for such reasonable time as the Owner, in its sole discretion, may determine.

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 West Courtyard and Pomerantz Center 4th floor Air Handler Units Replacement.**

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 **West Courtyard and Pomerantz Center 4th floor Air Handler Units Replacement** 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 **September 30, 2022**. **The project shall be Substantially Completed no later than August 11, 2023.** 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 https://www.fitnyc.edu/policies/. 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.**

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 &
WEST COURTYARD AND POMERANTZ CENTER 4TH FL
AIR HANDLER UNITS REPLACEMENT REBID
REQUEST FOR QUOTATION NUMBER C1532R
NYS PREVAILING WAGE SCHEDULE PRC # 2022008666

BID BREAKDOWN

Line	Description	Total Labor Cost	Total Materials, Tools & Equipment	Line Total
1	SELECTIVE DEMOLITION	$	$	$
2	MASONRY	$	$	$
3	HVAC SPECIALTIES	$	$	$
4	HVAC AIR HANDLING UNITS	$	$	$
5	HVAC DUCTWORK	$	$	$
6	HVAC PIPING	$	$	$
7	HVAC AUTOMATIC TEMPERATURE CONTROLS	$	$	$
8	ELECTRICAL	$	$	$
9	FIRE ALARM	$	$	$
10	GENERAL REQUIREMENTS	$	$	$
11	GENERAL CONDITIONS	$	$	$

TOTAL BID PRICE (1-11) **$_____**

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

Table of Contents
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	200
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	200
Subcontractor Total	$1,200
10% Contractor overhead and profit on base cost	100
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	40,000
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	3,000
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	3,000
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	1,000
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	3,000
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 Contactor 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 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)

_____ (City, State, Zip)

_____ (Address)

_____ (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 Principalor 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

TRADE PAYMENT BREAKDOWN

PROJECT: _____ **CONTRACT # C**

CONTRACTOR: _____

			CONTRACT AMOUNT			
ITEM no.	**DESCRIPTION**	**UNIT MEAS.**	**QUANTITY**	**LABOR**	**MATERIAL**	**TOTAL**
1	Mobilization	LS				
2	Bonds	LS				
3	Insurance	LS				
4	Safety Program	MTLY				
5	Supervision	MTLY				
6	Permits/Licenses	LS				
7	CPM Schedules	LS				
8	Samples - Submittals	LS				
9	Data Submittals	LS				
10	Field Coordination	MTLY				
11	Coordinate with HVAC, Electrical	MTLY				
12	Coordinate with Plumbing/Fire Prevention	MTLY				
13	Coordinate with Kitchen Equipment Contractor	MTLY				
14	Temporary Electric	LS				
15	Temporary Light	LS				
16	Temporary Facilities	MTLY				
17	Fire Prevention	LS				
18	Temporary Field Office	MTLY				
19	Material Hoisting	LS				
20	Hoisting Operations	LS				
21	Storage	LS				
22	Warranties, Etc.	LS				

EXHIBIT A: SAFETY EHS PLAN

EXHIBIT A. SAFTEY EHS PLAN

FASHION INSTITUTE OF TECHNOLOGY

OUTLINE FOR PREPARING WORK-SPECIFIC ENVIROMENT, 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 liner 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 1

Project Name: _____Bid Number: _____

CONTACTOR ORGANIZATION CHART AND SAFETY DATA

COMPANY	:	Name: Address: Phone:
President	:	Name: Phone:
Vice President – Operations		Name: Phone:
Director of Environmental, Health, and Safety	:	Name: Phone:
Contractor EHS Program Development	:	Name: Phone:
OSHA Total Case Recordable Rate (TCRR)	:	
Days Away from work, or Restricted work or job Transfer (DART)	:	
Experience Modification Rate (EMR)	:	

Listing of On-site Subcontractors for project work, as applicable -

COMPANY NAME	ADDRESS	PHONE NUMBER	TASKS

TABLE 2

ON-SITE SUPERVISORY PERSONNEL

TITLE	:	**NAME(S) AND ON-SITE PHONE NUMBER**
On-site EHS Coordinator	:	
Contractor Project Managers	:	
FIT's Project Manager(s)	:	
Contractor's Competent Persons		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
• Confined Spaces	:	
• Excavations	:	
• Industrial Hygiene	:	
• Electrical--Lock Out/Tag Out	:	
• PPE, Respiratory Protection	:	
• Hazard Communication (Required for each department and project. Identify responsible employee for each subcontractor)	:	
• Fall Protection	:	
• Scaffolds	:	
• Cranes & Derricks	:	
• 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 3

LISTING OF REQUIRED EMPLOYEE/SUPERVISORY BRIEFINGS

Page 1 of 1

DATE	TOPIC	Comments	TYPE (Monthly Supervisor/Bi-weekly Employee/Supervisor	Comments
	FIT Haz Com Briefing	At start of Work		
	Briefing for FIT Employees in work area(s)	FIT briefing for all FIT Department Supervisors in areas where work may potentially affect FIT employees or students at start of work. Record name of FIT employee(s) briefed	Complete Daily Safety Management Work Permit (See Appendix 1)	
	Review of FIT Emergency Evacuation Procedures	At start of Work		

TABLE 4

EMERGENCY CONTACT NAMES & TELEPHONE NUMBERS

TITLE	CONTACT NAME	EMERGENCY PHONE NUMBERS
Contractor: MAIN OFFICE		
Contractor President:		
On-site EHS Coordinator		
FIT Facilities Management	**Executive Director:** George Jefremow **Assoc. Executive Director:** Allen King	Phone: 212-217-4423 Phone: 212-217-4424
FIT Environmental, Health and Safety Department	**Director:** Paul DeBiase paul_debiase@fitnyc.edu **Acting Coordinator:** Kathy Espinoza-Caraba kathy_espinozacaraba@fitnyc.edu	Phone: 212-217-3752 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 ofTechnology

Sam Li, Deputy Director of Purchasing
227 W27th Street
New York NY 10001

Schedule Year	2022
Date Requested	07/26/2022
PRC#	2022008666

Location	Fashion Institute ofTechnology
Project ID#	C1532R
Project Type	Complete the West Courtyard Roof and Pomerantz Center Air Handling Units replacement 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 Wage Case Number (PRC#) has been assigned to the schedule(s) for your project.

The schedule is effective from July 2022 through June 2023. 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.

There are very few exceptions to this rule. Complete information regarding these exceptions is available on the "Request for a dispensation to work overtime" form (PW30) and "4 Day / 10 Hour Work Schedule" form (PW 30.1).

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 form 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 12240; 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, contemperaneous, 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 NYSDOL 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 12240 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.

Fashion Institute ofTechnology

Sam Li, Deputy Director of Purchasing
227 W27th Street
New York NY 10001

Schedule Year 2022
Date Requested 07/26/2022
PRC# 2022008666

Location Fashion Institute ofTechnology
Project ID# C1532R
Project Type Complete the West Courtyard Roof and Pomerantz Center Air Handling Units replacement 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: $_____

Approximate Starting Date: ____/____/____

Approximate Completion Date: ____/____/____

Contract Type:
- [ ] (01) General Construction
- [ ] (02) Heating/Ventilation
- [ ] (03) Electrical
- [ ] (04) Plumbing
- [ ] (05) Other : _____

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

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

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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 12240

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.

NEW YORK STATE OF OPPORTUNITY. Department of Labor

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)

New York State Department of Labor
Bureau of Public Work

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.

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/public-work-and-prevailing-wage

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) 568-5156		

* 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 of 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 requirement s 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 that 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 12240

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 — 07/01/2022

JOB DESCRIPTION Asbestos Worker **DISTRICT** 4

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

WAGES
Per Hour: 07/01/2022

Asbestos Worker Removal & Abatement Only*	$ 44.00

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

SUPPLEMENTAL BENEFITS
Per Hour:

Asbestos Worker Removal & Abatement Only	$ 8.70

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	$ 8.70

4-12a - Removal Only

Boilermaker — 07/01/2022

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: 07/01/2022

Boilermaker	$ 63.38
Repairs & Renovations	63.38

SUPPLEMENTAL BENEFITS
Per Hour:

Boilermaker	32% of hourly
Repair $ Renovations	Wage Paid + $ 25.38

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 (D, O) on OVERTIME PAGE
Repairs & Renovation see (B,E,Q)

HOLIDAY
Paid: See (8, 16, 23, 24) on HOLIDAY PAGE
Overtime: See (5, 6, 8, 11, 12, 15, 16, 22, 23, 24, 25) on HOLIDAY PAGE
NOTE: *Employee must work in pay week to receive Holiday Pay.

**Employee gets 4 times the hourly wage rate for working Labor Day.

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:

Apprentice(s)	32% of Hourly Wage Paid Plus Amount Below
1st Term	$ 19.41
2nd Term	20.26
3rd Term	21.11
4th Term	21.96
5th Term	22.82
6th Term	23.68
7th Term	24.52

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

4-5

Carpenter — 07/01/2022

JOB DESCRIPTION Carpenter **DISTRICT** 8

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

WAGES
Per hour: 07/01/2022

Piledriver	$ 67.70
Dockbuilder	$ 67.70

SUPPLEMENTAL BENEFITS
Per hour:

Journeyworker	$ 44.54

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
$29.65	$35.25	$43.63	$52.02

Supplemental benefits per hour:

All Terms: $ 31.03

8-1556 Db

Carpenter — 07/01/2022

JOB DESCRIPTION Carpenter **DISTRICT** 8

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

WAGES

Per hour: 07/01/2022

Carpet/Resilient
Floor Coverer $ 63.30

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

SUPPLEMENTAL BENEFITS
Per hour:
$ 39.40

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
$ 26.65	$ 30.15	$ 34.90	$ 43.78

Supplemental benefits per hour:

1st	2nd	3rd	4th
$ 14.80	$ 15.80	$ 18.90	$ 19.90

8-2287

Carpenter 07/01/2022

JOB DESCRIPTION Carpenter **DISTRICT** 8

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

WAGES
Per Hour: 07/01/2022

Marine Construction:

Marine Diver $ 82.57
Marine Tender 62.11

SUPPLEMENTAL BENEFITS
Per Hour:

Journeyworker $ 44.54

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

HOLIDAY
Paid: See (18, 19) on HOLIDAY PAGE
Overtime: See (5, 6, 10, 11, 13, 16, 18, 19) on HOLIDAY PAGE

REGISTERED APPRENTICES
Wages per hour:
One (1) year terms.

1st year $ 29.65
2nd year 35.25
3rd year 43.63
4th year 52.02

Supplemental Benefits
Per Hour:

All terms $ 31.03

8-1456MC

Carpenter **07/01/2022**

JOB DESCRIPTION Carpenter **DISTRICT** 8

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

WAGES
Per hour: 07/01/2022

Building
Millwright $ 70.42

SUPPLEMENTAL BENEFITS
Per hour:

Millwright $ 43.16

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

HOLIDAY
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.
$37.99	$44.61	$51.23	$64.47

Supplemental benefits per hour:
One (1) year terms:

1st.	2nd.	3rd.	4th.
$29.01	$31.54	$34.72	$39.14

8-740.1

Carpenter **07/01/2022**

JOB DESCRIPTION Carpenter **DISTRICT** 8

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

WAGES
Per Hour:
07/01/2022

Timberman $ 63.06

SUPPLEMENTAL BENEFITS
Per Hour:
07/01/2022

$ 43.75

OVERTIME PAY
See (B, E, E2, Q) 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:
One (1) year terms:

1st	2nd	3rd	4th
$27.72	$32.83	$40.48	$48.14

Supplemental benefits per hour:
All terms $ 30.74

8-1556 Tm

Carpenter **07/01/2022**

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:	07/01/2022	10/18/2022
Core Drilling:		
Driller	$ 44.57	$ 46.38
Driller Helper	35.77	36.97

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.

SUPPLEMENTAL BENEFITS
Per hour:

Driller and Helper	$ 28.30	$ 28.85

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 **07/01/2022**

JOB DESCRIPTION Carpenter **DISTRICT** 8

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

PARTIAL COUNTIES
Nassau: That portion of the county that lies west of Seaford Creekand south of the Southern State Parkway.

WAGES

Per hour:	07/01/2022
Show Exhibit	$ 64.50
Bldg. Carpenter	63.30*

* Not applicable in Putnam County

SUPPLEMENTAL BENEFITS
Per hour worked:

Show Exhibit	$ 44.20
Bldg. Carpenter	39.40

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.
$26.75	$32.50	$40.50	$48.75

Supplemental benefits per hour:
All terms $ 30.25

Wages per hour: Bldg. Carpenter
(1) year terms:

1st	2nd	3rd	4th
$21.65	$25.10	$29.85	$38.73

Supplemental benefits per hour:

1st	2nd	3rd	4th
$14.82	$15.87	$18.97	$19.97

8-EXHIB

Carpenter - Building High Rise Concrete Form Work — 07/01/2022

JOB DESCRIPTION Carpenter - Building High Rise Concrete Form Work **DISTRICT** 8

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

PARTIAL COUNTIES
Nassau: Work performed beginning at the Intersection of the City Line & North Shore of Long Island, then running Southerly to the Southern State Pkwy, then East to Seaford Creek in Nassau County, then South to Atlantic Ocean, then West to Southern tip of Richmond County

WAGES
Per hour: 07/01/2022
Building High Rise:

Concrete Carpenter A	$ 59.21
Concrete Carpenter B*	$ 42.04

*NOTE: Tier B work excludes erection of decking, perimeter debris netting, leading edge work, self & climbing form systems and the installation of cocoon systems.

SUPPLEMENTAL BENEFITS
Per hour:

Concrete Carpenter A	$ 35.86
Concrete Carpenter B	$ 15.75

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

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

REGISTERED APPRENTICES
Wage per hour:

One (1) year terms:

	1st	2nd	3rd	4th
Concrete Carpenter Apprentices	$ 18.92	$ 26.48	$ 33.19	$ 40.96

Supplemental benefits per hour:

	All Terms
Concrete Carpenter: Apprentices	$ 15.75

8-NYC Bldg/212

Carpenter - Heavy&Highway — 07/01/2022

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:

	07/01/2022
Heavy & Highway	
Carpenter	$ 67.70

SUPPLEMENTAL BENEFITS
Per hour worked:

Heavy & Highway	
Carpenter	$ 44.54

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	$ 29.65	$ 35.25	$ 43.63	$ 52.02

Supplemental Benefits:
Per Hour:

All terms
$ 31.03

8-NYC H/H

Electrician 07/01/2022

JOB DESCRIPTION Electrician **DISTRICT** 9

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

WAGES
Per hour:

	07/01/2022	01/01/2023
Tree Trimmer	$ 33.22	$ 34.21
Ground Person	20.69	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	$ 12.44	$ 12.81
Ground Person	7.75	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
HOLIDAY:
Paid: See (5,6,10,11,15,16,26) on HOLIDAY PAGE.

(An additional floating holiday after four years service)

Overtime: See (5,6,10,11,15,16,26) on HOLIDAY PAGE.

9-3T

Electrician **07/01/2022**

JOB DESCRIPTION Electrician **DISTRICT** 9

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

WAGES

Per hour:	07/01/2022	04/12/2023
Electrician	$ 31.25	$ 31.25
Telephone	31.25	31.25

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:

07/01/2022	04/12/2023
$ 25.30	$ 26.55
27.28*	28.52*

* 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 **07/01/2022**

JOB DESCRIPTION Electrician **DISTRICT** 9

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

WAGES

Per hour:	07/01/2022	03/09/2023
Service Technician	$ 35.40	$ 36.40

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:	$ 20.18	$ 21.07

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 **07/01/2022**

JOB DESCRIPTION Electrician **DISTRICT** 9

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

WAGES

Per Hour:	07/01/2022	04/13/2023
Electrician Audio/Sound and Temporary Light/ Power	$ 59.00	$ 61.00
Evening(Swing Shift):		
Electrician Audio/Sound and Temporary Light/ Power	69.23	71.57
Night (Graveyard Shift): Electrician Audio/Sound and Temporary Light	77.54	80.17
Solar-Photovoltaic Systems		
Group 1 All tasks not listed in Group 2	59.00	61.00
Group 2	31.25	31.25

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 PC 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.

SUPPLEMENTAL BENEFITS

Per Hour:

Electrician	$ 61.50 65.22*	$ 63.84 67.69*
Swing Shift:	69.97 74.34*	72.58 77.10*
Graveyard Shift:	77.12 82.01*	79.96 85.02*
Temporary Light/Power:	28.10 31.16*	28.56 31.81*
Group 1:	61.50 65.22*	63.84 67.69*
Group 2:	25.30 27.28*	26.55 28.52*

* Applies when premium 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 $137,700 for the same employer.

OVERTIME PAY

See (A, H) on OVERTIME PAGE
See (B) for Temporary Light and Power

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

REGISTERED APPRENTICES
Wages Per Hour:

One (1) year terms		
First term:	07/01/2022	04/13/2023
0-6 mos.	$ 18.00	$ 18.00
7-12 mos.	18.50	18.50
Second term:		
0-6 mos.	19.50	19.50
7-12 mos.	20.50	20.50
Third term:		
0-6 mos.	21.50	21.50
7-12 mos.	22.50	22.50
Fourth term:		
0-6 mos.	23.50	23.50
7-12 mos.	25.50	25.50
Fifth term/MIJ:		
0-12 mos.	26.75	26.75
13-18 mos.	31.25	31.25

Supplemental Benefits per hour:

One (1) year terms:

First Term:	Regular	Overtime	Regular	Overtime
0-6 mos.	$ 15.68	$ 16.88	$ 16.68	$ 17.87
7-12 mos.	15.94	17.17	16.69	17.92
Second Term:				
0-6 mos.	16.47	17.76	17.48	18.78
7-12 mos.	16.99	18.35	17.74	19.10
Third Term:				
0-6 mos.	17.52	18.94	18.56	19.98
7-12 mos.	18.04	19.53	18.79	20.28
Fourth Term:				
0-6 mos.	18.56	20.12	19.63	21.19
7-12 mos.	19.61	21.30	20.36	22.05
Fifth Term/MIJ:				
1-12 mos.	22.88	24.57	24.13	25.82
13-18 mos.	25.30	27.28	26.55	28.52

9-3

Electrician - Highway and Street Lighting, Traffic Signals and Controls — 07/01/2022

JOB DESCRIPTION Electrician - Highway and Street Lighting, Traffic Signals and Controls **DISTRICT** 9

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

WAGES
Per hour:

	07/01/2022	04/19/2023
Electro Pole Electrician	$ 59.00	$ 61.00
Electro Pole Foundation Installer	44.66	46.66
Electro Pole Maintainer	38.61	40.61

SUPPLEMENTAL BENEFITS
Per Hour:

	07/01/2022	04/19/2023

Electro Pole Electrician	$ 63.50	$ 65.91
	67.23*	69.77*
Electro Pole Foundation Installer	48.04	50.05
	50.86*	53.00*
Electro Pole Maintainer	43.40	45.40
	45.83*	47.97*

* Applies when premium wages are paid
Note:Reduce benefit rate by 6.2% for any employee who has accumulated wages in $137,700 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 — 07/01/2022

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:

	07/01/2022	03/17/2023
Elevator Constructor	$ 75.14	$ 77.49
Modernization & Service/Repair	59.09	60.89

Four(4), ten(10) hour days may be worked at straight time during a week, Monday thru Friday.

NOTE- In order to use the '4 Day/10 Hour Work Schedule', as your normal schedule, you must submit an 'Employer Registration for Use of 4 Day/10 Hour Work Schedule' form PW30.1; and there must be a dispensation of hours in place on the project. If the PW30.1 IS NOT SUBMITTED you will be liable for overtime payments for work over the allotted hours per day listed.

SUPPLEMENTAL BENEFITS
Per Hour:

Elevator Constructor	$ 43.914	$ 45.574
Modernization & Service/Repairs	42.787	44.412

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:
*Note:1st, 2nd, 3rd Terms are based on Average wage of Constructor & Modernization.
Terms 4 thru 9 Based on Journeyman's wage of classification Working in.

6 MONTH TERMS:

1st Term*	2nd & 3rd Term*	4th & 5th Term	6th & 7th Term	8th & 9th Term
50%	50%	55%	65%	75%

SUPPLEMENTAL BENEFITS

Elevator Constructor		
1st Term	$ 0.00	$ 0.00
2nd & 3rd Term	34.772	36.024
4th & 5th Term	35.606	36.943
6th & 7th Term	37.052	38.448
8th & 9th Term	38.497	39.953

Modernization & Service/Repair		
1st Term	$ 0.00	$ 0.00
2nd & 3rd Term	34.672	35.694
4th & 5th Term	35.195	36.525
6th & 7th Term	36.571	37.948
8th & 9th Term	37.938	39.38

Glazier 07/01/2022

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:	7/01/2022	11/01/2022 Additional
Glazier	$ 59.59	$ 1.25
*Scaffolding	61.55	
Glass Tinting & Window Film	30.11	
**Repair & Maintenance	30.11	

*Scaffolding includes swing scaffold, mechanical equipment, scissor jacks, man lifts, booms & buckets 24' or more, but not pipe scaffolding.

**Repair & Maintenance- All repair & maintenance work on a particular building whenever performed, where the total cumulative contract value is under $148,837. All Glass tinting, window film, regardless of material or intended use, and all affixing of decals to windows or glass.

SUPPLEMENTAL BENEFITS

Per hour:	7/01/2022
Journeyworker	$ 37.55
Glass tinting & Window Film	22.01
Repair & Maintenance	22.01

OVERTIME PAY
See (B,H,V) on OVERTIME PAGE.
For 'Repair & Maintenance' and 'Glass Tinting & Window Film' see (B, B2, I, S) on overtime page.

HOLIDAY
Paid: See (1) on HOLIDAY PAGE
Overtime: See (4, 6, 16, 25) on HOLIDAY PAGE
For 'Repair & Maintenance' and 'Glass Tinting & Window Film' Only
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:

	7/01/2022	11/01/2022
1st term	$ 21.15	TBD
2nd term	29.07	
3rd term	35.20	
4th term	47.38	

Supplemental Benefits:
(Per hour)

1st term	$ 17.15
2nd term	24.42
3rd term	27.06
4th term	32.15

8-1087 (DC9 NYC)

Insulator - Heat & Frost — 07/01/2022

JOB DESCRIPTION Insulator - Heat & Frost **DISTRICT** 4

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

WAGES

Per Hour:	07/01/2022	06/01/2023
Insulators Heat & Frost	$ 70.01	Additional $ 1.10/Hr.

SUPPLEMENTAL BENEFITS
Per Hour:

Insulators Heat & Frost	$ 35.16

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
$ 28.00	$ 35.02	$ 42.01	$ 49.02

Supplemental Benefits:

$ 14.06	$ 17.59	$ 21.10	$ 24.62

4-12

Ironworker — 07/01/2022

JOB DESCRIPTION Ironworker **DISTRICT** 9

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

WAGES

Per Hour:	07/01/2022	01/01/2023 Additional
Stone Derrickmen Rigger	$ 72.26	+ $ 1.64
Stone Handset Derrickman	70.11	+ $ 1.11

SUPPLEMENTAL BENEFITS
Per hour:

Stone Derrickmen Rigger	$ 42.10

Stone Handset	42.09
Derrickman	

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
07/01/2022	$ 35.58	$ 50.89	$ 56.71	$ 62.48

Supplemental benefits:
Per hour:

07/01/2022	21.61	31.97	31.97	31.97

Stone Handset:

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

	1st	2nd	3rd	4th
07/01/2022	34.50	49.43	54.99	61.00

Supplemental benefits:
Per hour:

07/01/2022	21.60	31.96	31.96	31.96

9-197D/R

Ironworker — 07/01/2022

JOB DESCRIPTION Ironworker **DISTRICT** 4

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

WAGES

Per Hour:	07/01/2022	01/01/2023
Ornamental	$ 46.65	Additional
Chain Link Fence	46.65	$ 1.25
Guide Rail	46.65	

SUPPLEMENTAL BENEFITS
Per hour:
Journeyworker: $ 62.04

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
Apprentices Hired after 9/1/18:
1 year terms

1st Term	$ 20.63
2nd Term	24.22
3rd Term	27.80
4th Term	31.38

Supplemental Benefits per hour:

1st Term	$ 17.90
2nd Term	19.15
3rd Term	20.41
4th Term	21.67

4-580-Or

Ironworker **07/01/2022**

JOB DESCRIPTION Ironworker **DISTRICT** 4

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

WAGES
PER HOUR:

	07/01/2022	01/01/2023
Ironworker:		Additional
Structural	$ 55.70	$ 1.75
Bridges		
Machinery		

SUPPLEMENTAL BENEFITS
PER HOUR PAID:

Journeyman $ 85.35

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	$ 28.97
2nd	29.57
3rd - 6th	30.18

Supplemental Benefits
PER HOUR PAID:
All Terms $ 59.18

4-40/361-Str

Ironworker **07/01/2022**

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:	07/01/2022	07/01/2023
Reinforcing &		Additional
Metal Lathing	$ 56.90	$ 1.50
"Base" Wage	$ 55.20 plus $ 1.70	

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

SUPPLEMENTAL BENEFITS
Per hour:
Reinforcing & Metal Lathing $ 41.18

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	$ 47.68
Double Time	$ 54.18

HOLIDAY
Paid: See (1) on HOLIDAY PAGE
Overtime: See (5, 6, 11, 13, *18, **19, 25) on HOLIDAY PAGE
*Note: Work performed after first 4 Hours.

REGISTERED APPRENTICES
(1) year terms at the following wage rates:

1st term	2nd term	3rd term	4th Term
Wage Per Hour:			
$ 22.55	$ 23.60	$ 24.60	$ 37.18
"Base" Wage			
$ 21.00	$ 22.00	$ 23.00	$ 35.60
plus $1.55	plus $1.60	plus $1.60	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	$ 17.17	$ 16.22	$ 22.50

4-46Reinf

Laborer 07/01/2022

JOB DESCRIPTION Laborer **DISTRICT** 9

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

WAGES

Per hour:	07/01/2022	07/01/2023
Laborer/Excavation		Additional
**Asbestos and Lead Abatement & Removal, Hazardous Waste Removal (including soil)	$ 44.00	$ 2.30
Basic	44.00	
Flagman	44.00	
Pipelayer	44.00	
*Tree Work, *Landscape	44.00	

*Includes trimming, cutting, planting and/or removal of trees.
** Applies to Heavy & Highway projects

SUPPLEMENTAL BENEFITS
Per hour:

Journeyworker	$ 50.43

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.

07/01/2022

1st	0 - 1000	$ 22.00
2nd	1001-2000	26.40
3rd	2001-3000	33.00
4th	3001-4000	39.60

Supplemental Benefits per hour:

All Apprentices	50.43

9-731Ex

Laborer **07/01/2022**

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)	07/01/2022
Laborer (Tunnel)-FREE AIR:	
Group 14	$ 71.94
Group 16	68.80
Group 17*	63.59
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: For jobs bid before July 1, 2010 employer shall pay $6.00 per day for each one half (1/2) mile or fraction starting from a point 500 feet from the shaft. For all jobs bid after July 1, 2010, said premium shall be $10.00 per day.

SUPPLEMENTAL BENEFITS
Per hour:

GROUP 14	$ 51.27
GROUP 16	49.16
GROUP 17	45.51
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 & Micro Tunneling See (B, F, R*) on OVERTIME PAGE.
* 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 — 07/01/2022

JOB DESCRIPTION Laborer **DISTRICT** 9

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

WAGES

Per hour: 07/01/2022

Laborer:
Laborer-Concrete
(including flag person) $ 42.53
+ $6.75*

* This portion is not subjected to overtime premiums.

SUPPLEMENTAL BENEFITS

Per Hour
$ 19.70
+ $8.00**

** 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
$ 19.04 +$1.99*	$ 21.26 +$5.82*	$ 26.83 +$6.30*

* This portion is not subjected to overtime premiums.

Supplemental Benefits:
Per hour:

$ 12.20 +$2.00*	$ 16.20 +$2.45*	$ 16.20 +$3.55*

Journeyworker rate applies after 4000 hours
*This portion subjected to same premium as wages.

9-6A/18A/20-C

Laborer - Building — 07/01/2022

JOB DESCRIPTION Laborer - Building **DISTRICT** 9

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

WAGES

Per hour:	07/01/2022	01/01/2023 Additional
Basic Laborer and Mason Tender	$ 42.70*	$ 1.25

*Before calculating premium wage deduct $2.75

SUPPLEMENTAL BENEFITS
Per hour:

Basic Laborer and Mason Tender	$ 29.24

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
(Easter is paid at Time and One-half if worked)

REGISTERED APPRENTICES
Wage per hour:

1000 hour terms at the following wage rate:

Term:	1st	2nd	3rd	4th
Basic Laborer and Mason Tender 07/01/2022	$ 21.45*	$ 23.40*	$ 24.90*	$ 27.40*

*Before calculating premium wage deduct $0.50

Supplemental Benefits per hour:

07/01/2022 All Terms	$ 10.32

9-MTDC(79)

Laborer - Building — 07/01/2022

JOB DESCRIPTION Laborer - Building **DISTRICT** 9

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

WAGES
Per hour:

	07/01/2022
Skilled Interior Demolition Laborer:	$ 39.19*
General Interior Demolition Laborer:	28.38**

* Before calculating overtime wages deduct $1.50

**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.

SUPPLEMENTAL BENEFITS
Per Hour:

Skilled Interior Demolition Laborer:	24.60
General Interior Demolition Laborer:	18.92

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
$ 21.20*	$ 23.15*	$ 24.65*	$ 27.15*

* Before calculating overtime wages deduct $0.50

Supplemental Benefits per hour:

All Terms: 10.32

9-MTDC (79-ID)

Laborer - Building — 07/01/2022

JOB DESCRIPTION Laborer - Building **DISTRICT** 9

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

WAGES

Per hour:	07/01/2022	01/01/2023
Building:		Additional
Plasterer Tender and Spray Fireproofing Tender	$ 42.70*	$ 1.25

* Before calculating overtime wages deduct $2.75.

SUPPLEMENTAL BENEFITS
Per hour:
Journeyworker $ 29.24

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
$21.45*	$23.40*	$24.90*	$27.40*

* Before calculating overtime wages deduct $ 0.50

Supplemental Benefits per hour:

07/01/2022
All Terms: $ 10.32

9-30 (79)

Laborer - Building — 07/01/2022

JOB DESCRIPTION Laborer - Building **DISTRICT** 4

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

WAGES

Per Hour:	07/01/2022
Asbestos, Lead and Hazardous Material Abatement Laborer	$ 38.05

(Re-Roofing Removal See Roofer)
NOTE: Asbestos removed from Mechanical Systems not to be scrapped
See Asbestos Worker

SUPPLEMENTAL BENEFITS
Per Hour:

Laborer	$ 19.10

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

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	$ 14.25

4-NYDC(78)

Laborer - Building — 07/01/2022

JOB DESCRIPTION Laborer - Building **DISTRICT** 9

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

WAGES
Per hour: 07/01/2022

Skilled Demolition Laborer:	$ 41.08*
General Demolition Laborer:	29.66**

*Before calculating overtime wages deduct $2.85
**Before calculating overtime wages deduct $2.20

**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:	$ 28.12
General Demolition Laborer:	21.18

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.

07/01/2022

1st	2nd	3rd	4th
$ 21.20*	$ 23.15*	$ 24.65*	$ 27.15*

*Before calculating overtime wages deduct $0.40

Supplemental Benefits per hour:

All Terms: $ 10.27

9-79/95

Laborer - Concrete & Asphalt Paving 07/01/2022

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:	07/01/2022
Concrete Formsetter	$ 55.10
Asphalt Screedman / Micro Paver	55.70
Asphalt Raker	55.10
Group 1	51.23
Group 2	51.23

SUPPLEMENTAL BENEFITS
Per hour:

Journeyworker	$ 43.44

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
$ 37.11	$ 38.75

Supplemental Benefits per hour:
2000 hours term:

1st term	2nd term
1-1999	2000-4000
$ 17.15	$ 17.15

9-1010H/H

Laborer - Trac Drill 07/01/2022

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:	07/01/2022
Group 1	$ 44.00
Group 2	51.35
Group 3	50.52
Group 4	57.21

SUPPLEMENTAL BENEFITS
Per Hour:

All Classifications	50.43

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.

		07/01/2022
1st	0 - 1000	$ 22.00
2nd	1001-2000	26.40
3rd	2001-3000	33.00
4th	3001-4000	39.60

Supplemental Benefits per hour:

All Apprentices	50.43

9-731/29

Laborer - Tunnel — 07/01/2022

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)

	07/01/2022
Laborer(Compressed Air):	
GROUP 5	$ 75.42
GROUP 6	72.73
GROUP 7	71.52
GROUP 8,9	70.09
GROUP 10	61.62

Note: For jobs bid before July I, 2010 employer shall pay $6.00 per day for each one half (1/2) mile or fraction starting from a point 500 feet from the shaft. For all jobs bid after July 1, 2010, said premium shall be $10.00 per day.

SUPPLEMENTAL BENEFITS
SUPPLEMENTAL BENEFITS:
per hour:

GROUP 5	$ 53.35
GROUP 6	51.70
GROUP 7	50.66
GROUP 8,9	49.85
GROUP 10	47.25

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 — 07/01/2022

JOB DESCRIPTION Mason **DISTRICT** 4

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

WAGES

Per Hour:	07/01/2022	07/01/2023 Additional
Brick/Block Layer	$ 65.23	$ 2.41
Base Wage for OT Calculation	54.18	

SUPPLEMENTAL BENEFITS
Per Hour:

Brick/Block Layer	$ 30.60

OVERTIME PAY
See (A, E, E2, Q) on OVERTIME PAGE
Note: OT Calculated on Base Wage plus $ 11.10/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 $ 6.35/hr.:

1st	2nd	3rd	4th	5th
50%	60%	70%	80%	90%

Supplemental Benefits per hour:

All Apprentices	$ 21.45

4-1Brk

Mason - Building 07/01/2022

JOB DESCRIPTION Mason - Building **DISTRICT** 9

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

WAGES
Building

Wages per hour:	07/01/2022
Mosaic & Terrazzo Mechanic	$ 59.21
Mosaic & Terrazzo Finisher	57.60

SUPPLEMENTAL BENEFITS
Per hour:

Mosaic & Terrazzo Mechanic	$ 26.21* + $11.73
Mosaic & Terrazzo Finisher	$ 26.21* + $11.72

*This portion of benefits subject to same premium rate as shown for overtime wages.

OVERTIME PAY
See (A, E, Q) on OVERTIME PAGE
07/01/2022- 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
$ 22.82	$ 29.34	$ 31.32	$ 36.55	$ 41.77	$ 46.99

Supplemental Benefits per hour:

$4.62* +$6.56	$5.94* +$8.43	$15.73* +$11.24	$18.35* +$13.11	$20.97* +$14.99	$23.59* +$16.85

*This portion of benefits subject to same premium rate as shown for overtime wages.

9-7/3

Mason - Building 07/01/2022

JOB DESCRIPTION Mason - Building **DISTRICT** 9

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

WAGES

Per hour:	07/01/2022	12/05/2022 Additional	06/05/2023 Additional
Tile Setters	$ 62.41	$ 0.73	$ 0.73

SUPPLEMENTAL BENEFITS
Per Hour:
$ 26.06*

+ 10.04

*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
$21.23	$26.11	$33.26	$38.14	$41.67	$45.04	$48.60	$53.47	$56.25	$60.33

Supplemental Benefits per hour:

1st	2nd	3rd	4th	5th	6th	7th	8th	9th	10th
$12.55* + $.69	$12.55* + $.74	$15.16* + $.84	$15.16* + $.88	$16.75* +$1.28	$18.30* +$1.33	$19.35* +$1.70	$19.40* +$1.75	$17.45* +$5.90	$22.80* +$6.42

*This portion of benefits subject to same premium rate as shown for overtime wages.

9-7/52

Mason - Building — 07/01/2022

JOB DESCRIPTION Mason - Building **DISTRICT** 9

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

WAGES
Per hour: 07/01/2022

Building-Marble Restoration:
Marble, Stone & $ 46.60

Terrazzo Polisher, etc

SUPPLEMENTAL BENEFITS
Per Hour:
Journeyworker:

Building-Marble Restoration:
Marble, Stone &
Polisher $ 29.77

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
1ST TERM APPRENTICE GETS PAID FOR ALL OBSERVED HOLIDAYS.

REGISTERED APPRENTICES
WAGES per hour:

900 hour term at the following wage:

1st 1-900	2nd 901-1800	3rd 1801-2700	4th 2701

$ 32.61	$ 37.28	$ 41.94	$ 46.60

Supplemental Benefits Per Hour:

27.07	27.97	28.87	29.77

9-7/24-MP

Mason - Building 07/01/2022

JOB DESCRIPTION Mason - Building **DISTRICT** 9

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

WAGES

Wages:	07/01/2022
Marble Cutters & Setters	$ 62.17

SUPPLEMENTAL BENEFITS

Per Hour:	
Journeyworker	$ 38.27

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:

750 hour terms at the following wage.

1st	2nd	3rd	4th	5th	6th	7th	8th	9th	10th
1-750	751-1500	1501-2250	2251-3000	3001-3750	3751-4500	4501-5250	5251-6000	6001-6751	6751-7500
$ 24.88	$ 27.97	$ 31.08	$ 34.17	$ 37.29	$ 40.39	$ 43.51	$ 46.61	$ 52.82	$ 59.05

Supplemental Benefits per hour:

1st	2nd	3rd	4th	5th	6th	7th	8th	9th	10th
$ 20.55	$ 22.04	$ 23.52	$ 25.01	$ 26.47	$ 27.96	$ 29.42	$ 30.91	$ 33.86	$ 36.81

9-7/4

Mason - Building 07/01/2022

JOB DESCRIPTION Mason - Building **DISTRICT** 9

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

WAGES

Per hour:	07/01/2022	12/05/2022 Additional	06/05/2023 Additional
Tile Finisher	$ 48.00	$ 0.59	$ 0.60

SUPPLEMENTAL BENEFITS
Per Hour:
$ 22.91*
+ $9.86

* 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 07/01/2022

JOB DESCRIPTION Mason - Building **DISTRICT** 9

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

WAGES
Per hour: 07/01/2022

Marble, Stone, etc.
Maintenance Finishers: $ 27.01

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.

SUPPLEMENTAL BENEFITS
Per Hour:

Marble, Stone, etc
Maintenance Finishers: $ 14.40

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:

	07/01/2022
0-750	$ 21.67
751-1500	22.38
1501-2250	23.10
2251-3000	23.80
3001-3750	24.87
3751-4500	26.29
4501+	27.01

Supplemental Benefits:
Per hour:

0-750	11.52
751-1500	11.90
1501-2250	12.29
2251-3000	12.67
3001-3750	13.25
3751-4500	14.01
4501+	14.40

9-7/24M-MF

Mason - Building / Heavy&Highway 07/01/2022

JOB DESCRIPTION Mason - Building / Heavy&Highway **DISTRICT** 9

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

WAGES
Per hour: 07/01/2022

Marble-Finisher $ 48.97

SUPPLEMENTAL BENEFITS
Journeyworker:
per hour

Marble- Finisher $ 35.76

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 07/01/2022

JOB DESCRIPTION Mason - Building / Heavy&Highway **DISTRICT** 4

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

WAGES
Per Hour: 07/01/2022

Cement Mason $ 51.97 + an additional $1.00/Hr.

SUPPLEMENTAL BENEFITS
Per Hour:

Cement Mason $ 33.71
Overtime Rate* $ 54.42

OVERTIME PAY
See (*B1, Q, V) on OVERTIME PAGE
* Applies to 9th and 10th hours and up to the 10th hour on Saturday

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 Percentage of Journeyworkers Wage.

1st Term 50%
2nd Term 60%
3rd Term 70%

Supplement Benefits per hour paid:

1st Term $ 16.86 OT Rate $ 27.22
2nd Term $ 20.23 OT Rate $ 32.66
3rd Term $ 23.60 OT Rate $ 38.10

4-780

Mason - Building / Heavy&Highway 07/01/2022

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:

	07/01/2022	05/01/2023 Additional
Stone Setter	$ 69.72	$ 2.17
Base Rate	52.06	
Stone Tender	52.12	

Base Rate 44.54

SUPPLEMENTAL BENEFITS
Per Hour:

Stone Setter $ 37.07

Stone Tender 21.35

OVERTIME PAY
See (*C, **E, Q) on OVERTIME PAGE
Base Rates are use to Calculate Overtime Premiums then adding in:
$16.70/Hr. for Stone Setter and $7.58/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 $8.16:

1st	2nd	3rd	4th	5th	6th
50%	60%	70%	80%	90%	100%

Supplemental Benefits:
All Apprentices $ 23.95

4-1Stn

Mason - Heavy&Highway — 07/01/2022

JOB DESCRIPTION Mason - Heavy&Highway **DISTRICT** 4

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

WAGES
Per Hour: 07/01/2022

Pointer, Caulkers & Cleaners $ 59.09

SUPPLEMENTAL BENEFITS
Per Hour:

Pointer, Cleaners & Caulkers $ 31.22

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
$ 29.86	$ 33.74	$ 39.02	$ 47.05

Apprentices Supplemental Benefits:
(per hour paid)

$ 15.30	$ 19.85	$ 23.60	$ 24.60

4-1PCC

Operating Engineer - Building — 07/01/2022

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)	07/01/2022
Building Construction:	
Party Chief	$ 76.64
Instrument Man	60.50
Rodman	40.64
Steel Erection:	
Party Chief	79.41
Instrument Man	62.85
Rodman	43.48
Heavy Construction-NYC counties only: (Foundation, Excavation.)	
Party Chief	84.60
Instrument man	63.79
Rodman	54.52

SUPPLEMENTAL BENEFITS

Per Hour:	07/01/2022
Building Construction	$ 26.69* +$ 7.40
Steel Erection	27.29* +$ 7.40
Heavy Construction	25.25* +$ 7.15

* This portion subject to same premium as wages

Non-Worked Holiday Supplemental Benefit:
16.45

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 — 07/01/2022

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, Gunite 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, Lorrain, Lebherr, Mannes or machines of a similar nature, Wellpoints)-Driving maintenance trucks and truck mounted welding machines, burning, welding-operating of accumilator 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:	07/01/2022
Steel Erection:	
Group 1	$ 78.26
Group 2	73.64
Group 3	57.51
Building Construction:	
Group 1	$ 73.13
Group 2	58.08
Group 3	69.81
Group 4	53.34
Group 5	46.79
Heavy Construction:	
Group 1	$ 55.76
Group 2	57.01
Group 3	103.68
Group 4	80.71

SUPPLEMENTAL BENEFITS

Per Hour:	07/01/2022
Building Construction	$ 27.80* plus $7.40
Steel Erection & Heavy	28.30* plus $7.40

* This portion of benefits subject to same premium as wages.

Non-Worked Holiday Supplemental Benefits:

23.47

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.
$ 36.11	$ 42.97	$ 46.40	$ 49.83

Supplemental Benefits:
Per Hour:
All Terms $ 12.55* Plus 7.40

* This portion of benefits subject to same premium as wages.

9-15Ab

Operating Engineer - Building / Heavy&Highway 07/01/2022

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:	07/01/2022
Maintenance Engineer (Sewer Systems)	$ 80.71

SUPPLEMENTAL BENEFITS

Per Hour:	07/01/2022
Journeyman	26.05* plus $ 7.40

*This portion of benefits subject to same premium as wages.

Non-Worked Holiday Supplemental Benefits:
16.95

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
$36.11	$42.97	$46.40	$49.83

Supplemental Benefits:
Per Hour:

All Apprentices: $ 12.55* plus $ 7.40

* This portion of benefits subject to the same premium as overtime wages

9-15Sewer

Operating Engineer - Building / Heavy&Highway 07/01/2022

JOB DESCRIPTION Operating Engineer - Building / Heavy&Highway **DISTRICT** 4

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

WAGES

Per Hour:	07/01/2022	08/01/2022
Well Driller	$ 39.45	$ 40.63
Well Driller Helper	34.17	34.17
Hazardous Waste Differential Added to Hourly Wage:		
Level A	$ 3.00	$ 3.00
Level B	2.00	2.00
Level C	1.00	1.00
Monitoring Well Work Add to Hourly Wage:		
Level A	$ 3.00	$ 3.00
Level B	2.00	2.00

SUPPLEMENTAL BENEFITS
Per Hour:

Well Driller & Helper	10% of straight time rate plus $ 13.50	10% of straight time rate plus $ 13.50

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	$ 28.00
2nd Term	29.00	29.00
3rd Term	30.00	30.00

SUPPLEMENTAL BENEFITS
Per Hour:
All Terms 10% of Wage + $ 13.50

Additional $4.25/Hr. for premium time hours worked.

4-138well

Operating Engineer - Building & Steel Erection 07/01/2022

JOB DESCRIPTION Operating Engineer - Building & Steel Erection **DISTRICT** 9

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

WAGES

Per Hour:	07/01/2022
STEEL ERECTION:	
Three Drum Derricks	$ 101.88
Cranes, Two Drum Derricks, Hydraulic Cranes & Fork Lifts, Boom Trucks	98.19
Compressors, Welding Machines	61.54
Compressors (not combined with welding machines)	58.96

BUILDING CONSTRUCTION:

Cranes, Stone Derrick, Boom Trucks, Hydraulic Cranes,	98.72
Double Drum	93.64
4 Pole Hoists and Single Drum Hoists	87.38
Fork Lifts, Plaster(Platform Machine)Plaster Bucket, Concrete Pumps and all other equipment used for hoisting	80.14
*House Cars and Rack & Pinion	70.75
*House Cars (New Projects)	58.07
Erecting and dismantling Cranes	88.24
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	61.80

APPLICABLE TO ALL CATEGORIES:
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

SUPPLEMENTAL BENEFITS

Per Hour:	07/01/2022
All Operator Classes	$ 24.65* plus $ 6.20

* 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, 7, 8, 11, 12, 16, 26) on HOLIDAY PAGE
Overtime: See (5, 6, 7, 8, 11, 12, 16, 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
07/01/2022	$ 41.98	$ 50.77	$ 59.56

Supplemental Benefits Per Hour:

	07/01/2022
Straight Time	$ 13.65* plus $ 5.95

* This portion of benefits subject to the same premium as shown for overtime wages.

9-14 B&S

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)	07/01/2022
Group 1	$ 114.55
Group 2	95.85
Group 3	98.69
Group 4	96.50
Group 5	94.74
Group 6	91.28
Group 7	92.85
Group 8	90.39
Group 9	88.65
Group 10	85.08
Group 11	80.01
Group 12	81.61
Group 13	82.16
Group 14	74.51
Group 15	63.86
Group 16	59.91
Group 17	86.36
Group 18	59.57
Group 19	90.39
Group 20	88.27
Group 21	75.84
Group 22	88.27

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 $ 24.65* plus $ 6.20

* This portion of benefits subject to the same premium as shown for wages.

Non-Worked Holiday Supplemental Benefits:
$ 18.50

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:

Groups 1-22	1st	2nd	3rd
	41.98	50.77	59.56

Supplemental Benefits:
Per Hour:
Groups 1-22
Regular Time $ 13.65*
plus $ 5.95

* This portion of benefits is subject to the SAME PREMIUM as shown for overtime wages

9-14 HC

Operating Engineer - Heavy Construction 2 — 07/01/2022

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)	07/01/2022
Group 23	$ 83.31
Group 24	81.06
Group 25	77.28
Group 26	73.48
Group 27	53.11
Group 28	77.28

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 26.05* plus $7.40

* This portion of benefits subject to the same premium as shown for wages.

Non-Worked Holiday Supplemental Benefits:
16.95

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	$36.11	$42.97	$46.40	$49.83

Supplemental Benefits:
Per Hour:
Groups 23-28

Regular Time $ 12.55* plus $ 7.40

* This portion of benefits is subject to the SAME PREMIUM as shown for overtime wages

9-15 HC

Operating Engineer - Marine Dredging 07/01/2022

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:	07/01/2022	10/01/2022
CLASS A1 Deck Captain, Leverman Mechanical Dredge Operator Licensed Tug Operator 1000HP or more.	$ 42.66	$ 43.94
CLASS A2 Crane Operator (360 swing)	38.02	39.16
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	36.89	38.00
CLASS B2 Certified Welder	34.73	35.77
CLASS C1 Drag Barge Operator, Steward, Mate,	33.78	34.79

Assistant Fill Placer

CLASS C2 Boat Operator	32.69	33.67
CLASS D Shoreman, Deckhand, Oiler, Rodman, Scowman, Cook, Messman, Porter/Janitor	27.16	27.97

SUPPLEMENTAL BENEFITS
Per Hour:
THE FOLLOWING SUPPLEMENTAL BENEFITS APPLY TO ALL CATEGORIES

All Classes A & B	$ 11.40 plus 6% of straight time wage, Overtime hours add $ 0.63	$ 11.85 plus 6% of straight time wage, Overtime hours add $ 0.63
All Class C	$ 11.10 plus 6% of straight time wage, Overtime hours add $ 0.48	$ 11.60 plus 6% of straight time wage, Overtime hours add $ 0.50
All Class D	$ 10.80 plus 6% of straight time wage, Overtime hours add $ 0.33	$ 11.35 plus 6% of straight time wage, Overtime hours add $ 0.38

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 — 07/01/2022

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 Duchess 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:	07/01/2022
Survey Classifications	
Party Chief	$ 46.44
Instrument Man	38.60
Rodman	33.64

SUPPLEMENTAL BENEFITS
Per Hour:

All Crew Members: $ 21.60

OVERTIME PAY
OVERTIME:.... See (B, E*, Q, V) ON OVERTIME PAGE.
*Doubletime 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 **07/01/2022**

JOB DESCRIPTION Painter **DISTRICT** 8

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

WAGES

Per hour:	07/01/2022
Brush	$ 51.45*
Abatement/Removal of lead based or lead containing paint on materials to be repainted.	51.45*
Spray & Scaffold	$ 54.45*
Fire Escape	54.45*
Decorator	54.45*
Paperhanger/Wall Coverer	53.83*

*Subtract $ 0.10 to calculate premium rate.

SUPPLEMENTAL BENEFITS
Per hour:

Paperhanger	$ 33.15
All others	30.88
Premium	37.72**

**Applies only to "All others" category, not paperhanger journeyworker.

OVERTIME PAY
See (A, H) 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:	07/01/2022
Appr 1st term...	$ 19.95*
Appr 2nd term...	25.56*
Appr 3rd term...	31.00*
Appr 4th term...	41.52*

*Subtract $ 0.10 to calculate premium rate.

Supplemental benefits:
Per Hour:

Appr 1st term...	$ 15.22
Appr 2nd term...	18.90
Appr 3rd term...	21.81
Appr 4th term...	27.58

8-NYDC9-B/S

Painter **07/01/2022**

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: 07/01/2022

Drywall Taper $ 55.10

SUPPLEMENTAL BENEFITS
Per Hour:
Journeyworker: $ 23.88

OVERTIME PAY
See (A, H) 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	$ 21.29
2nd term	27.84
3rd term	33.29
4th term	44.20

Supplemental Benefits per hour:

1st term	$ 14.43
2nd term	18.16
3rd term	19.30
4th term	21.59

8-NYC9-1974-DWT

Painter - Bridge & Structural Steel — 07/01/2022

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:

	07/01/2022	10/01/2022
Bridge Painting:	$ 53.00	Additional
	+ 9.63*	$ 3.00

ADDITIONAL $6.00 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 (no 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:

$ 10.90
+ 30.60*

* 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 (no 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	$ 21.20
	+ 3.86
2nd year	$ 31.80
	+ 5.78
3rd year	$ 42.40
	+ 7.70

Supplemental Benefits - Per hour:

1st year	$ .25
	+ 12.24
2nd year	$ 10.90
	+ 18.36
3rd year	$ 10.90
	+ 24.48

NOTE: All premium wages are to be calculated on base rate per hour only.

8-DC-9/806/155-BrSS

Painter - Line Striping — 07/01/2022

JOB DESCRIPTION Painter - Line Striping **DISTRICT** 9

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

WAGES
Per hour:

Painter (Striping-Highway):	07/01/2022	07/01/2023 Additional
Striping-Machine Operator*	$ 39.00	$ 3.00
Linerman Thermoplastic	43.00	
Flagger - Traffic Safety*	37.00	

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

SUPPLEMENTAL BENEFITS
Per hour paid:

Journeyworker	15.27

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)	$ 30.36
2nd Term (2001-4000 hours)	32.00

Supplemental Benefits per hour:
All Terms 15.27

9-1010-LS

Painter - Metal Polisher 07/01/2022

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, Schuyler, Seneca, St. Lawrence, Steuben, Suffolk, Sullivan, Tioga, Tompkins, Ulster, Warren, Washington, Wayne, Westchester, Wyoming, Yates

WAGES

	07/01/2022
Metal Polisher	$ 37.78
Metal Polisher*	38.80
Metal Polisher**	41.78

*Note: Applies on New Construction & complete renovation
** Note: Applies when working on scaffolds over 34 feet.

SUPPLEMENTAL BENEFITS
Per Hour: 07/01/2022

Journeyworker:
All classification $ 11.24

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, 9, 11, 15, 16, 25, 26) on HOLIDAY PAGE

REGISTERED APPRENTICES
Wages per hour:
One (1) year term at the following wage rates:

	07/01/2022
1st year	$ 16.00
2nd year	17.00
3rd year	18.00
1st year*	$ 16.39
2nd year*	17.44
3rd year*	18.54
1st year**	$ 18.50
2nd year**	19.50
3rd year**	20.50

*Note: Applies on New Construction & complete renovation
** Note: Applies when working on scaffolds over 34 feet.

Supplemental benefits:
Per hour:

1st year	$ 7.99
2nd year	7.99
3rd year	7.99

8-8A/28A-MP

Plasterer 07/01/2022

JOB DESCRIPTION Plasterer **DISTRICT** 9

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

WAGES
Per hour:

	07/01/2022
Building:	
Plasterer/Traditional & Spraying Fireproofing	$ 51.00*

SUPPLEMENTAL BENEFITS
Per hour:

Journeyworker	$ 23.15

OVERTIME PAY
See (B, E, Q) on OVERTIME PAGE
*When calculating overtime pay, subtract $5.00 from wages.

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

REGISTERED APPRENTICES
Wages:
(per hour)
800 hours term:

1st term	$ 28.19
2nd term	30.59
3rd term	35.88
4th term	38.43

Supplemental Benefits:
(per hour):
(800) hours term:

1st term	$ 14.70
2nd term	15.60
3rd term	17.43
4th term	18.35

9-262

Plumber — 07/01/2022

JOB DESCRIPTION Plumber **DISTRICT** 9

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

WAGES
Per hour:

	07/01/2022
Plumber	$ 74.00
Temporary Service**	$ 57.08

** 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	$ 39.95
Temporary Service	$ 31.08

OVERTIME PAY
Plumber See (C, O, V) on OVERTIME PAGE.

When calculating premium pay, subtract $ 0.33 from regular hourly wage rate for Plumber Classification and Repairs & Maintenance, subtract $ 0.31 from regular hourly wage for Temporary Service.

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
$16.78	$19.78	$28.36	$30.46	$33.31	$34.71	$46.78

Supplemental Benefits:
(1/2) year term at the following dollar amount:

1st	2nd	3rd-10th
$5.43	$6.43	$21.19

9-1 Const

Plumber - Pump & Tank: Oil Trades Installation & Maintenance — 07/01/2022

JOB DESCRIPTION Plumber - Pump & Tank: Oil Trades Installation & Maintenance **DISTRICT** 9

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

WAGES
Per hour:

	07/01/2022
Pump & Tank	$ 69.31

SUPPLEMENTAL BENEFITS
Per hour:

Plumber	$ 26.33

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 — 07/01/2022

JOB DESCRIPTION Plumber - Repairs & Maintenance **DISTRICT** 9

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

WAGES
Per hour:

	07/01/2022
Repairs & Maintenance	$ 47.50

*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 Maintenance	$ 19.06

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 — 07/01/2022

JOB DESCRIPTION Roofer **DISTRICT** 9

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

WAGES

Per Hour:	07/01/2022	05/01/2023 Additional
Roofer/Waterproofer	$ 45.25 + $7.00*	$ 2.00

* 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:	$ 30.62

OVERTIME PAY
See (B, H) on OVERTIME PAGE
Note: An observed holiday that falls on a Sunday will be observed the following Monday.

HOLIDAY

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

REGISTERED APPRENTICES
(1) year term

1st	2nd	3rd	4th
$ 15.84	$ 22.63 + 3.50*	$ 27.15 + 4.20*	$ 33.94 + 5.26*

Supplements:

1st	2nd	3rd	4th
$ 3.88	$ 15.48	$ 18.50	$ 23.04

* This portion is not subjected to overtime premiums.

9-8R

Sheetmetal Worker — 07/01/2022

JOB DESCRIPTION Sheetmetal Worker **DISTRICT** 4

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

WAGES

Per Hour:	07/01/2022
Sign Erector	$ 53.79

NOTE: Structurally Supported Overhead Highway Signs(See STRUCTURAL IRON WORKER CLASS)

SUPPLEMENTAL BENEFITS
Per Hour: 07/01/2022

Sign Erector $ 53.33

OVERTIME PAY
See (A, 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:

07/01/2022

1st	2nd	3rd	4th	5th	6th	7th	8th	9th	10th
$ 14.34	$ 16.26	$ 18.17	$ 20.10	$ 28.02	$ 30.47	$ 33.72	$ 36.27	$ 38.77	$ 41.29

4-137-SE

Sheetmetal Worker — 07/01/2022

JOB DESCRIPTION Sheetmetal Worker **DISTRICT** 4

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

WAGES
Per Hour: 07/01/2022
Sheetmetal Worker $ 57.60
Temporary Operation or Maintenance of Fans 47.33

SUPPLEMENTAL BENEFITS
Per Hour:
Sheetmetal Worker $ 49.24
Maintenance Worker 49.24

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	$ 20.19
3rd & 4th Term	25.96
5th & 6th Term	31.71
7th & 8th Term	40.37
9th Term	46.10

Per Hour: Supplemental Benifits

1st & 2nd Term $ 18.10

3rd & 4th Term	24.79
5th & 6th Term	29.25
7th & 8th Term	35.90
9th Term	40.37

4-28

Steamfitter **07/01/2022**

JOB DESCRIPTION Steamfitter **DISTRICT** 4

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

WAGES
Per Hour: 07/01/2022

AC Service/Heat Service & Refrigeration	$ 43.85

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 Condition / Heating Compressor installation.(Not to exceed 15 tons combined on any one project).

SUPPLEMENTAL BENEFITS
Per Hour Worked:

AC Service/Heat Service	$ 19.96
Per Hour Paid:	16.45

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

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

REGISTERED APPRENTICES
1 year terms
Wages per hour:

1st Term	$ 21.23
2nd Term	25.63
3rd Term	29.85
4th Term	36.05

Benefits per hour Worked:		Per Hour Paid:
1st Term	$ 13.29	$ 9.78
2nd Term	14.57	11.06
3rd Term	15.91	12.40
4th Term	17.72	14.21

4-638B-StmFtrRef

Steamfitter **07/01/2022**

JOB DESCRIPTION Steamfitter **DISTRICT** 4

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

WAGES
Per Hour: 07/01/2022

Sprinkler/Steam AC/Heat Fitter	$ 68.61
Temporary Heat & AC Fitter	52.16

Note: Add 15% to Hourly Wage for "Contracting Agency" Mandated Off Shift Work.

SUPPLEMENTAL BENEFITS
Per Hour:

Sprinkler/Steam Fitter	$ 52.74
Temporary Heat & AC Fitter	43.29

Note: Add 15% to Hourly Benefit for "Contracting Agency" Mandated Off Shift Work.

OVERTIME PAY
All overtime which is defined as work after 7 hours a day plus Saturday, Sunday and Holidays are subject to the amounts below*:

*Note: The posted overtime rates are applicable after 8 hours plus Saturday, Sunday and Holidays for Temporary Heat & AC Fitter on Fire Protection/Sprinkler contracts under $3,000,000.00 and HVAC/Mechanical contracts under $30,000,000.00:

Sprinkler/Steam	Wages $ 137.22	Benefit $ 103.50
Temp Heat/AC	Wages $ 104.32	Benefit $ 84.60

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
$ 27.48	$ 34.34	$ 41.19	$ 48.05	$ 54.90

SUPPLEMENTAL BENEFIT per hour:

1st Term	2nd Term	3rd Term	4th Term	5th Term
$ 21.60	$ 26.80	$ 31.98	$ 37.18	$ 42.36

Premium Time Amounts:

41.52	51.86	62.18	75.52	82.84

4-638A-StmSpFtr

Teamster - Heavy Construction — 07/01/2022

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)

	07/01/2022
Dump Trucks	$ 43.835
Tractor Trailers	46.115
Euclid/Turnapull	46.68

Effective 7/1/2020 an Additional $2.75/Hr. to be allocated.

SUPPLEMENTAL BENEFITS
Per Hour:

Dump Trucks Up to 40 Hours Worked	$ 51.5525
ALL OTHERS Up to 40 Hours Worked	51.5025

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 **07/01/2022**

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, Schuyler, Seneca, St. Lawrence, Steuben, Suffolk, Sullivan, Tioga, Tompkins, Ulster, Warren, Washington, Wayne, Westchester, Wyoming, Yates

WAGES
Per hour 07/01/2022

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
(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 12240

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
- ☐ 1O 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
- ☐ Guards, Watchmen
- ☐ Janitors, Porters, Cleaners, Elevator Operators
- ☐ Moving furniture and equipment
- ☐ Trash and refuse removal
- ☐ Window cleaners
- ☐ Other (Describe)

9. Has this project been reviewed for compliance with the Wicks Law involving separate bidding? YES ☐ NO ☐

10. Name and Title of Requester

Signature

SEE PAGE TWO FOR LAWS RELATING TO PUBLIC WORK CONTRACTS

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://applications.labor.ny.gov/EDList/searchPage.do

For inquiries where WCB is listed as the "Agency", please call 1-866-546-9322

NYSDOL Bureau of Public Work Debarment List 07/22/2022

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	*****4018	ADIRONDACK BUILDING RESTORATION INC.		4156 WILSON ROAD EAST TABERG NY 13471	03/26/2019	03/26/2024
DOL	AG	*****1812	ADVANCED BUILDERS & LAND DEVELOPMENT, INC.		400 OSER AVE #2300HAUPPAUGE NY 11788	09/11/2019	09/11/2024
DOL	DOL	*****1687	ADVANCED SAFETY SPRINKLER INC		261 MILL ROAD P.O BOX 296EAST AURORA NY 14052	05/29/2019	05/29/2024
DOL	NYC	*****6775	ADVENTURE MASONRY CORP.		1535 RICHMOND AVENUE STATEN ISLAND NY 10314	12/13/2017	12/13/2022
DOL	NYC		AGOSTINHO TOME		405 BARRETTO ST BRONX NY 10474	05/31/2018	05/31/2023
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 F COKER		2610 SOUTH SALINA STREET SUITE 14SYRACUSE NY 13205	12/04/2018	12/04/2023
DOL	DOL		ANGELO GARCIA		515 WEST AVE UNIT PH 13NORWALK CT 06850	05/12/2021	05/12/2026
DOL	DOL		ANITA SALERNO		158 SOLAR ST SYRACUSE NY 13204	01/07/2019	01/07/2024
DOL	DOL		ANTONIO ESTIVEZ		442 ARMONK RD MOUNT KISCO NY 10549	06/12/2018	06/12/2023
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		ARSHAD MEHMOOD		168-42 88TH AVENUE JAMAICA NY 11432	11/20/2019	11/20/2024
DOL	NYC	*****6683	ATLAS RESTORATION CORP.		35-12 19TH AVENUE ASTORIA NY 11105	08/02/2017	08/02/2022
DOL	NYC	*****2591	AVI 212 INC.		260 CROPSEY AVENUE APT 11GBROOKLYN NY 11214	10/30/2018	10/30/2023
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	NYC		BALWINDER SINGH		421 HUDSON ST SUITE C5NEW YORK NY 10014	02/20/2019	02/20/2024
DOL	NYC	*****8416	BEAM CONSTRUCTION, INC.		50 MAIN ST WHITE PLAINS NY 10606	01/04/2019	01/04/2024
DOL	DOL		BERNARD BEGLEY		38 LONG RIDGE ROAD BEDFORD NY 10506	12/18/2019	12/18/2024
DOL	NYC	*****2113	BHW CONTRACTING, INC.		401 HANOVER AVENUE STATEN ISLAND NY 10304	01/11/2021	01/11/2026
DOL	DOL		BIAGIO CANTISANI			06/12/2018	06/12/2023
DOL	DOL	*****3627	BJB CONSTRUCTION CORP.		38 LONG RIDGE ROAD BEDFORD NY 10506	12/18/2019	12/18/2024
DOL	DOL	*****4512	BOB BRUNO EXCAVATING, INC		5 MORNINGSIDE DR AUBURN NY 13021	05/28/2019	05/28/2024
DOL	DOL		BOGDAN MARKOVSKI		370 W. PLEASANTVIEW AVE SUITE 2.329HACKENSACK NJ 07601	02/11/2019	02/11/2024
DOL	DOL		BRADLEY J SCHUKA		4 BROTHERS ROAD WAPPINGERS FALLS NY 12590	10/20/2020	10/20/2025
DOL	DOL		BRUCE P. NASH JR.		5841 BUTTERNUT ROAD EAST SYRACUSE NY 13057	09/12/2018	09/12/2023
DOL	DOL	*****0225	C&D LAFACE CONSTRUCTION, INC.		8531 OSWEGO RD BALDWINSVILLE NY 13027	02/03/2020	01/09/2023
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	*****9383	C.C. PAVING AND EXCAVATING, INC.		2610 SOUTH SALINA ST SUITE 12SYRACUSE NY 13205	12/04/2018	12/04/2023
DOL	DOL	*****4083	C.P.D. ENTERPRISES, INC		P.O BOX 281 WALDEN NY 12586	03/03/2020	03/03/2025

NYSDOL Bureau of Public Work Debarment List 07/22/2022

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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	NYC		CALVIN WALTERS		465 EAST THIRD ST MT. VERNON NY 10550	09/09/2019	09/09/2024
DOL	DOL		CANTISANI & ASSOCIATES LTD		442 ARMONK RD MOUNT KISCSO NY 10549	06/12/2018	06/12/2023
DOL	DOL		CANTISANI HOLDING LLC			06/12/2018	06/12/2023
DOL	DOL		CARMEN RACHETTA		8531 OSWEGO RD BALDWINSVILLE NY 13027	02/03/2020	02/03/2025
DOL	DOL		CARMENA RACHETTA		8531 OSWEGO ROAD BALDWINSVILLE NY 13027	02/03/2020	01/09/2023
DOL	DOL	*****3812	CARMODY "2" INC			06/12/2018	06/12/2023
DOL	DOL	*****1143	CARMODY BUILDING CORP	CARMODY CONTRACTING AND CARMODY CONTRACTING CORP.	442 ARMONK RD MOUNT KISCO NY 10549	06/12/2018	06/12/2023
DOL	DOL		CARMODY CONCRETE CORPORATION			06/12/2018	06/12/2023
DOL	DOL		CARMODY ENTERPRISES, LTD.		442 ARMONK RD MOUNT KISCO NY 10549	06/12/2018	06/12/2023
DOL	DOL		CARMODY INC		442 ARMONK RD MOUNT KISCO NY 10549	06/12/2018	06/12/2023
DOL	DOL	*****3812	CARMODY INDUSTRIES INC			06/12/2018	06/12/2023
DOL	DOL		CARMODY MAINTENANCE CORPORATION		442 ARMONK RD MOUNT KISCO NY 10549	06/12/2018	06/12/2023
DOL	DOL		CARMODY MASONRY CORP		442 ARMONK RD MOUNT KISCO NY 10549	06/12/2018	06/12/2023
DOL	AG	*****7247	CENTURY CONCRETE CORP		2375 RAYNOR ST RONKONKOMA NY 11779	08/04/2021	08/04/2026
DOL	AG		CESAR J. AGUDELO		81-06 34TH AVENUE APT. 6EJACKSON HEIGHTS NY 11372	02/07/2018	02/07/2023
DOL	DOL	*****0026	CHANTICLEER CONSTRUCTION LLC		4 BROTHERS ROAD WAPPINGERS FALLS NY 12590	10/20/2020	10/20/2025
DOL	NYC		CHARLES ZAHRADKA		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		CHRISTOPHER J MAINI		19 CAITLIN AVE JAMESTOWN NY 14701	09/17/2018	09/17/2023
DOL	DOL		CHRISTOPHER PAPASTEFANOU A/K/A CHRIS PAPASTEFANOU		1445 COMMERCE AVE BRONX NY 10461	05/30/2019	05/30/2024
DOL	DOL	*****1927	CONSTRUCTION PARTS WAREHOUSE, INC.	CPW	5841 BUTTERNUT ROAD EAST SYRACUSE NY 13057	09/12/2018	09/12/2023
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	*****2524	CSI ELECTRICAL & MECHANICAL INC		42-32 235TH ST DOUGLASTON NY 11363	01/14/2019	01/14/2024
DOL	NYC		DALJIT KAUR BOPARAI		185-06 56TH AVE FRESH MEADOW NY 11365	10/17/2017	10/17/2022
DOL	DOL	*****7619	DANCO CONSTRUCTION UNLIMITED INC.		485 RAFT AVENUE HOLBROOK NY 11741	10/19/2021	10/19/2026
DOL	DOL		DARIAN L COKER		2610 SOUTH SALINA ST SUITE 2CSYRACUSE NY 13205	09/17/2020	09/17/2025
DOL	DOL		DARIAN L COKER		2610 SOUTH SALINA ST SUITE 2CSYRACUSE NY 13205	12/04/2018	12/04/2023
DOL	NYC		DAVID WEINER		14 NEW DROP LANE 2ND FLOORSTATEN ISLAND NY 10306	11/14/2019	11/14/2024
DOL	AG		DEBRA MARTINEZ		31 BAY ST BROOKLYN NY 11231	03/28/2018	03/28/2023
DOL	DOL		DELPHI PAINTING & DECORATING CO INC		1445 COMMERCE AVE BRONX NY 10461	05/30/2019	05/30/2024
DOL	NYC		DIMITRIOS TSOUMAS		35-12 19TH AVENUE ASTORIA NY 11105	08/02/2017	08/02/2022
DOL	DOL		DOMENICO LAFACE		8531 OSWEGO RD BALDWINSVILLE NY 13027	02/03/2020	01/09/2023

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DOL	DOL	*****5175	EAGLE MECHANICAL AND GENERAL CONSTRUCTION LLC		11371 RIDGE RD WOLCOTT NY 14590	02/03/2020	02/03/2025
DOL	DOL		EAST COAST PAVING		2238 BAKER RD GILLETT PA 16923	03/12/2018	03/12/2023
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	NYC	*****5917	EPOCH ELECTRICAL, INC		97-18 50TH AVE CORONA NY 11368	04/19/2018	04/19/2024
DOL	DOL		FAIGY LOWINGER		11 MOUNTAIN RD 28 VAN BUREN DRMONROE NY 10950	03/20/2019	03/20/2024
DOL	DOL		FRANK BENEDETTO		19 CATLIN AVE JAMESTOWN NY 14701	09/17/2018	09/17/2023
DOL	DOL	*****4722	FRANK BENEDETTO AND CHRISTOPHER J MAINI	B & M CONCRETE	19 CAITLIN AVE JAMESTOWN NY 14701	09/17/2018	09/17/2023
DOL	NYC		FRANK MAINI		1766 FRONT ST YORKTOWN HEIGHTS NY 10598	01/17/2018	01/17/2023
DOL	DA		FREDERICK HUTZLER		2375 RAYNOR STREET RONKONKOMA NY 11779	08/04/2021	08/04/2026
DOL	NYC	*****6616	G & G MECHANICAL ENTERPRISES, LLC.		1936 HEMPSTEAD TURNPIKE EAST MEDOW NY 11554	11/29/2019	11/29/2024
DOL	DOL		GABRIEL FRASSETTI			04/10/2019	04/10/2024
DOL	NYC		GAYATRI MANGRU		21 DAREWOOD LANE VALLEY STREAM NY 11581	09/17/2020	09/17/2025
DOL	DOL		GEOFF CORLETT		415 FLAGGER AVE #302STUART FL 34994	10/31/2018	10/31/2023
DOL	DA		GEORGE LUCEY		150 KINGS STREET BROOKLYN NY 11231	01/19/1998	01/19/2998
DOL	DOL		GIGI SCHNECKENBURGER		261 MILL RD EAST AURORA NY 14052	05/29/2019	05/29/2024
DOL	DOL		GIOVANNI LAFACE		8531 OSWEGO RD BALDWINSVILLE NY 13027	02/03/2020	01/09/2023
DOL	NYC	*****3164	GLOBE GATES INC	GLOBAL OVERHEAD DOORS	405 BARRETTO ST BRONX NY 10474	05/31/2018	05/31/2023
DOL	NYC		GREAT ESTATE CONSTRUCTION, INC.		327 STAGG ST BROOKLYN NY 11206	10/10/2017	10/10/2022
DOL	DOL		GREGORY S. OLSON		P.O BOX 100 200 LATTA BROOK PARKHORSEHEADS NY 14845	03/08/2018	03/08/2023
DOL	DOL		HANS RATH		24 ELDOR AVENUE NEW CITY NY 10956	02/03/2020	02/03/2025
DOL	NYC	*****3228	HEIGHTS ELEVATOR CORP.		1766 FRONT ST YORKTOWN HEIGHTS NY 10598	01/17/2018	01/17/2023
DOL	DOL	*****5131	INTEGRITY MASONRY, INC.	M&R CONCRETE	722 8TH AVE WATERVLIET NY 12189	06/05/2018	06/05/2023
DOL	DOL		IRENE KASELIS		32 PENNINGTON AVE WALDWICK NJ 07463	05/30/2019	05/30/2024
DOL	DOL	*****9211	J. WASE CONSTRUCTION CORP.		8545 RT 9W ATHENS NY 12015	03/09/2021	03/09/2026
DOL	DOL		J.A. HIRES CADWALLADER		P.O BOX 100 200 LATTA BROOK PARKHORSEHEADS NY 14845	03/08/2018	03/08/2023
DOL	DOL		JAMES C. DELGIACCO		722 8TH AVE WATERVLIET NY 12189	06/05/2018	06/05/2023
DOL	DOL		JAMES J. BAKER		7901 GEE ROAD CANASTOTA NY 13032	08/17/2021	08/17/2026
DOL	DOL		JAMES LIACONE		9365 WASHINGTON ST LOCKPORT IL 60441	07/23/2018	07/23/2023
DOL	DOL		JAMES RACHEL		9365 WASHINGTON ST LOCKPORT IL 60441	07/23/2018	07/23/2023
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	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	*****5368	JCH MASONRY & LANDSCAPING INC.		35 CLINTON AVE OSSINING NY 10562	09/12/2018	09/12/2023
DOL	NYC		JENNIFER GUERRERO		1936 HEMPSTEAD TURNPIKE EAST MEADOW NY 11554	11/29/2019	11/29/2024
DOL	DOL		JIM PLAUGHER		17613 SANTE FE LINE ROAD WAYNEFIELD OH 45896	07/16/2021	07/16/2026
DOL	AG		JOHN ANTHONY MASSINO		36-49 204TH STREET BAYSIDE NY 11372	02/07/2018	02/07/2023
DOL	DOL		JOHN F. CADWALLADER		200 LATTA BROOK PARK HORSEHEADS NY 14845	03/08/2018	03/08/2023
DOL	DOL	*****4612	JOHN F. CADWALLADER, INC.	THE GLASS COMPANY	P.O BOX 100 200 LATTA BROOK PARKHORSEHEADS NY 14845	03/08/2018	03/08/2023
DOL	DOL		JOHN GOCEK		14B COMMERCIAL AVE ALBANY NY 12065	11/14/2019	11/14/2024
DOL	DOL		JOHN LUCIANO			05/14/2018	05/14/2023
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	AG	*****0600	JOHNCO CONTRACTING, INC.		36-49 204TH STREET BAYSIDE NY 11372	02/07/2018	02/07/2023
DOL	DOL		JON E DEYOUNG		261 MILL RD P.O BOX 296EAST AURORA NY 14052	05/29/2019	05/29/2024
DOL	DOL		JORGE RAMOS		8970 MIKE GARCIA DR MANASSAS VA 20109	07/16/2021	07/16/2026
DOL	DOL		JORI PEDERSEN		415 FLAGER AVE #302STUART FL 34994	10/31/2018	10/31/2023
DOL	DOL		JOSE CHUCHUCA		35 CLINTON AVE OSSINING NY 10562	09/12/2018	09/12/2023
DOL	NYC		JOSEPH MARTINO		1535 RICHMOND AVENUE STATEN ISLAND NY 10314	12/13/2017	12/13/2022
DOL	DOL		JOY MARTIN		2404 DELAWARE AVE NIGARA FALLS NY 14305	09/12/2018	09/12/2023
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	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		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		KATIE BURDICK		2238 BAKER RD GILLETT PA 16923	03/12/2018	03/12/2023
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	*****3490	L & M CONSTRUCTION/DRYWALL INC.		1079 YONKERS AVE YONKERS NY 10704	08/07/2018	08/07/2023
DOL	DA	*****8816	LAKE CONSTRUCTION AND DEVELOPMENT CORPORATION		150 KINGS STREET BROOKLYN NY 11231	08/19/1998	08/19/2998
DOL	DOL		LAVERN GLAVE		161 ROBYN RD MONROE NY 10950	01/30/2018	01/30/2023
DOL	DOL	*****4388	LEN.J CONSTRUCTION, LLC		PO BOX 10007 ALBANY NY 12201	06/24/2016	09/19/2022
DOL	DOL	*****4388	LEN.J CONSTRUCTION, LLC		PO BOX 10007 ALBANY NY 12201	06/24/2016	09/19/2022
DOL	DOL	*****4388	LEN.J CONSTRUCTION, LLC		PO BOX 10007 ALBANY NY 12201	09/19/2017	09/19/2022
DOL	DOL	*****4388	LEN.J CONSTRUCTION, LLC		PO BOX 10007 ALBANY NY 12201	09/19/2017	09/19/2022

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DOL	DOL	*****4388	LEN.J CONSTRUCTION, LLC		PO BOX 10007 ALBANY NY 12201	01/17/2017	09/19/2022
DOL	DOL	*****4388	LEN.J CONSTRUCTION, LLC		PO BOX 10007 ALBANY NY 12201	09/19/2017	09/19/2022
DOL	DOL	*****4388	LEN.J CONSTRUCTION, LLC		PO BOX 10007 ALBANY NY 12201	09/19/2017	09/19/2022
DOL	DOL	*****4388	LEN.J CONSTRUCTION, LLC		PO BOX 10007 ALBANY NY 12201	08/14/2017	09/19/2022
DOL	DOL		LEROY NELSON JR		PO BOX 10007 ALBANY NY 12201	09/19/2017	09/19/2022
DOL	DOL		LEROY NELSON JR		PO BOX 10007 ALBANY NY 12201	09/19/2017	09/19/2022
DOL	DOL		LEROY NELSON JR		PO BOX 10007 ALBANY NY 12201	09/19/2017	09/19/2022
DOL	DOL		LEROY NELSON JR		PO BOX 10007 ALBANY NY 12201	09/19/2017	09/19/2022
DOL	DOL		LEROY NELSON JR		PO BOX 10007 ALBANY NY 12201	08/14/2017	08/14/2022
DOL	DOL		LEROY NELSON JR		PO BOX 10007 ALBANY NY 12201	01/17/2017	09/19/2022
DOL	AG	*****3291	LINTECH ELECTRIC, INC.		3006 TILDEN AVE BROOKLYN NY 11226	02/16/2022	02/16/2027
DOL	DA	*****4460	LONG ISLAND GLASS & STOREFRONTS, LLC		4 MANHASSET TRL RIDGE NY 11961	09/06/2018	09/06/2023
DOL	AG	*****4216	LOTUS-C CORP.		81-06 34TH AVENUE APT. 6EJACKSON HEIGHTS NY 11372	02/07/2018	02/07/2023
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	NYC		MAREK FABIJANOWSKI		50 MAIN ST WHITE PLAINS NY 10606	01/04/2019	01/04/2024
DOL	NYC		MARIA NUBILE		84-22 GRAND AVENUE ELMHURST NY 11373	03/10/2020	03/10/2025
DOL	DOL		MASONRY CONSTRUCTION, INC.		442 ARMONK RD MOUNT KISCO NY 10549	06/12/2018	06/12/2023
DOL	DOL	*****3333	MASONRY INDUSTRIES, INC.		442 ARMONK RD MOUNT KISCO NY 10549	06/12/2018	06/12/2023
DOL	NYC		MATINA KARAGIANNIS		97-18 50TH AVE CORONA NY 11368	04/19/2018	04/19/2023
DOL	DOL		MATTHEW P. KILGORE		4156 WILSON ROAD EAST TABERG NY 13471	03/26/2019	03/26/2024
DOL	DOL		MAURICE GAWENO		442 ARMONK RD MOUNT KISCO NY 10549	06/12/2018	06/12/2023
DOL	DOL		MICHAEL LENIHAN		1079 YONKERS AVE UNIT 4YONKERS NY 10704	08/07/2018	08/07/2023
DOL	AG		MICHAEL RIGLIETTI		31 BAY ST BROOKLYN NY 11231	03/28/2018	03/28/2023
DOL	DOL	*****4829	MILESTONE ENVIRONMENTAL CORPORATION		704 GINESI DRIVE SUITE 29MORGANVILLE NJ 07751	04/10/2019	04/10/2024
DOL	NYC	*****9926	MILLENNIUM FIRE PROTECTION, LLC		325 W. 38TH STREET SUITE 204NEW YORK NY 10018	11/14/2019	11/14/2024
DOL	NYC	*****0627	MILLENNIUM FIRE SERVICES, LLC		14 NEW DROP LNE 2ND FLOORSTATEN ISLAND NY 10306	11/14/2019	11/14/2024
DOL	AG		MSR ELECTRICAL CONSTRUCTION CORP.		31 BAY ST BROOKLYN NY 11231	03/28/2018	03/28/2023
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	DA	*****9786	NATIONAL INSULATION & GC CORP		180 MILLER PLACE HICKSVILLE NY 11801	12/12/2018	12/12/2023

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DOL	DOL	*****3684	NATIONAL LAWN SPRINKLERS, INC.		645 N BROADWAY WHITE PLAINS NY 10603	05/14/2018	05/14/2023
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	09/29/2021	09/29/2026
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	DOL	*****1845	OC ERECTERS, LLC A/K/A OC ERECTERS OF NY INC.		1207 SW 48TH TERRACE DEERFIELD BEACH FL 33442	01/16/2018	01/16/2023
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	*****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	01/30/2018	01/30/2023
DOL	AG	*****7015	RCM PAINTING INC.		69-06 GRAND AVENUE 2ND FLOORMASPETH NY 11378	02/07/2018	02/07/2023
DOL	DA	*****7559	REGAL CONTRACTING INC.		24 WOODBINE AVE NORTHPORT NY 11768	10/01/2020	10/01/2025
DOL	DOL		REGINALD WARREN		161 ROBYN RD MONROE NY 10950	01/30/2018	01/30/2023
DOL	DOL	*****9148	RICH T CONSTRUCTION		107 WILLOW WOOD LANE CAMILLUS NY 13031	11/13/2018	11/13/2023
DOL	DOL		RICHARD MACONE		8617 THIRD AVE BROOKLYN NY 11209	09/17/2018	09/17/2023
DOL	DOL		RICHARD REGGIO		1617 MAIN ST PEEKSKILL NY 10566	03/03/2020	03/03/2025
DOL	DOL	*****9148	RICHARD TIMIAN	RICH T CONSTRUCTION	108 LAMONT AVE SYRACUSE NY 13209	10/16/2018	10/16/2023
DOL	DOL		RICHARD TIMIAN JR.		108 LAMONT AVE SYRACUSE NY 13209	10/16/2018	10/16/2023
DOL	DOL		RICHARD TIMIAN JR.		108 LAMONT AVE SYRACUSE NY 13209	11/13/2018	11/13/2023
DOL	DOL		ROBBYE BISSESAR		89-51 SPRINGFIELD BLVD QUEENS VILLAGE NY 11427	01/11/2003	01/11/3003
DOL	DOL		ROBERT A. VALERINO		3841 LANYARD COURT NEW PORT RICHEY FL 34652	07/09/2019	07/09/2024
DOL	DOL		ROBERT BRUNO		5 MORNINGSIDE DRIVE AUBURN NY 13021	05/28/2019	05/28/2024
DOL	DOL		RODERICK PUGH		404 OAK ST SUITE 101SYRACUSE NY 13203	07/23/2018	07/23/2023
DOL	DOL	*****4880	RODERICK PUGH CONSTRUCTION INC.		404 OAK ST SUITE 101SYRACUSE NY 13203	07/23/2018	07/23/2023
DOL	DOL		ROMEO WARREN		161 ROBYN RD MONROE NY 10950	01/30/2018	01/30/2023
DOL	DOL		RONALD MESSEN		14B COMMERCIAL AVE ALBANY NY 12065	11/14/2019	11/14/2024
DOL	DOL		ROSEANNE CANTISANI			06/12/2018	06/12/2023
DOL	DOL	*****1365	S & L PAINTING, INC.		11 MOUNTAIN ROAD P.O BOX 408MONROE NY 10950	03/20/2019	03/20/2024
DOL	DOL	*****7730	S C MARTIN GROUP INC.		2404 DELAWARE AVE NIAGARA FALLS NY 14305	09/12/2018	09/12/2023
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

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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	NYC	*****0349	SAM WATERPROOFING INC		168-42 88TH AVENUE APT.1 AJAMAICA NY 11432	11/20/2019	11/20/2024
DOL	NYC		SANDEEP BOPARAI		185-06 56TH AVE FRESH MEADOW NY 11365	10/17/2017	10/17/2022
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	NYC	*****6597	SHAIRA CONSTRUCTION CORP.		421 HUDSON STREET SUITE C5NEW YORK NY 10014	02/20/2019	02/20/2024
DOL	DOL	*****1961	SHANE BURDICK	CENTRAL TRAFFIC CONTROL, LLC.	2238 BAKER ROAD GILLETT PA 16923	03/12/2018	03/12/2023
DOL	DOL		SHANE BURDICK		2238 BAKER ROAD GILLETT PA 16923	03/12/2018	03/12/2023
DOL	DOL		SHANE NOLAN		9365 WASHINGTON ST LOCKPORT IL 60441	07/23/2018	07/23/2023
DOL	DOL		SHULEM LOWINGER		11 MOUNTAIN ROAD 28 VAN BUREN DRMONROE NY 10950	03/20/2019	03/20/2024
DOL	DOL	*****0816	SOLAR ARRAY SOLUTIONS, LLC		9365 WASHINGTON ST LOCKPORT IL 60441	07/23/2018	07/23/2023
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	DOL	*****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
DOL	DOL	*****3496	STAR INTERNATIONAL INC		89-51 SPRINGFIELD BLVD QUEENS VILLAGE NY 11427	08/11/2003	08/11/3003
DOL	DOL	*****6844	STEAM PLANT AND CHX SYSTEMS INC.		14B COMMERCIAL AVENUE ALBANY NY 12065	11/14/2019	11/14/2024
DOL	DOL	*****9933	STEED GENERAL CONTRACTORS, INC.		1445 COMMERCE AVE BRONX NY 10461	05/30/2019	05/30/2024
DOL	DOL	*****9528	STEEL-IT, LLC.		17613 SANTE FE LINE ROAD WAYNESFIELD OH 45896	07/16/2021	07/16/2026
DOL	DOL		STEFANOS PAPASTEFANOU, JR. A/K/A STEVE PAPASTEFANOU, JR.		256 WEST SADDLE RIVER RD UPPER SADDLE RIVER NJ 07458	05/30/2019	05/30/2024
DOL	DOL		STEVE TATE		415 FLAGER AVE #302STUART FL 34994	10/31/2018	10/31/2023
DOL	DOL		STEVEN MARTIN		2404 DELWARE AVE NIAGARA FALLS NY 14305	09/12/2018	09/12/2023
DOL	DOL	*****3800	SUBURBAN RESTORATION CO. INC.		5-10 BANTA PLACE FAIR LAWN PLACE NJ 07410	03/29/2021	03/29/2026
DOL	NYC	*****5863	SUKHMANY CONSTRUCTION, INC.		185-06 56TH AVE FRESH MEADOW NY 11365	10/17/2017	10/17/2022
DOL	DOL	*****1060	SUNN ENTERPRISES GROUP, LLC		370 W. PLEASANTVIEW AVE SUITE 2.329HACKENSACK NJ 07601	02/11/2019	02/11/2024
DOL	DOL	*****8209	SYRACUSE SCALES, INC.		158 SOLAR ST SYRACUSE NY 13204	01/07/2019	01/07/2024
DOL	DOL		TALAILA OCAMPA		1207 SW 48TH TERRACE DEERFIELD BEACH FL 33442	01/16/2018	01/16/2023
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

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DOL	DOL		TERSAL DEVELOPMENT CORP.		1935 TEALL AVENUE SYRACUSE NY 13206	07/16/2021	07/16/2026
DOL	DOL		TEST		P.O BOX 123 ALBANY NY 12204	05/20/2020	05/20/2025
DOL	DOL	*****6789	TEST1000		P.O BOX 123 ALBANY NY 12044	03/01/2021	03/01/2026
DOL	DOL	*****5766	THE COKER CORPORATION	COKER CORPORATIO N	2610 SOUTH SALINA ST SUITE 14SYRACUSE NY 13205	12/04/2018	12/04/2023
DOL	DOL	*****5766	THE COKER CORPORATION	COKER CORPORATIO N	2610 SOUTH SALINA ST SUITE 14SYRACUSE NY 13205	09/17/2020	09/17/2025
DOL	DA	*****4106	TRIPLE H CONCRETE CORP		2375 RAYNOR STREET RONKONKOMA NY 11779	08/04/2021	08/04/2026
DOL	DOL	*****6392	V.M.K CORP.		8617 THIRD AVE BROOKLYN NY 11209	09/17/2018	09/17/2023
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		VICTOR ALICANTI		42-32 235TH ST DOUGLASTON NY 11363	01/14/2019	01/14/2024
DOL	NYC		VIKTAR PATONICH		2630 CROPSEY AVE BROOKLYN NY 11214	10/30/2018	10/30/2023
DOL	DOL		VIKTORIA RATH		24 ELDOR AVENUE NEW CITY NY 10956	02/03/2020	02/03/2025
DOL	NYC		VITO GARGANO		1535 RICHMOND AVE STATEN ISLAND NY 10314	12/13/2017	12/13/2022
DOL	NYC	*****3673	WALTERS AND WALTERS, INC.		465 EAST AND THIRD ST MT. VERNON NY 10550	09/09/2019	09/09/2024
DOL	DOL	*****3296	WESTERN NEW YORK CONTRACTORS, INC.		3841 LAYNARD COURT NEW PORT RICHEY FL 34652	07/09/2019	07/09/2024
DOL	DOL		WHITE PLAINS CARPENTRY CORP		442 ARMONK RD	06/12/2018	06/12/2023
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	*****4043	WINDSHIELD INSTALLATION NETWORK, INC.		200 LATTA BROOK PARK HORSEHEADS NY 14845	03/08/2018	03/08/2023
DOL	DOL	*****4730	XGD SYSTEMS, LLC	TDI GOLF	415 GLAGE AVE #302STUART FL 34994	10/31/2018	10/31/2023
DOL	NYC		ZAKIR NASEEM		30 MEADOW ST BROOKLYN NY 11206	10/10/2017	10/10/2022
DOL	NYC	*****8277	ZHN CONTRACTING CORP		30 MEADOW ST BROOKLYN NY 11206	10/10/2017	10/10/2022

EXHIBIT C: SPECIFICATIONS

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Division 23 – Heating, Ventilating, and Air Conditioning (HVAC)

Division 26 – Electrical

Division 28 – Electronic Safety and Security

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SECTION 01 12 00

BASIS OF DESIGN

PART 1 – GENERAL

1.01 INTRODUCTION

A. This document summarizes the Basis of Design for the replacement of four (4) Air Conditioning Units located on the roof of West Courtyard building and 4th floor of Pomerantz Center building at Fashion Institute of Technology, New York, New York.

1.02 SCOPE OF WORK

A. The scope of work includes the replacement of four (4) Air Handling Units in two (2) locations: the roof of West Courtyard and on the 4th floor of Pomerantz Center.
B. The scope of work including but limited to, shall be as follows:
    - West Courtyard scope of work will include the replacement of three (3) Air Handling Units and all the associated accessories as shown on the plans and here after. Modify and replace the piping and ductwork as needed to connect the new Air Handling Units.
    - Extend the existing chilled water pipes from the West Courtyard ceiling to the subcellar with new chilled water pipes and install new chilled water pumps to serve the new Air Handling Units (AC-1W, AC-2W, and AC-3W).
    - Reconnect the new AHUs to the steam pipes, electrical power, and fire alarm system and test for functionality.
    - Provide new Automatic Temperature Controls and connect to the existing Building Management System (BMS).
    - Provide waterproofing for the curbs.
    - 4th floor Pomerantz Center scope of work will include the replacement of one Air Handling Unit (AC-5D) and all the associated accessories as shown on the plans and here after. Modify and replace the piping and ductwork as needed to connect the new Air Handling Units.
    - Install new chilled water pipes from the riser located behind the elevator to the Mechanical room where the new unit is installed. Install new chilled water pumps.
    - Reconnect the new AHUs to the electrical power, and fire alarm system and test for functionality.
    - Provide new Automatic Temperature Controls and connect to the existing Building Management System (BMS).

1.03 CODES AND STANDARDS

A. 2014 New York City Building Code, with latest supplement, unless otherwise noted.
B. ASHRAE 90.1-2019 – Energy Standard for Buildings Except Low-Rise Residential Buildings.
C. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products 2017.

D. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process 2018.

E. ASTM B117 - Standard Practice for Operating Salt Spray (Fog) Apparatus 2018.

F. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2018b.

G. ASTM D2794 - Standard Test Method for Resistance of Organic Coatings to the Effects of Rapid Deformation (Impact).

H. ABMA STD 9 - Load Ratings and Fatigue Life for Ball Bearings 2015.

I. ABMA STD 11 - Load Ratings and Fatigue Life for Roller Bearings 2014.

J. CTI STD-201 OM - Operations Manual for Thermal Performance Certification of Evaporative Heat Rejection Equipment 2017.

K. CTI STD-201 RS - Performance Rating of Evaporative Heat Rejection Equipment 2017.

L. CTI STD-111 - Gear Speed Reducers for Application on Industrial Water Cooling Towers; 2009. (Only for gear-driven products)

M. ISO 9001 - Quality management systems -- Requirements 2015.

N. NEMA MG 1 - Motors and Generators 2017.

O. Structural Steel Painting Council

- SSPC Standards.
- SSPC Painting Manual Volume 1, “Good Painting Practice”.
- SSPC Painting Manual Volume 2, “Systems and Specifications”.

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SECTION 01 31 46

SPECIAL REQUIREMENTS FOR MECHANICAL AND ELECTRICAL WORK

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PART 1 - GENERAL

1.01 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.

1.02 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.

1.03 CODES AND STANDARDS

A. NY State Building Code, Fire Code, Mechanical Code, Plumbing Code, Fuel Gas Code, Energy Conservation Construction Code

B. NFPA National Fire Protection Association

C. ASME American Society of Mechanical Engineers

D. ANSI American National Standards Institute

E. ASTM American Society for Testing Materials

F. AWWA American Water Works Association

G. IBR Institute of Boiler and Radiator Manufacturers

H. NEMA National Electrical Manufacturers Association

I. ASHRAE American Society of Heating, Refrigeration and Air Conditioning Engineers

J. SMACNA Sheet Metal and Air Conditioning Contractors National Association, Inc.

K. ARI Air Conditioning and Refrigeration Institute

L. UL Underwriters' Laboratories

M. AMCA Air Movement Control Association

N. ADC Air Diffusion Council

O. AABC Associated Air Balance Council

P. 1980 National Standard Plumbing Code with all New Jersey State Amendments.

Q. Local Water Company Rules and Regulations

R. NFPA-90A Air Conditioning and Ventilation Systems

1.04 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.

1.05 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, 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 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.

1.06 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.

1.07 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.

1.08 EQUIPMENT AND MATERIALS

A. All pipe, fittings and valves shall be manufactured in the United States of America.

B. 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.

C. 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.

D. If material or equipment is installed before the Contractor obtained "No Objections" comment from 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.

E. The materials, workmanship, design, and arrangement of all work installed under the Contract shall be subject to the approval of the Architect.

F. If material or equipment is installed before the Contractor obtained "No Objections" comment from the Architect, 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.

G. 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 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.

H. 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.

I. 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.

J. 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.

K. All equipment of one type (such as fan, coils, etc.) shall be the product of the same manufacturer.

L. 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 does not invalidate the Plans and Specifications if the shop drawings are in conflict with the Plans and Specifications.

1.09 SHOP DRAWINGS AND SUBMITTALS

A. Prior to delivery to 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 will develop 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 via email in PDF format. Other electronic file formats will be rejected without review. Additionally, large format prints (larger than 18” x 24”) shall also be sent in paper (hard copy) form, either mailed or hand delivered. If and where such hard copies are sent, the Contractor shall send a sufficient quantity of prints of each, knowing that one (1) copy will each be required for the Engineer’s record, the Architect, the Owner, and various subcontractors.

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 identification in catalog, pamphlet, etc., of item submitted shall be clearly made in ink. Data of a general nature such as tabulated charts will not be accepted.

J. Shop drawings indicating an unsuitable manufacturer shall be rejected without review.

K. The HVAC Subcontractor shall prepare ductwork shop drawings at ⅜"=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 finished floor of all ducts, location and height of building structure (beams, etc.), 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 approved for construction, fabrication and/or manufacture subject 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 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 deviation 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 ⅜" = 1'-0" scale.

S. Incorporate a numbering system to help keep track of shop drawing submittals as follows:
1. H.....HVAC shop drawings
2. P .....Plumbing shop drawings
3. SP.....Sprinkler shop drawings
4. E .....Electrical 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 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 which exist in the complete work. Furnishing of 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 review of 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, controlled inspections, submission of fire alarm as-built drawings, backflow prevention device (BFP) sign-offs, 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 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 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 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 five (5) copies of 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, five (5) copies of a preliminary schedule of installation of the various systems. This list shall be revised monthly and five (5) copies shall be submitted. 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 ⅜" = 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 ⅜" = 1'-0" scale shop drawing for piping and ductwork indicating location of piping and ductwork with dimensions for each floor and Mechanical Rooms. A transparent copy of these shop drawings shall be given to the Electrical Contractor. The Electrical Subcontractor shall indicate the location of all lighting fixtures and conduit runs on these shop drawings. The Electrical Subcontractor shall give the transparent copy of these shop drawings, with lighting fixtures and conduit runs indicated to the Plumbing Contractor. The Plumbing and Sprinkler Contractor shall indicate his piping on these shop drawings. Each Contractor shall keep each transparent copy not more than three (3) working days.

L. The Heating, Ventilating and Air Conditioning Contractor shall arrange a Coordination Meeting for each floor and Mechanical Equipment Room with Plumbing and Electrical Subcontractors under the supervision of the General Contractor. After coordination, each Contractor shall sign the transparent 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 original design to the Architect's attention. After receiving 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 dry wall 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 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 location of all panels, cabinets, etc. to receive the Corbin lock. This schedule shall designate, 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 of 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. This shall include ceiling tiles which 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 assure 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 supports 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 machinery base in all directions, with top edge chamfered. Provide ½" 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 doweled 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 in 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 shall be Schedule 40 black steel pipe. Sleeves through non-masonry partitions shall be 22 gauge sheet steel, set flush with 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 Thunderline 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 or interior masonry walls shall be Schedule 40 black steel pipe, set flush with finished wall surfaces, but 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" 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 from structural steel building members only or approved malleable steel inserts imbedded in concrete pours. Concentrated loads up to 50 lbs. can use inserts in concrete. All other loads shall be supported from steel building members. Inserts shall not be located in the same 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. The Contractor shall have the option of providing 18 gauge sheet metal sleeves in lieu of Schedule 40 steel pipe.

I. Piping and conduit 3" and smaller shall be supported from existing slab by "Phillips" ¾ expansion bolts with lead shields. Piping 4" and larger shall be supported by means of 4" x 4" x ⅜" 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.

J. Provide sleeves for pipes passing through roofs. Sleeves passing through roofs shall be as detailed on drawings extending min. 12" above finished roof. All pipes passing through roof shall be minimum of 10" from walls or other construction to permit proper flashing. Provide counter flashing.

K. 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 finished floor.

L. 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.

M. All hangers, rods and supports shall be installed prior to construction fireproofing.

N. 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.

O. Owner shall retain the services of a NYS Licensed Professional Engineer and under his direction shall inspect the existing spray or fire proofing 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 or 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 bakelite 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 wire 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 steams of valves with wire 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 larger than 4 inches diameter, markers shall be strap-on type. For piping located outdoors, all markers shall be strap-on type for all pipe diameters.

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. 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 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.
Chilled Water Supply	Chilled Water	Green	CHWS
Chilled Water Ret.	Chilled Water Return	Green	CHWR
Sanitary Sewer	San. Sewer	Green	----
Storm Sewer	Storm Sewer	Green	----
Combined Sewer	Comb. Sewer	Green	----
Storm Water Piping	St. W.	Green	----
Vent Piping	Vent	Green	----
Air Conditioning Drain	Air Conditioning Drain	Green	----
Safety Valve Discharge	Safety V. Disch.	Yellow	S.V.D.
Relief Vent	Relief V.	Yellow	----
Low Pressure Steam	L.P. Steam----psi	Yellow	L.P.S.___psi
Low Pressure Condensate Return	L.P.Cond. Ret.	Yellow	L.P.C.R.
Pumped Condensate Return	Pumped Cond. Ret.	Green	P.C.R.
Air Conditioned Supply Air	A.C. Supply Air	Green	----
Return Air	R.A.	Green	----
General Exhaust Air	General E.A.	Yellow	----
Toilet Exhaust Air	Toilet E.A.	Yellow	----
Fume Hood Exhaust Air	Fume Hood E.A.	Yellow	----
Outside Air	O.A.	Green	----

LABEL AND VALVE TAG SCHEDULE			
Service	Label Designation	Color	Tag Designation
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 System .....Red
2. Mechanical & Electrical Supervisory System .....Green & Blue

H. 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.

I. 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.

J. 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.

K. 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.

L. Serial numbers shall be stenciled on the tanks and covers of transformers having their nameplates attached to the high voltage switch chamber covers.

M. Signs for Equipment Controlled through the BAS: For all fans, pumps and other motor driven equipment with start/stop control through the BAS provide a red surface, white core laminated bakelite 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 ¾ inch drain, to nearest floor drain or slopsink.
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. 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 ⅛ 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 ¾” (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 20 tons of refrigeration	¾”
Over 20 tons to 40 tons of refrigeration	1”
Over 40 tons 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 which 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 so 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 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 for 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 supports 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 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 existing building will be done under another Section.

1.36 PAINTING

A. Painting Schedule
1. No on-site painting is required on the following items unless specifically indicated otherwise:
   a. Stainless steel or monel sheet metal.
   b. Stainless steel or monel 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 smoke stacks 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 required.
   e. Vessels, Tanks, and Like Equipment Specified to be Insulated: l 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. 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.

h. 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.

i. 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.

B. 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. Piping, Exposed - Bare and Insulated on Unfinished Spaces and Rooms:
      a. Steam Supply (all pressures) .....Yellow
      b. Steam Condensate Returns .....Orange
   3. Piping Not Listed Above: Color code by classification as follows:
      a. Fire Protection .....Red
   4. Ductwork: Grey.
   5. Equipment - Bare and Insulated (Except Factory Painted): Grey.

C. The inside of all ductworks where visible through openings shall be painted with two prime coats of flat black paint.

D. Nameplates on all equipment shall be cleaned and left free of paint. Where equipment is to be painted, the Contractor shall carefully mask of all equipment nameplates and data tags prior to application of paint. Such masking shall be removed after paint has dried.

E. All lead bends and lead safes and 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 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 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.
   2. Packaged Rooftop AC 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 & 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 and MCC's, 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 from 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 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 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 which 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 ⅓ 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. All motors shall be built in accordance with the latest rules of the National Electrical Manufacturers Assn., and of the Institute of Electrical and Electronic Engineers and also as hereinafter specified.

E. Motors ½ HP and larger shall have Class B 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.

F. Motors ½ HP and larger shall have ball or roller bearings with pressure grease lubrication, except where otherwise noted.

G. 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.

H. All motor leads shall be permanently identified and supplied with connectors.

I. Motors shall have nameplates giving manufacturer's name, serial number, horsepower, speed, voltage, phase and current characteristics.

J. The insulation resistance between stator conductors and frames of motors at the time of final inspection shall be not less than one-half megohm.

K. 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.

L. The maximum full load speed of each direct connected motor shall be suitable for the equipment it drives.

M. 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.

N. All motors except motors furnished as an integral part of equipment and factory installed on the equipment, shall be of same manufacture.

O. Polyphase motors shall be squirrel cage induction high efficiency energy saver type, suitable for the starting torque and current requirements.

P. Single phase motors shall be of the capacitor start induction run or split phase type as required for proper operation of the driven equipment.

Q. Where used with VFD equipment, motor shall be rated for inverter service without excessive noise, vibration, hum or damage.

R. 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 micro fibers 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.

S. 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 the 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%

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
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 ⅓ 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 combination circuit breaker and magnetic starter with pilot light.

B. For 3-phase motors ½ 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 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 die-cast 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 shall 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 and have 7A , DPDT 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 mm^2 wire range, 41A maximum current, 800 VAC/VDC voltage rating
      3) ATEX – 6 mm^2 (#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 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.

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.

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, disconnects and breakers and twist types 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 transformer or series resistor type. There shall be one red light for each single speed motor to indicate when 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 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 starters shall be clearly identified by engraved nameplates after installation. The nameplates shall be bakelite 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 as 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 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 1 general purpose steel enclosures. Outdoor controllers shall be provided with weather resistant NEMA Type 3R steel enclosures. Provide 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 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 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/oiltight 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 shall 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_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.

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 mm^2 wire range, 41A maximum current, 800 VAC/VDC voltage rating
      3) ATEX – 6 mm^2 (#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 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.

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, disconnects and breakers and twist types 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

3.01 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 91 13

COMMISSIONING-GENERAL REQUIREMENTS

PART 1 - GENERAL

1.01 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□s 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.

1.02 SCOPE

A. The functions and responsibility 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: 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 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.

1.03 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. VFD
4. Piping System
5. Ductwork System
6. TAB
7. Controls

1.04 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.

1.05 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.

1.06 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

2.01 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 *I* 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 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

3.01 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 (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.

3.02 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.

3.03 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.

3.04 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 test 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.

3.05 SOFTWARE DOCUMENTATION REVIEW

A. Review detailed software documentation for all DDC control systems related to the commissioned equipment and systems. This includes 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.

3.06 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 shell 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.

3.07 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 installing contractors shall provide training on all the major systems per specifications, including aspects, 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.

3.08 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.

3.09 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 07 84 00

FIRESTOPS AND SMOKE SEALS

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Provide firestop systems consisting of a material, or combination of materials installed to retain the integrity of fire resistance rated construction by maintaining an effective barrier against the spread of flame, smoke and/or hot gases through penetrations, fire resistive joints, and perimeter openings in accordance with the requirements of the Building Code for this project.

B. Firestop systems shall be used in locations including, but not limited to, the following:

1. Penetrations through fire resistance rated floor and roof assemblies including both empty openings and openings containing penetrants.
2. Penetrations through fire resistance rated wall assemblies including both empty openings and openings containing penetrants.
3. Membrane penetrations in fire resistance rated wall assemblies where items penetrate one side of the barrier.
4. Joints between fire resistance rated assemblies.
5. Perimeter gaps between rated floors/roofs and an exterior wall assembly.

C. Related Sections include, but are not limited to, the following:

1. Division 23 – Heating, Ventilating and Air Conditioning
2. Division 26 – Electrical

1.03 REFERENCES

A. New York City Building Code

B. National Fire Protection Association (NFPA)

1. NFPA 101 (Life Safety Code)

C. American Society For Testing and Materials Standards (ASTM):

1. ASTM E84: Standard Test Method for Surface Burning Characteristics of Building Materials.
2. ASTM E814: Standard Test Method for Fire Tests of Through-Penetration Firestops.
3. ASTM E1966: Test Method for Resistance of Building Joint Systems.
4. ASTM E1399: Test Method for Cyclic Movement and Measuring Minimum and Maximum Joint Width.
5. ASTM E119: Methods of Fire Tests of Building Construction and Materials.
6. ASTM E2174: Standard Practice for On-Site Inspection of Installed Fire Stops
7. ASTM E2307: Standard Test Method for Determining the Fire Endurance of Perimeter Fire Barrier Systems Using the Intermediate-Scale, Multi Story Test Apparatus (ISMA)
8. ASTM E2393-04 Standard Practice for On-Site Inspection of Installed Fire Resistive Joint Systems and Perimeter Fire Barriers

D. Underwriters Laboratories Inc. (UL):

1. UL Qualified Firestop Contractor Program.
2. UL 263: Fire Tests of Building Construction and Materials.
3. UL 723: Surface Burning Characteristics of Building Materials.
4. UL 1479: Fire Tests of Through-Penetration Fire Stops.
5. UL 2079: Tests for Fire Resistance of Building Joint Systems.

E. UL Fire Resistance Directory -Volume 2:

1. Through-Penetration Firestop Devices (XHJI)
2. Fire Resistive Ratings (BXUV)
3. Through-Penetration Firestop Systems (XHEZ)
4. Fill, Void, or Cavity Material (XHHW)

F. Omega Point Laboratories (OPL)

1. Building Products, Materials & Assemblies – Volume II

G. Factory Mutual Research (FM):

1. FM 4991: FM Approval Standard of Firestop Contractors – Class 4991

1.04 DEFINITIONS

A. Firestopping: The use of a material or combination of materials in a fire-rated structure (wall or floor) where it has been breached, so as to restore the integrity of the fire rating on that wall or floor.

B. System: The use of a specific firestop material or combination of materials in conjunction with a specific wall or floor construction type and a specific penetrant(s).

C. Barrier: Any bearing or non-bearing wall or floor that has an hourly fire and smoke rating.

D. Through-penetration: Any penetration of a fire-rated wall or floor that completely breaches the barrier.

E. Membrane-penetration: Any penetration in a fire-rated wall or floor/roof-ceiling assembly that breaches only one side of the barrier.

F. Fire Resistive/Construction Joint: Any gap, joint, or opening, whether static or dynamic, between two fire rated barriers including where the top of a wall meets a floor; wall edge to wall edge applications; floor edge to floor edge configurations; floor edge to wall.

G. Perimeter Barrier: Any gap, joint, or opening, whether static or dynamic, between a fire rated floor assembly and an exterior wall assembly.

H. Approved Testing Agencies: Not limited to: Underwriters Laboratory (UL), Factory Mutual (FM), Warnock Hersey, and Omega Point Laboratory (OPL).

1.05 PERFORMANCE REQUIREMENTS

A. Penetrations: Provide through-penetration and membrane-penetration firestop systems that are produced and installed to resist the spread of fire, passage of smoke and other hot gases according to requirements indicated, to restore the original fire-resistance rating of assembly penetrated.

1. Provide and install complete penetration firestopping systems that have been tested and approved by nationally accepted testing agencies per ASTM E814 or UL 1479 fire tests in a configuration that is representative of field conditions.

2. F-Rated Systems: Provide firestop systems with F-ratings indicated, as determined per ASTM E814 or UL 1479, but not less than one (1) hour or the fire resistance rating of the assembly being penetrated.

3. T-Rated Systems: Provide firestop systems with T-ratings indicated, as well as F-ratings, as determined per ASTM E814 or UL 1479, and where required by the Building Code for floor penetrations which are not located within the cavity of a wall.

4. L- Rated Systems: Provide firestop systems with L- ratings less than 5cfm/sf.

5. W-Rated systems: Provide firestop systems that are resistant to water. For piping penetrations for plumbing and wet-pipe sprinkler systems, provide moisture-resistant through-penetration firestop systems.

6. For penetrations involving non-metallic, CPVC, PVC, or plastic piping, tubing or conduit, provide firestop systems that are chemically compatible in accordance with Manufacturer requirements.

7. For penetrations involving insulated piping, provide firestop systems not requiring removal of insulation.

8. For penetrations involving fire or fire/smoke dampers, only firestop products approved by the damper manufacturer shall be installed in accordance with the damper installation instructions.

B. Fire Resistive Joints: Provide joint systems with fire resistance assembly ratings indicated, as determined by UL 2079 (ASTM E1399 and E1966), but not less than the fire resistance assembly rating of the construction in which the joint occurs. Firestopping assemblies must be capable of withstanding anticipated movements for the installed field conditions.

1. For firestopping assemblies exposed to view, traffic, moisture, and physical damage, provide products that after curing do not deteriorate when exposed to these conditions both during and after construction.

2. For floor penetrations exposed to possible loading and traffic, provide firestop systems capable of supporting floor loads involved either by installing floor plates or by other means, as specified by the Architect.

3. L- Rated Systems: Provide firestop systems with L- ratings less than 5cfm/sf.

C. Firestopping products shall have flame spread ratings less than 25 and smoke-developed ratings less than 450, as determined per ASTM E 84. Note: Firestop products installed in plenum spaces shall have a smoke developed rating less that 50.

D. Engineering Judgment (EJ): Where there is no specific third party tested and classified firestop system available for an installed condition, the Contractor shall obtain from the firestopping material manufacturer an Engineering Judgment (EJ) to be submitted to the Design Professional and where required the Authority Having Jurisdiction for approval prior to installation. The EJ shall follow International Firestop Council (IFC) guidelines. Note: Tested and Listed firestop systems are to be used before an Engineering Judgment (EJ). Engineeing Judgments (EJ) shall not be utilized as an alternative to proper construction or coordination.

1.06 SUBMITTALS

A. Product Data: For each type of firestopping product selected. Manufacturers certification must verify that firestopping materials are free of asbestos, lead and contain volatile organic compounds (VOCs) within limits of the local jurisdiction.

B. Design Listings: Submit system design listings, including illustrations, from a qualified testing and inspecting agency that is applicable to each firestop configuration.

C. Installation Instructions: Submit the manufacturer’s installation instruction for each firestop assembly.

D. Where there is no specific third party tested and classified firestop system available for a particular configuration, the Contractor shall obtain from the firestopping material manufacturer an Engineering Judgment (EJ) for submittal.

E. Material Safety Data Sheet (MSDS): Submit for each type of firestopping product selected.

F. Qualification Data: For firms and persons specified in “Quality Assurance” Article to demonstrate their capabilities and experience. Submit documents as per 1.7.

G. A quality control manual approved by FM or UL (if applicable).

H. Firestop Schedule: Submit schedule (see appendix A) itemizing the following:

1. Manufacturer’s product reference numbers and/or drawing numbers.

2. Listing agency’s design number.

3. Penetrating Item Description/Limits: Material, size, insulated or uninsulated, and combustibility.
4. Maximum allowable annular space or maximum size opening.
5. Wall type construction.
6. Floor type construction.
7. Hourly Fire resistance rating of wall or floor.
8. F rating.
9. T rating for floor penetrations not in a cavity of a wall. The F and T ratings shall be equal.
10. L and W rating, if applicable.

I. Firestop Application Log: A separate binder shall be prepared and kept on site for use by the Inspection Agency and the Authority Having Jurisdiction. The binder shall contain the following:

1. The binder shall be a three (3) ring binder.
2. Firestop Schedule (see appendix A)
3. All approved firestopping assemblies including engineering judgments shall be provided and organized by trade.
4. Copy of manufacturer's installation instruction for each firestop assembly.
5. A matrix or table of contents listing each assembly shall be provided.
6. The binder shall be updated as new firestop assemblies or EJ's are added.
7. The binder shall be kept on-site at a location approved by the Owner.
8. Qualifications or Certification of each Installer

1.07 QUALITY ASSURANCE

A. Provide firestopping system design listings from UL, FM, Warnock Hersey or OPL in accordance with the appropriate ASTM Standard(s) per article 1.5.

B. Contractor Qualifications: An acceptable Firestop Contractor shall be:

1. Licensed by State or Local Authority where applicable, or
2. FM Research approved in accordance with FM Standard 4991, or
3. UL Qualified Firestop Contractor, or
4. Meet the following requirements
   i. Installation personnel shall be trained by the approved firestop manufacturer.
   ii. The installation firm shall be experienced in installing firestop systems and fire resistive joint systems similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful performance.
   iii. Qualifications include having the necessary experience, staff, and training to install manufacturer's products per specified tested and listed system requirements.
   iv. Minimum of three (3) years experience and shown to have successfully completed not less than 5 comparable scale projects and provide references.

C. Single Source Limitations: Obtain firestop systems for all conditions from a single manufacturer. The only exception is where a listed firestop system is available for a specific opening from another manufacturer, it shall be utilized before an Engineering Judgment.

D. Materials from different firestop manufacturers shall not be installed in the same firestop system or opening.

E. Firestopping material shall be asbestos and lead free and shall not incorporate nor require the use of hazardous solvents.

F. Firestopping sealants must be flexible, allowing for normal movement.

G. Firestopping materials shall not shrink upon drying as evidenced by cracking or pulling back from contact surfaces such that a void is created.

H. Firestopping materials shall be moisture resistant, and may not dissolve in water after curing.

I. Materials used shall be in accordance with the manufacturer's written installation instructions.

J. Identify installed firestop systems with preprinted metal or plastic labels. Attach labels permanently to surfaces adjacent to and within 6 inches (150 mm) of edge of the firestop systems so that labels will be visible to anyone seeking to remove penetrating items or firestop systems. In addition, for perimeter or joint firestop systems attach labels at locations every 20 feet or at least each section where separated. Use mechanical fasteners for metal labels. For plastic labels, use self-adhering type with adhesives capable of permanently bonding labels to surfaces on which labels are placed and provide a label material that will result in partial destruction of label if removal is attempted. Include the following information on labels:

   1. The words "Warning - Firestop System - Do Not Disturb. Notify Building Management of Any Damage."
   2. Contractor's name, address, and phone number.
   3. Firestop system designation of applicable testing and listing agency.
   4. Date of installation.
   5. Firestop system manufacturer's name.
   6. Installer's name.
   7. Inspector's name (if applicable)

K. Inspection of penetrations through fire rated floor and wall assemblies shall be in accordance with ASTM E2174, Standard Practice for On-Site Inspection of Installed Fire Stops and ASTM E2393-04 Standard Practice for On-Site Inspection of Installed Fire Resistive Joint Systems and Perimeter Fire Barriers. The Owner may engage a qualified, independent inspection agency, or material testing agency to perform these inspections.

L. In high-rise buildings or in buildings assigned to Risk Category III or IV, Special inspection for through-penetrations, membrane penetration firestops, fire-resistant joint systems and perimeter fire barrier systems shall be conducted by an approved agency.

M. Field Mock-up Installations: Prior to installing firestopping, erect mock-up installations for each type firestop system indicated in the Firestop Schedule to verify selections made and to establish standard of quality and performance by which the firestopping work will be judged by the Owner or Owner's Representative. Obtain acceptance of mock-up installations by the Owner or Owner's Representative before start of firestopping installation. Provide at least 72 hours notice to Owner or Owner's Representative prior to inspection.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Deliver firestopping products to Project site in original, unopened containers or packages with intact and legible manufacturer's labels identifying product and manufacturer, date of manufacture/expiration, lot number, listing agency's classification marking, and mixing instructions for multi-component materials.

B. Store and handle materials per manufacturer's instructions to prevent deterioration or damage due to moisture, temperature changes, contaminants, or other causes.

C. All firestop materials shall be installed prior to expiration date.

1.09 PROJECT CONDITIONS

A. Environmental Limitations: Install firestopping when ambient or substrate temperatures are within limits permitted by the manufacturer's written instructions. Do not install firestopping when substrates are wet due to rain, frost, condensation, or other causes.

B. Ventilate per the manufacturers written instructions on the product's Material Safety Data Sheet.

C. Verify the condition of the substrates before starting work.

D. Care should be taken to ensure that firestopping materials are installed so as not to contaminate adjacent surfaces.

1.10 COORDINATION

A. Coordinate areas prior to firestopping installation with the Owner, Construction Manager and/or all other Contractors.

B. Coordinate construction of openings and penetrating items to ensure that firestopping assemblies are installed according to specified requirements. Opening shall not exceed maximum restrictions allowable for annular spacing per listing or acceptable Engineering Judgments.

C. Coordinate sizing of sleeves, openings, core-drilled holes, or cut openings to accommodate through-penetration firestop systems.

D. Do not conceal firestopping installations until the Owner's inspection agency or Authorities Having Jurisdiction have examined each installation.

E. Schedule firestopping after installation of penetrants and joints but prior to concealing or obstructing access to areas requiring firestopping.

F. Preinstallation Conference: This conference should be a joint meeting attended by the Owner's Representative and all prime contractors, respective firestopping sub-contractors and firestopping company field advisor to review project requirements. The agenda for the conference should include the following topics:

1. Review scope of work.
2. Review shop drawings and firestop application log.
3. Review mock-up requirements.
4. Discuss identification labels and locations.
5. Review schedule, coordination and sequencing with all trades.
6. Review any engineering judgments or other special requirements.

7. Function and frequency of inspections and testing labs.

G. Destructive testing shall be performed at mock up and at pre determined intervals according to ASTM E 2174 and ASTM E 2393-04 by the inspector and with the installing Contractor present. Inspector to test for in place installation conformance to tested and listed system or engineering judgment details. Non conformances will result in additional destructive testing, at the cost of the installer.

PART 2 - PRODUCTS

2.01 FIRESTOPPING, GENERAL

A. Firestopping products specified in system design listings by approved testing agencies may be used providing they conform to the construction type, penetrant type, annular space requirements and fire rating involved in each separate assembly.

B. Manufacturer of firestopping products shall have been successfully producing and supplying these products for a period of not less than three years and be able to show evidence of at least ten projects where similar products have been installed and accepted.

C. Accessories: Provide components for each firestop system that is needed to install fill materials and to comply with “Performance Requirements” Article. Use only components specified by the firestopping manufacturer and by the approved testing agencies for the firestop systems indicated. Accessories include, but are not limited to the following items:

1. Permanent forming/damming/backing materials, including the following:
    i. Slag wool fiber insulation.
    ii. Foams or sealants used to prevent leakage of fill materials in liquid state.
    iii. Fire-rated form board.
    iv. Polyethylene/polyurethane backer rod.
    v. Rigid polystyrene board.
2. Temporary forming materials.
3. Substrate primers.
4. Steel sleeves

D. All firestopping products and systems shall be designed and installed so that the basic sealing system will allow the full restoration of the thermal and fire resistance properties of the barrier being penetrated with minimal repair if penetrants are subsequently removed.

2.02 MIXING

A. For those products requiring mixing before application, comply with firestopping manufacturer's written instructions for accurate proportioning of materials, water (if required), type of mixing equipment, selection of mixer speeds, mixing containers, mixing time, and other items or procedures needed to produce products of uniform quality with optimum performance characteristics for application indicated.

2.03 MANUFACTURERS

A. Subject to compliance with the requirements, provide products by one of the following or equivalent manufacturers:

1. Grace Construction Products.
2. Nelson Firestop Products.
3. Hilti Firestop Products.
4. A/D Fire Protection Systems Inc.
5. RectorSeal Corporation (The).
6. Specified Technologies Inc.
7. 3M; Fire Protection Products Division.
8. Tremco; Sealant/Weatherproofing Division.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates and conditions for compliance with requirements for opening configurations, penetrating items, substrates, and other conditions affecting performance.

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

C. Verify that all pipes, conduits, cables, and/or other items which penetrate fire-rated construction have been permanently installed prior to installation of firestops.

3.02 PREPARATION

A. Surface Cleaning: Clean out openings immediately before installing firestop systems to comply with written recommendations of firestopping manufacturer and the following requirements:

1. Remove from surfaces of opening substrates and from penetrating items foreign materials that could interfere with adhesion of firestop systems.
2. Clean opening substrates and penetrating items to produce clean, sound surfaces capable of developing optimum bond with firestop systems. Remove loose particles remaining from cleaning operation.
3. Remove laitance and form-release agents from concrete.

3.03 FIRESTOP SYSTEMS INSTALLATION

A. General: Install firestop systems to comply with "Performance Requirements" article in Part 1 and firestopping manufacturer's written installation instructions and published drawings for products and applications indicated.

B. Installation of firestopping shall be performed by an applicator/installer qualified as described in article 1.7.

C. Apply firestopping in accordance with approved testing agencies listed system designs or as per the manufacturer's installation instructions.

D. Verify that environmental conditions are safe and suitable for installation of firestop products.

E. Install forming/damming/backing materials and other accessories required to support fill materials during their application and in the position needed to produce cross-sectional shapes and depths required to achieve fire resistance ratings required.

F. Install joint forming/damming materials and other accessories required to support fill materials during their application and in the position needed to produce cross-sectional shapes and depths of installed firestopping material relative to joint widths that allow optimum movement capability and achieve fire resistance ratings required.

G. Install metal framing, curtain wall insulation, mechanical attachments, safing materials and firestop materials as applicable within the system design.

H. Install fill materials for firestop systems by proven techniques to produce the following results:

1. Fill voids, joints and cavities formed by openings, forming materials, accessories, and penetrating items as required to achieve fire-resistance ratings indicated.

2. Apply materials so they fully contact and adhere to substrates formed by openings and penetrating items.

3. For fill materials that will remain exposed after completing Work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.

4. Tool non-sag firestop materials after their application and prior to the time skinning begins. Use tooling agents approved by the firestopping manufacturer.

I. On vertical pipe penetrations, lift riser clamps to permit the installation of firestopping around the entire pipe penetration. For penetrations involving fire or fire/smoke dampers, only firestop products approved by the damper manufacturer shall be installed in accordance with the damper installation instructions.

3.04 FIELD QUALITY CONTROL

A. Inspecting Agency: Authorities Having Jurisdiction, the Owner, or Owner's Representative shall be allowed to perform random destructive testing during inspection of firestop systems to verify compliance per listings or manufacturer's installation instructions. All areas of work must be accessible until inspection by the applicable Authorities Having Jurisdiction and inspection agencies. The contractor shall be responsible to repair all tested assemblies with no cost to the owner.

B. Proceed with enclosing firestop systems with other construction only after inspections are complete.

C. Where deficiencies are found, repair or replace firestop systems so they comply with requirements.

3.05 CLEANING AND PROTECTION

A. Clean off excess fill materials adjacent to openings, as Work progresses by methods and with cleaning materials that are approved in writing by firestopping manufacturer(s) and that do not damage materials in which openings occur. Leave finished work in neat, clean condition with no evidence of spillovers or damage to adjacent surfaces.

B. Provide final protection and maintain conditions during and after installation that ensure firestop systems are without damage or deterioration at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated firestop systems immediately and install new materials to produce firestop systems complying with specified requirements.

FIRESTOP SCHEDULE

Project No:	Contractor Name and Address:	Date Submitted:
Project Title:	Supplier/Installer Name and Address:	Company Field Advisor Name and Address:
	Manufacturer Name and Address:	

Manufacturer's Product Reference Numbers and/or Drawing Numbers	U.L., FM, Warnock Hersey or Omega Point Lab Penetration Design Nos.	Penetrating Item: Material, Size, Insulated, Combustible, Joint, Perimeter, etc. Description:	Maximum Allowable Annular Space or Maximum Size Opening	Wall type Construction		Floor Type Construction	Fire Resistance Rating of Wall or Floor (Hourly)	F Rating	T Rating (floors Only)	L Rating (if available)	W Rating (if available)
				DES.	CONST.						
Example No. 1 DCFSS-130	UL #130	Maximum 4" Steel Pipe Non-Insulated		P4	6" CMU	N.A.	1 Hour	1 Hour	N.A	.	
Example No. 2 5300-ICF88.01	UL #591	Maximum 4" PVC Pipe		N.A.	N.A.	UL # D916	3 Hour	1 Hour	2 Hour		
Exmple No. 3	CW-S-2006	Curtain Wall/Perimeter	6” to 12”	NA	NA	4 ½” Reinforced LW concrete	2 Hour	2 Hour	NA	1 CFM/ Lin Ft.	

Manufacturer's Product Reference Numbers and/or Drawing Numbers	U.L., FM, Warnock Hersey or Omega Point Lab Penetration Design Nos.	Penetrating Item: Material, Size, Insulated, Combustible, Joint, Perimeter, etc. Description:	Maximum Allowable Annular Space or Maximum Size Opening	Wall type Construction		Floor Type Construction	Fire Resistance Rating of Wall or Floor (Hourly)	F Rating	T Rating (floors Only)	L Rating (if available)	W Rating (if available)
				DES.	CONST.						

SECTION 23 05 12

GENERAL PROVISIONS FOR HVAC WORK

PART 1 - GENERAL

1.01 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.

1.02 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 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. Air handling units used for single duct systems, steam preheat coils, cooling coils where indicated.
   c. Filters.
   d. Fans.
   e. 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.
   f. Steam specialties such as traps, strainers, safety valves, flash tanks, etc.
   g. Accessories such as V-belt drives, flow measuring devices, draft gauges, machinery guards, thermostats, pressure gauges.
   h. Inertia blocks and vibration isolation equipment.
   i. Piping, fittings, and valves.
   j. Sheet metal ductwork and accessories such as dampers, access doors, etc.
   k. Fire dampers and smoke dampers.
   l. Installation of smoke detectors in ductwork.
   m. Acoustical duct lining.
   n. Pipe, duct and equipment insulation.
   o. 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.

p. Painting and pipe, duct and equipment identification for all work by this Contractor is previously specified under "Special Requirements for Mechanical and Electrical Work".
q. Test and balancing.
r. Sleeves, pipe inserts and anchor bolts, escutcheons, prefabricated roof curbs, etc., as hereinafter specified.
s. Identification, name plates, tags and charts.
t. Cutting and rough patching.
u. Furnishing and setting of electric motors.
v. Furnishing of starters, motor control centers and motor control devices as specified under "Special Requirements for Mechanical and Electrical Work".
w. Templates and anchor bolts for equipment bases.
x. Cap flashing for pipe and duct passing through roof.
y. Removal, relocation and/or demolition of existing HVAC work in conjunction with the existing buildings in order to erect the new buildings as indicated on the Contract Drawings.
z. Energy Management Building Automation System.
aa. Concrete pads for all HVAC work.
bb. All demolition work associated with HVAC systems.
cc. Installation of fire and smoke dampers in the existing ductwork and fan systems.

1.03 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. Valved water supply outlets within 5'-0" of the various pieces of the HVAC equipment will be left by the Plumbing Contractor. Final connections to HVAC equipment shall be made by this Contractor.
3. Floor and funnel drains adjacent to equipment requiring same will be furnished and installed by the Plumbing Contractor.
4. Outside air inlets, exhaust outlets, louvers and screens through walls, and elsewhere as noted on the Drawings. Motorized dampers furnished and installed under this Contract.
5. Base flashing of curbs and sleeves at roofs.
6. Power wiring for all motors except where otherwise noted.
7. Setting of access doors furnished by this Contractor.
8. All motor disconnect switches, except where in combination starters and where otherwise noted.
9. Finish painting.
10. Access doors in ceiling and walls.
11. Finish patching.
12. Wiring of switches, aquastats, pressure controls in power circuit of cabinet and unit heaters.
13. Fan shutdown system.
14. Mounting of all starters, motor control centers, starter panelboards, and motor control devices: Division 26.

1.04 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.

1.05 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. Schedule of ductwork, joints, gauges, supports, flexible connections, fire dampers, access doors, etc.
9. Utility fans, centrifugal fans, and power roof ventilators and propeller fans.
10. Sheet metal fabrication drawings.
11. Schedule of steam traps.
12. Machinery guards and V-belt drives.
13. Roof vent fittings.
14. Steam safety relief valves.
15. Schedule of piping and fitting materials.
16. Piping shop drawings.
17. Schedule of valves, strainers, vacuum breakers.
18. Schedule of steam pressure reducing valves.
19. Flow metering devices and systems.
20. Thermometers and pressure gauges.
21. Schedule of pipe and ductwork supports, including inserts, escutcheons, etc.
22. Water pumps including pump curves.
23. All motor starters, motor control devices and motor control centers.
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. 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 the Specifications.

PART 2 - PRODUCTS

2.01 SPARE PARTS

A. Chilled water - For each pump listed, unless otherwise specified:
1. One set of wearing rings.
2. One set of bearings.

3. One set of packing glands complete with rings, nuts and bolts.
4. Three gaskets for casing joint.
5. Sufficient stuffing box packing for four packings.

Where pump specifications do not require packing glands of stuffing boxes, items #3 & 5 shall be omitted. Inline pumps w/stuffing box design, item #1 & 2 shall be omitted. Inline pumps w/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 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. Furnish one complete set of V-belts for each belt driven unit installed.
3. Electrical equipment - two spare starter fuses identified for each type and size for all starters including pumps, supply, return and exhaust fan.
4. One set of bearings properly identified for each type and size supply, return and exhaust fan.
5. For each type and size pump furnished under this section of the contract, furnish as applicable for each type and size of 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 lock and two (2) keys. Pasted on the inside cover shall be a list of all tools provided in 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" of rubber tubing.

2.02 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. Grundfos
   c. Armstrong
   d. Taco
   e. or approved equal
2. Air Conditioning Units

a. Coolbreeze
b. Venmar
c. Governaire

3. Air Filters
   a. American Air Filter
   b. Camfill Farr
   c. Cambridge
   d. or approved equal
4. Draft Gauges
   a. Dwyer
   b. or approved equal
5. Centrifugal Fans and Utility Sets
   a. Cook
   b. Greenheck
   c. Twin Cities
   d. or approved equal
6. Louvers & Dampers
   a. Greenheck
   b. Ruskin
   c. Titus
   d. or approved equal
7. Water Specialties
   a. Bell & Gossett
   b. Taco
   c. Armstrong
   d. or approved equal
8. Expansion Joints
   a. Zallea
   b. Flexonics
   c. Flex Hose
   d. or approved equal
9. Flow Measuring Devices
   a. Greenheck
   b. Barco Division;
   c. Pres O Ind.
   d. or approved equal
10. Thermometers & Pressure Gauges
    a. Ashcroft
    b. Weiss Instruments
    c. or as specified in Section 23 05 80
11. Motors
    a. Toshiba
    b. or approved equal
12. Starters, Motor Control Centers, Switches
    a. Allen Bradley / Rockwell
    b. Square D
    c. General Electric
    d. Westinghouse
    e. Cutler-Hammer
    f. or approved equal
13. Valves

a. Milwaukee Valve
b. Crane
c. Hammond Valve
d. or as specified under paragraph on "Valves".

14. Insulation and Acoustic Lining
    a. Owens-Corning Fiberglass Corp.
    b. CSG Snap-on
    c. Johns Manville
    d. or approved equal
15. Vibration Isolation
    a. VMC East
    b. Mason Industries
    c. Korfund Corp
    d. or approved equal
16. Automatic Temperature Controls
    a. Distech
17. Internal Cleaning & Treating of Piping
    a. Heating Economy Services Co., Inc.
    b. Tower Water Management
    c. The Metro Group, Inc.
    d. Dew Chemical Co.
18. Electric Heater
    a. Neptronic.
    b. Indeeco.
    c. or approved equal

PART 3 - EXECUTION

A. Furnish and install all shut-off valves, traps and piping for each item of equipment. Any additional pipe and fittings required for connection of AHUs and not shown on Drawings, shall be furnished and installed by the Contractor.

END OF SECTION 23 05 12

SECTION 23 05 23

VALVES FOR HVAC

PART 1 - GENERAL

1.01 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.

C. Section 23 20 00 – Piping for HVAC.

1.02 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.

1.03 QUALITY ASSURANCE

A. "Manufacturers" - Firms regularly engaged in 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, "General Provisions for HVAC Work".

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.

1.04 SUBMITTALS

A. Refer to Section 01 31 46 - Special Requirements for Mechanical and Electrical Work and submit shop drawings.

1.05 GUARANTEE

A. Refer to Section 01 31 46 - Special Requirements for Mechanical and Electrical Work.

PART 2 - PRODUCTS

2.01 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 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 steam 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 check 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 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.

H. Provide capped blow-off valves at all strainers, and where shown on the Drawings.

I. Provide valve operating chain 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.

TYPE	SIZE	NIBCO NO.	CRANE NO.	VICTAULIC NO.	HAMMOND NO	MILWAUKEE NO.	ABZ No.	REMARKS
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

TYPE	SIZE	NIBCO NO.	CRANE NO.	VICTAULIC NO.	HAMMOND NO	MILWAUKEE NO.	ABZ No.	REMARKS
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	HP1LCS4212 HP1LCS4213	HP1LCS4212 HP1LCS4213	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
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

2.02 VALVES IN COPPER TUBING

A. Except where otherwise noted, all valves for use with copper tubing shall be as follows

TYPE	SIZE	NIBCO NO	CRANE NO	VICTAULIC NO	HAMMOND NO	MILWAUKEE NO	REMARKS
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
Globe Valve	2" & Smaller	S-211-Y	1310	----	IB418	1502	125 lb WSP, bronze

TYPE	SIZE	NIBCO NO	CRANE NO	VICTAULIC NO	HAMMOND NO	MILWAUKEE NO	REMARKS
	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

2.03 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 hand gun.
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.

2.04 VALVE CONSTRUCTION

A. Piping less than 100 psi: 200# WOG Class, cast iron body.

B. Piping 100 psi to 250 psi: ANSI Class 150, carbon steel.
1. 4" and larger: flanged, ANSI Class 150 rated.

C. Piping over 250 psi: ANSI Class 300, carbon steel body.
1. Up to 2": screwed

2. 2½" and larger: flanged, ANSI Class 300 rated.

2.05 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 as 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.

2.06 BALL VALVES

A. Ball Valves up to 2½" may be used for all water services as an alternate 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 paragraph 2.01.

2.07 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 full thickness of insulation.

D. Operators:
1. Valves to 4" shall have lever operators with 10 locking positions and adjustable memory stop.
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 blow out.

G. Discs: 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 steel 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 paragraph 2.01.

PART 3 - EXECUTION

3.01 INSPECTION

A. Contractor shall examine location where valves are to be installed and determine space conditions and notify architect in writing of conditions determined to proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. Install valves where 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).

C. Contractor is responsible for 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 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.

3.03 FIELD QUALITY CONTROL

A. Upon completion of installation of valves, test valves to demonstrate compliance with requirements. When possible, field correct malfunctioning valves, then retest to demonstrate compliance. Replace units which cannot be satisfactorily corrected.

END OF SECTION 23 05 23

SECTION 23 05 48

VIBRATION ISOLATION

PART 1 - GENERAL

1.01 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.

1.02 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.

1.03 QUALITY ASSURANCE

A. 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, " General Provisions for HVAC Work ".

C. Provide equipment whose performance under specified conditions is certified by the manufacturer.

1.04 SUBMITTALS

A. Refer to Section 01 31 46 - Special Requirements for Mechanical and Electrical Work and submit shop drawings.

1.05 COORDINATION

A. Refer to Section 01 31 46 - Special Requirements for Mechanical and Electrical Work.

1.06 GUARANTEE

A. Refer to Section 01 31 46 - Special Requirements for Mechanical and Electrical Work.

1.07 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 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 pipe runs within the mechanical equipment room area, but not less than 50 feet from connected equipment shall be isolated from building structure by means of units designed for insertion in rods.

PART 2 - PRODUCTS

2.01 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 □" neoprene acoustical friction pads between the base plate and the support. All mountings shall have leveling 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 D:
   a. Vibration hangers shall contain a steel spring and a double deflection neoprene element in series. Neoprene elements shall have a minimum deflection 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

4. 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

5. 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

6. 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 1¾" 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. 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 supports 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. 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 and 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)
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)		

Vibration Eliminator Specification Type for Equipment Location:		
Type of Equipment	With No Occupied or Unoccupied Spaces Below	Above Occupied or Unoccupied Spaces
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)
Piping in Boiler or Mechanical Equipment Rms.	See Spec. Text	See Spec. Text
High Pressure Ductwork in Mechanical Equipment Rms.	Type F	Type F

2.02 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. 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

3.01 INSPECTION AND COORDINATION

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.

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.

3.02 INSTALLATION

A. Mount floor-mounted equipment on 4" concrete housekeeping pads over 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". 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.

3.03 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.

3.04 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 67

DUCT CLEANING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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.

1.02 DESCRIPTION OF WORK

A. The work includes the providing of all labor, materials, equipment, accessories, services and tests necessary to clean all existing ductwork to remain and be reused.

B. Cleaning of ductwork must be performed prior to leak testing ductwork.

1.03 QUALITY ASSURANCE

A. Membership: The HVAC system cleaning contractor shall be a certified member of the National Air Duct Cleaners Association (NADCA), or shall maintain membership in a nationally recognized non-profit industry organization dedicated to the cleaning of HVAC systems.

B. Certification: The HVAC system cleaning contractor shall have a minimum of one (1) Air System Cleaning Specialist (ASCS) certified by NADCA on a full time basis, or shall have staff certified by a nationally recognized certification program and organization dedicated to the cleaning of HVAC systems.

C. Supervisor Qualifications: A person certified as an ASCS by NADCA, or maintaining an equivalent certification by a nationally recognized program and organization, shall be responsible for the total work herein specified.

D. Experience: The HVAC system cleaning contractor shall submit records of experience in the field of HVAC system cleaning as requested by the owner. Bids shall only be considered from firms which are regularly engaged in HVAC system maintenance with an emphasis on HVAC system cleaning and decontamination.

E. Equipment, Materials and Labor: The HVAC system cleaning contractor shall possess and furnish all necessary equipment, materials and labor to adequately perform the specified services.

1. The contractor shall assure that its employees have received safety equipment training, medical surveillance programs, individual health protection measures, and manufacturer's product and material safety data sheets (MSDS) as required for the work by the U.S. Occupational Safety and Health Administration, and as described by this specification. For work performed in countries outside of the U.S.A., contractors should comply with applicable national safety codes and standards.

2. The contractor shall maintain a copy of all current MSDS documentation and safety certifications at the site at all times, as well as comply with all other site documentation requirements of applicable OSHA programs and this specification
3. Contractor shall submit to the owner all Material Safety Data Sheets (MSDS) for all chemical products proposed to be used in the cleaning process.

F. Licensing: The HVAC system cleaning contractor shall provide proof of maintaining the proper license(s), if any, as required to do work in this state. Contractor shall comply with all Federal, state and local rules, regulations, and licensing requirements.

1.04 STANDARDS

A. NADCA Standards: The HVAC system cleaning contractor shall perform the services specified here in accordance with the current published standards of the National Air Duct Cleaners Association (NADCA).
1. All terms in this specification shall have their meaning defined as stated in the NADCA Standards.
2. NADCA Standards must be followed with no modifications or deviations being allowed.

1.05 DOCUMENTS

A. Mechanical Drawings: The mechanical contractor shall provide the HVAC system cleaning contractor with one copy of the following documents:
1. Project drawings and specifications
2. Approved construction revisions pertaining to the HVAC system
3. Any existing indoor air quality (IAQ) assessments or environmental reports prepared for the facility.

1.06 PRE-QUALIFIED CLEANING CONTRACTORS

A. Pre-qualified acceptable firms include the following:
1. G&G Duct Cleaning, (718) 786-6401.
2. Duct Dusters, (914) 776-5700.
3. Scientific Environmental Services, Co. (718) 389-3260.
4. Fire Proofing Corp. of America, (212) 254-6340.

1.07 SUBMITTALS

A. Refer to Section 01 31 46 - Special Requirements for Mechanical and Electrical Work and submit shop drawings.

B. Submit list of references for at least five (5) projects of size similar for which the firm has provided duct cleaning services successfully. Lists shall include:
1. Name and address of the project.
2. A description of the project and the services provided.
3. Name and telephone number of references.

C. Submit a detailed description of how the duct cleaning will be carried out. The description should be specific to this project, identifying and describing equipment and procedures to be used.

D. Catalog cuts for equipment to be used shall be submitted.

E. Fiber-optic borescope pictures of the pre-cleaned conditions as required in paragraph 3.3. Do not start cleaning until these pictures have been submitted and approved.

F. Fiber-optic borescope pictures of the post-cleaned conditions.

G. Provide a detailed schedule for when cleaning work which will be carried out. Coordinate with other work under this contract.

1.08 COORDINATION

A. Refer to Section 01 31 46 - Special Requirements for Mechanical and Electrical Work.

1.09 GUARANTEE

A. Refer to Section 01 31 46 - Special Requirements for Mechanical and Electrical Work.

PART 2 - HVAC SYSTEM CLEANING SPECIFICATIONS AND REQUIREMENTS

2.01 SCOPE OF WORK

A. Scope: This section defines the ***minimum*** requirements necessary to render HVAC components clean, and to verify the cleanliness through inspection and/or testing in accordance with items specified herein and applicable NADCA Standards.

The Contractor shall be responsible for the removal of visible surface contaminants and deposits from within the HVAC system in strict accordance with these specifications.

The HVAC system includes any interior surface of the facility's air distribution system for conditioned spaces and/or occupied zones. This includes the entire heating, air conditioning and ventilation system from the points where the air enters the system to the points where the air is discharged from the system. The return air grilles, return air ducts (except ceiling plenums and mechanical room) to the air handling unit (AHU), the interior surfaces of the AHU, mixing box, coil compartment, condensate drain pans, humidifiers and dehumidifiers, supply air ducts, fans, fan housing, fan blades, air wash systems, spray eliminators, turning vanes, filters, filter housings, reheat coils, and supply diffusers are all considered part of the HVAC system and is shown on mechanical drawings to remain.

2.02 HVAC SYSTEM INSPECTIONS AND SITE PREPARATIONS

A. HVAC System Evaluation: Prior to the commencement of any cleaning work, the HVAC system cleaning contractor shall perform a visual inspection of the HVAC system to determine appropriate methods, tools, and equipment required to satisfactorily complete this project.
   1. Damaged system components found during the inspection shall be documented and brought to the attention of the owner.

B. Site Evaluation and Preparations: Contractor shall conduct a site evaluation, and establish a specific, coordinated plan which details how each area of the building will be protected during the various phases of the project.

2.03 GENERAL HVAC SYSTEM CLEANING REQUIREMENTS

A. Containment: Debris removed during cleaning shall be collected and precautions must be taken to ensure that Debris is not otherwise dispersed outside the HVAC system during the cleaning process.

B. Particulate Collection: Where the Particulate Collection Equipment is exhausting inside the building, HEPA filtration with 99.97% collection efficiency for 0.3-micron size (or greater) particles shall be used. When the Particulate Collection Equipment is exhausting outside the building, Mechanical Cleaning operations shall be undertaken only with Particulate Collection Equipment in place, including adequate filtration to contain Debris removed from the HVAC system. When the Particulate Collection Equipment is exhausting outside the building, precautions shall be taken to locate the equipment down wind and away from all air intakes and other points of entry into the building.

C. Controlling Odors: All reasonable measures shall be taken to control offensive odors and/or mist vapors during the cleaning process.

D. Component Cleaning: Cleaning methods shall be employed such that all HVAC system components must be Visibly Clean as defined in applicable standards (see NADCA Standards). Upon completion, all components must be returned to those settings recorded just prior to cleaning operations.

E. Air-Volume Control Devices: Dampers and any air-directional mechanical devices inside the HVAC system must have their position marked prior to cleaning and, upon completion, must be restored to their marked position.

F. Service Openings: The contractor shall utilize service openings, as required for proper cleaning, at various points of the HVAC system for physical and mechanical entry, and inspection.
   1. Contractor shall utilize the existing service openings already installed in the HVAC system where possible.
   2. Other openings shall be created where needed and they must be created so they can be sealed in accordance with industry codes and standards.
   3. Closures must not significantly hinder, restrict, or alter the air-flow within the system.
   4. Closures must be properly insulated to prevent heat loss/gain or condensation on surfaces within the system.
   5. Openings must not compromise the structural integrity of the system.
   6. Construction techniques used in the creation of openings should conform to requirements of applicable building and fire codes, and applicable NFPA, SMACNA and NADCA Standards.
   7. Cutting service openings into flexible duct is not permitted. Flexible duct shall be disconnected at the ends as needed for proper cleaning and inspection.
   8. Rigid fiber glass ductboard duct systems shall be resealed in accordance with NAIMA recommended practices. Only closure techniques which comply *with* UL Standard 181 or UL Standard 181a are suitable for fiber glass duct system closures.
   9. All service openings capable of being re-opened for future inspection or remediation shall be clearly marked and shall have their location reported to the owner in project report documents.

G. Ceiling sections (tile): The contractor may remove and reinstall ceiling sections to gain access to HVAC systems during the cleaning process.

H. Shaft walls (CHV): The Contractor may create openings to gain access to HVAC risers during the cleaning process.

I. Duct Systems: Contractor shall:
1. Create service openings in the system as necessary in order to accommodate cleaning of otherwise inaccessible areas.
2. Mechanically clean all duct systems to remove all visible contaminants, such that the systems are capable of passing Cleaning Verification Testings (see NADCA Standards).

2.04 HEALTH AND SAFETY

A. Safety Standards: Cleaning contractors shall comply with all applicable federal, state, and local requirements for protecting the safety of the contractors' employees, building occupants, and the environment. In particular, all applicable standards of the Occupational Safety and Health Administration (OSHA) shall be followed when working in accordance with this specification.

B. Occupant Safety: No processes or materials shall be employed in such a manner that they will introduce additional hazards into occupied spaces.

C. Disposal of Debris. All Debris removed from the HVAC System shall be disposed of in accordance with applicable federal, state and local requirements.

2.05 MECHANICAL CLEANING METHODOLOGY

A. Source Removal Cleaning Methods: the HVAC system shall be cleaned using Source Removal mechanical cleaning methods designed to extract contaminants from within the HVAC system and safely remove contaminants from the facility. It is the contractor's responsibility to select Source Removal methods which will render the HVAC system Visibly Clean and capable of passing cleaning verification methods (See applicable NADCA Standards) and other specified tests, in accordance with all general requirements. No cleaning method, or combination of methods, shall be used which could potentially damage components of the HVAC system or negatively alter the integrity of the system.
1. All methods used shall incorporate the use of vacuum collection devices that are operated continuously during cleaning. A vacuum device shall be connected to the downstream end of the section being cleaned through a predetermined opening. The vacuum collection device must be of sufficient power to render all areas being cleaned under negative pressure, such that containment of debris and the protection of the indoor environment is assured.
2. All vacuum devices exhausting air inside the building shall be equipped with HEPA filters (minimum efficiency), including hand-held vacuums and wet vacuums.
3. All vacuum devices exhausting air outside the facility shall be equipped with Particulate Collection including adequate filtration to contain Debris removed from the HVAC system. Such devices shall exhaust in a manner that *will* not allow contaminants to re-enter the facility. Release of debris outdoors must not violate any outdoor environmental standards, codes or regulations.
4. All methods require mechanical agitation devices to dislodge debris adhered to interior HVAC system surfaces, such that debris may be safely conveyed to vacuum collection devices. Acceptable methods will include those which will not potentially damage the integrity of the ductwork, nor damage porous surface materials such as liners inside the ductwork or system components.

B. Methods of Cleaning Fibrous Glass Insulated Components:
   1. Fibrous glass thermal or acoustical insulation elements present in any equipment or ductwork shall be thoroughly cleaned with HEPA vacuuming equipment, while the HVAC system is under constant negative pressure, and not permitted to get wet in accordance with applicable NADCA and NAIMA standards and recommendations.
   2. Cleaning methods used shall not cause damage to fibrous glass components and will render the system capable of passing Cleaning Verification Tests (see NADCA Standards).

C. Damaged Fibrous Glass Material
   1. If there is any evidence of damage, deterioration, delamination, friable material, mold or fungus growth, or moisture such that fibrous glass materials cannot be restored by cleaning or resurfacing with an acceptable insulation repair coating, they shall be identified for replacement.
   2. When requested or specified, Contractor must be capable of remediating exposed damaged insulation in air handlers and/or ductwork requiring replacement.
   3. Replacement material: In the event fiber glass materials must be replaced, all materials shall conform to applicable industry codes and standards, including those of UL and SMACNA.
   4. Replacement of damaged insulation is not covered by this specification.

D. Biocidal Agents and Coatings
   1. Biocidal agents shall only be applied if active fungal growth is reasonably suspected, or where unacceptable levels of fungal contamination have been verified through testing.
   2. Application of any biocidal agents used to control the growth of fungal or bacteriological contaminants shall be performed after the removal of surface deposits and debris.
   3. Only biocidal agents registered by the U.S. Environmental Protection Agency (EPA) specifically for use within HVAC system shall be used.
   4. Biocidal agents shall be applied in strict accordance with manufacturer's instructions.
   5. Biocidal coating products for both porous and non-porous surfaces shall be EPA registered, water soluble solutions with supporting efficacy data and MSDS records.
   6. Biocidal coatings shall be applied according to manufacturer's instructions. Coatings shall be sprayed directly onto interior ductwork surfaces, rather than 'fogged' downstream onto surfaces. A continuous film must be achieved on the surface to be treated by the coating application. Application of any biocidal coatings shall be in strict accordance with manufacturer's minimum millage surface application rate standards for effectiveness.

2.06 CLEANLINESS VERIFICATION

A. General: Verification of HVAC System cleanliness will be determined after mechanical cleaning and before the application of any treatment or introduction of any treatment-related substance to the HVAC system, including biocidal agents and coatings.

B. Visual Inspection: the HVAC system shall be inspected visually to ensure that no visible contaminants are present.
   1. If no contaminants are evident through visual inspection, the HVAC system shall be considered clean; however, the owner reserves the right to further verify system cleanliness through gravimetric or wipe testing analysis testing as specified herein.
   2. If visible contaminants are evident through visual inspection, those portions of the system where contaminants are visible shall be re-cleaned and subjected to re-inspection for cleanliness.

C. Gravimetric Analysis: At the discretion and expense of the owner, sections of the HVAC system may be tested for cleanliness using the NADCA Vacuum Test (gravimetric analysis) as specified in applicable NADCA Standards. Levels of debris collected shall be equal to or less than acceptable levels defined in applicable NADCA Standards.
   1. If gravimetric analysis determines that levels of debris are equal to or lower than those levels specified in applicable NADCA standards, the system shall be considered clean and shall have passed cleanliness verification.
   2. If gravimetric analysis determines that levels of debris exceed those specified in applicable NADCA standards, the system shall not be considered clean and those sections of the system which failed cleanliness verification shall be re-cleaned at the expense of the HVAC system cleaning contractor.
   3. Gravimetric analysis shall be performed by a qualified third party experienced in testing of this nature.
   4. Cleanliness verification shall be performed immediately after mechanical cleaning and before the HVAC system is restored to normal operation.

2.07 POST-PROJECT REPORT

A. At the conclusion of the project, the Contractor shall provide a report to the owner indicating the following:
   1. Success of the cleaning project, as verified through visual inspection and/or gravimetric analysis.
   2. Areas of the system found to be damaged and/or in need of repair.

2.08 APPLICABLE STANDARDS AND PUBLICATIONS

The following current standards and publications of the issues currently in effect form a part of this specification to the extent indicated by any reference thereto:

A. National Air Duct Cleaners Association, ACR-2013, “The Standard for the Assessment, Cleaning and Restoration of HVAC Systems.”

B. Underwriters' Laboratories UL Standard 181

C. American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE): Standard 62, "Ventilation for Acceptable Indoor Air Quality"

D. Environmental Protection Agency APA : "Building Air Quality" December, 1991

E. Sheet Metal and Air Conditioning Contractors' National Association (SMACNA): 'HVAC Duct Construction Standards - Metal and Flexible," Third Edition, 2005.

F. North American Insulation Manufacturers Association, Cleaning Fiberglass Insulated Air Duct Systems." 2007.

PART 3 - EXECUTION

3.01 INSPECTION

A. Contractor shall examine location where this work is to be performed and determine space conditions and notify Engineer 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.

3.02 PERFORMANCE OF WORK

A. Coordinate with other work as necessary to interface with other work being performed.

B. Protect all areas and equipment in the areas in which work is to be done, by providing drop cloths and other means.

3.03 FIELD QUALITY CONTROL

A. Upon completion of duct cleaning, demonstrate compliance with specification requirements. Provide a pre-cleaning and post-cleaning inspection of ductwork interior conditions with fiber-optic borescope through 1" holes in the duct. Provide no less than two (2) photographs, one (1) before and one (1) after, for each approximately 25 ft. of ductwork. Plug holes after pictures are taken. Submit pictures in report form along with sketches and/or drawings identifying locations where pictures were taken.

END OF SECTION 23 05 67

SECTION 23 05 71

STEAM SPECIALTIES

PART 1 - GENERAL

1.01 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.

1.02 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 steam specialties as shown on the drawings and hereinafter specified.

1.03 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 "General Provisions for HVAC Work".

C. Provide equipment whose performance, under specified conditions, is certified by the manufacturer.

1.04 SUBMITTALS

A. Refer to Section 01 31 46 - Special Requirements for Mechanical and Electrical Work and submit shop drawings.

1.05 COORDINATION

A. Refer to Section 01 31 46 - Special Requirements for Mechanical and Electrical Work.

1.06 GUARANTEE

A. Refer to Section 01 31 46 - Special Requirements for Mechanical and Electrical Work.

PART 2 - PRODUCTS

2.01 STEAM TRAPS

A. Furnish and install steam traps of approved types and capacities for proper venting and draining of all piping and of all pieces of equipment, including traps required at all ends of mains, heels of

risers, and any other point where condensate and/or air may collect, such as ahead of pressure and temperature regulating valves, lifts and drops in steam mains, etc.

B. All traps shall be designed for the steam pressure and service for which they are to be used and shall pass all condensate and air automatically, without passing any steam. Traps shall be of the types as specified hereafter, as may be required for satisfactory operation. All steam traps shall be warranted to have been tested in the manufacturer's plant under steam to insure tight closure and satisfactory operation.

C. All steam traps shall be sized for a minimum capacity of 300% of the steam loads indicted on the drawings, and at a maximum pressure drop of ½ psi for low pressure systems and 2 psi for medium pressure systems and 5 psi for high pressure systems, when continuously handling air and condensate. Ratings shall be in accordance with the standards of the Steam Heating Equipment Manufacturers Association.

D. Traps for heat exchangers shall be sized for 400% steam capacity.

E. It shall be this Contractor's responsibility to install the entire system of return line piping so that all condensate will be returned without water hammer.

F. Each heating unit, regardless of type, shall be installed with shut-off valve at inlet.

G. The following schedule of trap types shall apply:

Schedule of Steam Trap Types
Sarco as Standard

Drips for Low Pressure mains and risers	FT
Drips for Low Pressure risers under 2 inches	FT
Drips for High Pressure mains and risers	B
Radiators, convectors, fin-tube radiators	T
Air heating, blast coils, preheaters and reheaters	FT
Heating equipment requiring temperature control	FT
Hot water heaters	FT
Tank heaters	FT
Unit heaters	FT
Flash Tank Discharge	F
Heat Exchangers	FT

CODE:
FT - Float and Thermostatic Trap
B - Inverted Bucket Trap
T - Thermostatic Trap
F - Float traps without thermostatic vent

H. All traps up to and including 2½" size shall be provided with threaded connections. Traps over 2½" size shall be provided with welded flanged connection.

I. Traps 1" size or less shall be provided with union connections.

2.02 THERMOSTATIC STEAM TRAPS

A. Traps shall be Sarco or approved equal. Thermostatic traps shall be of the corrugated-bellows, balanced pressure type, with a bellows made of high grade red brass or phosphor bronze.

Regardless of working pressure traps shall have a minimum working pressure of 125 psi. All steam traps to be sized on condensate at steam temperature.

B. The bellows shall be either of Phosphor Bronze (with high temperature solder and brass sleeve protection), properly brazed.

C. Low pressure (0-25 psi) and medium pressure (0-65 psi) thermostatic traps shall have cast brass or forged brass bodies suitable for 125 psi pressure and shall be provided with a union connection at the inlet. Self-aligning valve heads and seats for the low-pressure traps shall be of a suitable, non-corrosive material. Seats shall be removable. Sarco type H or other approved equal shall be acceptable.

2.03 COMBINATION FLOAT AND THERMOSTATIC STEAM TRAPS

A. Combination float and thermostatic traps shall have a valve mechanism, the position of which is controlled by a closed, stainless steel ball float. The seat of the valve will be watertight at all times. The action of this type of trap must be gradual and modulating, it must discharge the condensate as soon as it enters the trap and its rate of discharge must be proportionate to the rate of the flow of condensate to the trap. A gate valve and strainer shall be installed ahead of all float and thermostatic traps.

B. The traps shall be provided with an automatic, thermostatic air bypass of the balanced pressure, multiple bellows type.

C. All working parts shall be of non-corrosive metal (hard bronze, monel or stainless steel) and shall be removable without disconnecting the piping. Floats shall be of stainless steel.

D. Body and cover shall be of high-grade cast iron suitable for 125 psi pressure for the 0-15 psi line. Traps shall be Sarco FT-15 or approved equal.

E. 0-30 psi traps - all bodies and covers shall be designed for 125 psi steam pressure.

2.04 HIGH CAPACITY FLOAT TRAPS

A. For high capacity, float traps with double ported, closely balanced stainless steel valves shall be used. These traps shall not require change of seat size with varying pressures. Thermostatic air vents shall be located on outside of trap body. Provide Sarco FT-20 or approved equal.

2.05 INVERTED BUCKET TRAPS

A. Inverted bucket traps for pressures from 1 to 250 psig, shall have semi-steel body; valve and valve mechanism are to be of stainless steel and shall be of "camlift action" for extra capacity. Up to 75 psi traps shall have 125 psi rating. Above 75 psi the rating shall be 250 psi.

B. An open inverted bucket with a vent-hole in its top shall activate the valve mechanism.

C. Inverted bucket shall be either of brass or of stainless steel.

D. Traps shall have bi-metallic vent. All traps shall be equipped with built-in removable strainer. Same is to be of perforated sheet brass or stainless steel. Traps to be "Sarco Type B" or approved equal and shall be designed as follows:

SIZE	WITH BIMETAL AIR VENT
½"	B12-X
¾"	B22
1"	B32
1½"	B42
2"	B52

2.06 SAFETY VALVES

A. Steam safety valves shall be the semi-nozzle type, having extra heavy cast iron bodies and bronze trim. Safety valves shall have two separately adjustable controls; one to control "pop" action and the other to control blow-down. Adjusting spring shall be enclosed. A plain lifting level shall be furnished with each valve.

B. Valves shall be sized in accordance with ASME Power Boiler Code where applicable and shall be ASME approved where necessary. Safety valves for unfired pressure vessels shall be in accordance with Section VIII of the ASME Boiler and Pressure Vessel Code.

C. Safety valves for use with PRV's shall be sized to handle the specified capacity of the PRV on a maximum capacity basis with no more than 10% accumulation. Unless otherwise shown on plans or specifications, safety valves shall be set 5 psig above delivery pressure of PRV when delivery pressure is 50 psig and less, and 10 psig above delivery pressure for delivery pressures exceeding 50 psig.

D. Safety valves shall be Lonergan 11W or 41W series, Kunkle Fig. 83 or 250 or approved equal.

E. Cast iron drip-pan elbow shall be furnished for each safety valve when discharge is piped and safety valve outlet is 2½" or larger. Drip-pan elbow shall be Lonergan DPE Series, or Kunkle Fig. 299 or approved equal.

2.07 STRAINERS FOR STEAM AND CONDENSATE

A. There shall be approved strainers in the inlet connections to each coil, steam trap, and each diaphragm valve, and where else indicated on the drawings. The intention is to protect by strainers, all apparatus of an automatic character, whose proper functioning would be interfered with by dirt on the seat, or by scoring of the seat.

B. All strainers in steam lines, shall be Y-pattern, set in a horizontal (or vertical downward) run of the pipe. Where this is not feasible, strainers may be of enlarged-cross-section type. Strainers shall be so arranged as not to "trap" pipes, and to facilitate disconnection and opening-up for cleaning. Unless otherwise indicated, strainers shall be line size.

C. All strainers, 2½" and above, shall have cast iron bodies and 2" and below shall have bronze bodies of ample strength for the pressure to which they shall be subjected, removable cylindrical or conical screens of monel or stainless steel and suitable flanges or tappings to connect with the piping they serve. They shall be of such a design as to allow blowing out of accumulated dirt, and to facilitate removal and replacement of a strainer screen, without disconnections of the main piping.

D. Strainer screen perforations shall be 1/32" for steam and mixture of steam and condensate. Strainers of the "Y" type similar to Sarco Bulletin 1220 type IF and AF or approved equal. Strainers smaller than 2" shall be Sarco type "BT".

E. Provide approved valved dirt blow-out connections for each strainer (with the valve located 6" to 1'-0" below strainer, or as directed). The blow-out connection shall terminate with a valve, nipple and cap. Blowoff shall be 4 pipe sizes smaller than straight pipe, ¾" minimum size and shall be suitable for a hose connection with cap.

F. All strainers shall be provided with flanged covers for screen removal in lieu of screwed covers wherever obtainable.

G. All strainer screens 8" and above shall be reinforced for the operating conditions.

2.08 STEAM AIR VENTS

A. Provide steam air valves on steam mains, returns, and unit heaters. Air vents shall be No. 5 air valve as made by the Dole Valve Co. or approved equal.

2.09 VACUUM BREAKERS

A. Provide vacuum breakers for jacketed kettles, closed tanks, hot water generator coils and heat exchangers.
1. Vacuum breakers shall be Johnson ¾" VB-75-SS-T, or approved equal. Vacuum breaker shall have stainless steel body with threaded outlet connections.

B. Provide vacuum breakers on piping to steam heating coils. Vacuum breakers shall be Johnson, Durable check valve or approved equal.

2.10 EXPANSION JOINTS

A. All piping shall be installed in such a manner as to allow for thermal expansion and contraction without strain to connections at equipment or interconnections piping. While it is preferred that pipe flexibility be utilized to the greatest extent, either through directional changes or pipe loops, expansion joints shall be installed where shown on the plans and shall comply with the following requirements:

B. Expansion joints in 3" size and over shall be of the stainless-steel bellows type, being hydraulically formed from a tube having only longitudinal seam welds. The weld bead of the seam shall be of the same thickness as the parent metal without grinding to avoid areas of stress concentration.

C. Expansion joints shall be flanged with drilling to meet 150 lb. ASS standards except where so noted. All components shall be suitable for 150 psig service and the traverse indicated on the plans or schedule.

D. Expansion joints shall be of the self-equalizing type, being furnished with equalizing rings designed to distribute the movement equally among the corrugations while supporting the roots and side walls of the corrugated element against internal pressure. The end reinforcing skirt flange assembly shall be made entirely of steel and welded into one integral unit. Acceptable manufacturers: Zallea Brothers, ADSCO and Flexonics Division of Calumet & Hella, Inc.

E. Expansion joints in sizes 2½" or less than be of the "Compensator" type and suitable for 1-¾" compression plus ¼" extension while at 150 psig internal pressure. Compensators shall be internally guided by a positive anti-torque device to prevent twisting on installation. For all high-pressure system and expansion joints on main and branch piping compensation shall be Zallea Series H. Expansion joint on radiation shall be Zallea Series L. Acceptable manufacturers: Zallea Brothers, Flexonics.

F. All piping shall be properly anchored and guided in accordance with the Standards of the Expansion Joint Manufacturers Association. The Contractor shall furnish drawings showing proposed expansion joint, anchor and pipe guide locations as well as details of construction of such piping system components not otherwise shown on plans and specifications.
   1. If more than a few expansion joints are illustrated on the drawings, it is generally best if these are shown by identifying number with additional details shown on a Schedule of Expansion Joints. Such schedule should include: Location, pipe size, service, amount of traverse in compression or extension as calculated and such other requirements such as internal sleeves, external covers, pantographic linkage assemblies, etc.
   2. Internal sleeves should be specified for all expansion joints, regardless of the metal of the bellows in the following cases:
      a. For all high temperature applications.
      b. When flow velocities are high. Lines should be specified for steam lines where the velocity exceeds 1000 fpm per inch of diameter in lines up to 6" size and where the velocity exceeds 6000 fpm in larger sizes.

PART 3 - EXECUTION

3.01 INSPECTION

A. Contractor shall examine location where steam specialties 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.

3.02 INSTALLATION

A. Install steam specialties 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 steam specialties with other components.

END OF SECTION 23 05 71

SECTION 23 05 80

HVAC SPECIALTIES

PART 1 - GENERAL

1.01 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.

1.02 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.

1.03 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 "General Provisions for HVAC Work".

C. Provide equipment whose performance under specified conditions is certified by the manufacturer.

1.04 SUBMITTALS

A. Refer to Section 01 31 46 - Special Requirements for Mechanical and Electrical Work and submit shop drawings.

1.05 COORDINATION

A. Refer to Section 01 31 46 - Special Requirements for Mechanical and Electrical Work.

1.06 GUARANTEE

A. Refer to Section 01 31 46 - Special Requirements for Mechanical and Electrical Work.

PART 2 - PRODUCTS

2.01 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
Hot Water	30 deg. F to 300 deg. F	
Chilled Water	0 deg. F to 120 deg. F	
Condenser Water	0 deg. F to 120 deg. F	

2.02 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 ⅜" 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 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 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, 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
Low Pressure Steam	0 to 30 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.

2.03 MACHINERY GUARDS

A. Moving parts of machinery exposed to contact by personnel shall be guarded by 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.

2.04 EXPANSION JOINTS, BALL JOINTS, LOOPS, ANCHORS AND GUIDES

A. Provisions for expansion in piping mains, branches, and risers shall be made by the installation of offsets, expansion loops, or compensators as indicated on the Drawings and as required. Every 100'-0" horizontal steam and hot water piping shall have expansion loop and anchors. Minimum loop shall be 8'-0" by 6'-0" if not indicated on the Drawings.

B. All piping with loops or compensators shall be anchored so as to throw all expansion toward the loops or compensators.

C. Guides shall be installed on both sides of each expansion loop and compensator. Guides shall be Flexonics pipe alignment guides or approved equal. Anchors and guides shall be secured to beams, columns or concrete slabs.

D. Pipe hangers and rollers are not considered guides.

E. Provide 12" long guides for each expansion joint. Guides shall be located 3'-0" on each side of the expansion joints.

F. Furnish and install as shown on plans, or where necessary to absorb max. 1¾" expansion and max. ¼" contraction between two anchor points in copper lines, up to and including 2½", Flexonics Model HB Expansion Compensators having two-ply phosphor bronze bellows and brass shrouds and end fittings, as manufactured by Flexonics Division of Calumet and Heela, Inc., Bartlett, Illinois. All internal parts shall be of non-ferrous metals. Service pressure shall be external to the bellows. Compensators shall have internal guides extending the full length of the bellows travel. Compensators shall have internal positive anti-torque devices to prevent twist or torque on installation and shall have properly located positioning clip to ensure installation of correct end-to-end dimension to allow full rated traverse. Compensator shall be for max. 125 psig. working pressure. Test pressure shall not exceed 175 psig.

G. Furnish and install as shown on plans, or where necessary to absorb max. 1¾" expansion and max. ¼" contraction between two anchor points in iron and steel pipe lines up to and including 2½", Flexonics Model II Expansion Compensators having two-ply stainless steel bellows and carbon steel shrouds and end fittings, as manufactured by Flexonics Division of Calumet & Heela, Inc., Bartlett, Illinois. Service pressure shall be external to the bellows. Compensators shall have properly located positioning clip to ensure installation at correct end-to-end dimension to allow full rated traverse. Compensator shall be for Max. 150 psig. working pressure. Test pressure shall not exceed 200 psig.

H. Expansion joints in 3" and above piping shall be hydraulically formed bellows type with internal sleeves and external covers for insulation. Expansion joints, except where otherwise noted, shall be of the self-equalizing type having fully-contoured, cast iron equalizing rings.

I. Provide non-equalizing type expansion joints with internal sleeves on low pressure service (up to 15 psig including test pressure) such as diesel engine exhaust, or flexible cooling tower connections.

J. Manufacturer shall note on all submittal forms the resultant anchor loads due to pressure thrust and compressive forces at design conditions. Expansion joints shall be as manufactured by Flex-Hose, ADSCO, Zallea, Flexonic, or approved equal.

K. Ball Joints
1. Flexible ball joints shall be Barco Type "N" rated for continuous service at 525 deg. F and shall have provision for seal adjustment. Ball joints shall be carbon steel, providing 15-degree angular flexing movement and 360 rotation, with two pressure molded non-asbestos composition gaskets.
2. All ball joints shall be with welded ends.
3. All joints shall be designed for welding to piping specified for the various services.
4. All joints shall be installed as shown on the Drawings and in strict accordance with the manufacturer's recommendations.

2.05 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 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 rooftop units and outdoor unite 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.

2.06 AIR VENTS

A. In installing water piping systems and all equipment, carefully plan the actual installation in such a manner that high pints 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 a 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 where 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 manual air vents Hoffman No. 500 or approved equal, for all upfed radiation. Furnish and install a 125 psig rated ball valve on the system side of each manual air vent. Provide access to all air vents.

2.07 AIR SEPARATORS

A. Furnish and install the air separators for water system where indicated on the Drawings. The separators shall be Rolairtrol, as manufactured by Bell and Gossett or equal as approved by the Architect.

B. The units shall be of ASME construction and shall be stamped 125 psig W.P.

C. The units shall be furnished without integral strainers.

D. The units shall be installed in strict accordance with the manufacturer's recommendations.

E. The units shall be supported on 2" pipe legs and shall be provided with a ¾" drain gate or ball valve with hose end and cap.

2.08 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 shall have variable speed drives.

2.09 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, ⅛" 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.

2.10 FLANGES FOR ORIFICE PLATES

A. The automatic control manufacturer shall furnish orifice plates for high temperature hot water lines as specified in the articles of this Section.

B. Install the orifice plates and furnish and install the companion flanges.

C. The orifice plates shall be installed in strict accordance with the manufacturer's recommendations.

D. Straightening vanes shall be installed if required by the automatic control manufacturer.

2.11 REDUCING AND SAFETY VALVES FOR 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.

2.12 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.

PART 3 - EXECUTION

3.01 INSPECTION

A. Contractor shall examine location where these specialties 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.

3.02 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.

3.03 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 which cannot be satisfactorily corrected.

END OF SECTION 23 05 80

SECTION 23 05 93

TESTING AND BALANCING

PART 1 - GENERAL

1.01 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.

1.02 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 balancing 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).

1.03 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.

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.

C. 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.

1.04 SUBMITTALS

A. Refer to Section 01 31 46 "Special Requirements for Mechanical and Electrical Work". Submit all test and balancing reports as described hereinafter.

PART 2 - PRODUCTS (NOT APPLICABLE)

PART 3 - EXECUTION

3.01 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

Item	Field Test
Low pressure steam and condensate piping	100 psi
Pumped low pressure condensate returns (discharge)	100 psi
Overflow and drain	50 psi
Cold Water (domestic)	100 psi
Chilled water, dual temperature water	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).

3.02 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.

3.03 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 full open position.

C. Kitchen Ventilation System
1. Performance Test (NYC Code Required)
a. A performance test shall be conducted upon completion and witnessed by a representative of the Fire Department before final approval of the installation of a ventilation system serving commercial cooking appliances. The test shall verify the rate of exhaust air flow required, makeup air flow required and proper operation as specified in this chapter. The permit holder shall furnish the necessary test equipment and devices required to perform the tests.

3.04 FIRE DAMPER AND FIRE SMOKE DAMPER TEST

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 het 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 retain by the Contractor.

3.05 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.

3.06 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.

3.07 ADDITIONAL REQUIREMENTS

A. Replacement of adjustable pulleys, additional balancing dampers, additional fan belts, pressure taps and fittings, hydronic balancing valves and any other devices or equipment required to effect proper testing, adjusting and balancing shall be provided at no additional cost to the Owner.

3.08 EMERGENCY SMOKE PURGE EXHAUST

A. All fans used for emergency smoke purge shall have air flow measurements made and documented which smoke purge mode.

B. Fans dedicated for emergency smoke purge shall be balanced to provide required smoke purge CFM or more.

3.09 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 chillers, condensers, coils, convertors, cabinet heaters, heat exchangers, unit heaters, induction units, fan coil units, etc., in accordance with design requirements.

F. For all orifice plates, record the pipe size, orifice size, flow factor, required differential pressure, final differential pressure and calculated final flow quantity.

G. 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.

H. 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 ±10% of design flow rate.

I. 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.

J. 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

1.01 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.

1.02 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.

1.03 PIPE INSULATION

A. The following pipes shall not be insulated. Insulate all other piping:
1. Steam traps.
2. Unions.
3. Automatic air vent drain pipes.
4. Drain pipes embedded in concrete.
5. Drain piping from safety relief valve drip pan elbows and steam exhaust heads.
6. Outside portion of emergency generator exhaust pipe.
7. Condenser water chemical treatment piping.

1.04 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.

1.05 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, "General Provisions for HVAC Work"

F. Insulation Materials: Insulating materials manufacturing facilities must be certified and registered with an approved registrar for conformance with ISO9000 quality standard.

1.06 SUBMITTALS

A. Refer to Section 01 31 46 - "Special Requirements for Mechanical and Electrical Work", and submit shop drawings and samples.

1.07 GUARANTEE

A. Refer to Section 01 31 46 - "Special Requirements for Mechanical and Electrical Work".

1.08 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

2.01 COLD AND DUAL TEMPERATURE PIPING INSULATION

A. The following piping shall be covered with fiberglass insulation with vapor barrier:

Service	Thickness

Chilled Water Supply & Return	
All pipe diameters	1½"
Hot-Chilled (Dual Temperature)	
Water Supply & Return	
Up to 1¼ "	1½"
1½" and above	2"
Chemical Treatment (Boiler Water,	
Hot Water, Chilled Water)	1½"
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"
Condenser Water Supply Return	
Inside Building	1½"

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 ft^2 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 ½" 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 shall 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
1½"- 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 hanger 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. 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.

2.02 HOT PIPE INSULATION

A. The following piping shall be covered with fiberglass insulation:

Service	Thickness
Steam Pressure below 15 psig Blowdown Vents, Sample Cooler Inlet, Steam Safety and Relief, Soot Blower Blow Off:	
Up to 1¼"	2½"
1½" and above	3"
Condensate Pump Discharge	
Up to 3½"	2½"
4" and above	3"
Exposed L.P. Steam Safety and Relief Vent	2½"

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, in addition to 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.

C. Insulation shall be glass fiber complying with ASTM C547, Type I with a maximum K factor of 0.23 at 75 degrees F. mean temperature. Insulation shall be suitable for 650-degree F. (2" minimum thickness above 450 degrees F.).

D. Insulation shall be sectional pipe insulation as made by Owens- Corning Fiberglass Corp., or Johns Manville Micro-Lok fiberglass pipe insulation, with all-purpose white kraft reinforced jacket with self-seal lap to comply with ASTM C1136 Type I.

E. Longitudinal jacket laps and butt strips shall be smoothly secured per manufacturers recommendations.

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 fittings as made by Johns Manville, except as specified in 2.02 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 fittings by Johns Manville, except as specified in 2.02 H.

H. Finish for Exposed Pipe Insulation:
   1. All exposed pipe, valve and fittings insulation shall have 0.016-inch-thick corrugated aluminum jacket banded with ½" s.s. bands spaced 12 inches 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).
   2. 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.
   3. 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.

I. Insulation shall be protected by saddles from hangers, guides and rollers.

J. Strainers on hot pipes shall not be insulated.

K. Direct contact between pipe and hanger shall be avoided. Hanger shall pass outside of a metal saddle which shall cover a section of high-density insulation (such as calcium silicate) 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
1½”- 2"	10" Long
3"-6"	12" Long
8"-10"	16" Long
12" & Over	22" Long

L. At pipe supports, insulation shield protection saddles and matching hanger shall be used.

2.03 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 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. 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 on 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.

2.04 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 where noted on the Drawings as to provide "Frost Insulation") shall, in addition to 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 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).

2.05 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.

2.06 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.

Service	R Value	With

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. 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.

Service	R Value	With
Cold and Hot Air Supply 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
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.

H. As an alternative to fiberglass insulation on ducts, elastomeric closed-cell insulation may be used.
1. Insulation material shall be a flexible, closed-cell or conformable elastomeric insulation in sheet form: AP Armaflex, and 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 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.

3. The insulation material shall contain MICOBAN Antimicrobial additive to aid in the prevention of mold and mildew.
4. 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.
5. 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.
6. 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. (other than conformable elastomeric)
7. 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.
8. 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. 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.

I. 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.

Service	R Value
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 stables 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 continuous vapor barrier. All edges, corners and joints, 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.

J. 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 surfaces, 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 orVi-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 rainwater runoff and so that no water accumulation will occur.

2.07 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. Entire top of 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. 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 jacket 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 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. Finish shall be Insulating Cement or approved equal applied □" thick in one coat, trowelled to a smooth finish. Same option of pipe and tank insulation with ASJ shall apply.

E. Sound traps shall be insulated same as the connecting ductwork.

PART 3 - EXECUTION

3.01 INSPECTION

A. Contractor shall examine location where this insulation 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.

3.02 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 thermofiber 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 ductwork. 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 ductwork 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 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 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. 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.

3.03 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 SYSTEMS

PART 1 - GENERAL

1.01 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 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 from 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

1.02 RELATED SECTIONS:

A. Commissioning - General Requirements Section 01 91 13.

B. Verification Test Check Lists – Commissioning of HVAC Systems Section 23 08 00.

C. Functional Test Checklist and Procedures - Commissioning of HVAC Systems Section 23 08 00.

1.03 CITIED STANDARDS:

A. ASHRAE Guideline 4-1993

1.04 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. Water-to-Water Heat Pumps
2. Pumps
3. Air Handling Units
4. VFD
5. Fans
6. Piping System
7. Ductwork System
8. TAB
9. 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.

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.

1.05 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 initial placement of major equipment and subsequent training sessions.
   c. Maintenance orientation and inspection.
2. Attend meetings with 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. 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 final review at acceptance meeting.

B. Commissioning Authority (CA)
1. Develop the commissioning requirements and all related testing, and quality control sections.
2. Include 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 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 assure 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 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 Owner's 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 inspection 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 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 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 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 to ensure 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 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, 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 understand 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 check list "Functional Performance Test-TAB Plans" Spot check verification of the TAB report shall be according to "Functional Performance Test 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, of 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 wells 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 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 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 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 to 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 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 in binders as required by the Commissioning Specification. Submit to 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 cost for commissioning requirements in the contract price.
2. Attend 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 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 functional performance required by 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 manufacturers 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 shut downs
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: □Virtual□ 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 schedule 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 operators 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 technician 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 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 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 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, tests of the system completed and approved by the E. The E shall determine if this 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 controls 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 cost for commissioning requirements in the contract price.
2. Provide submittals, and appropriate O&M manual section(s).
3. Attend 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.

1.06 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 commencement of O&M training required in this and other sections of the specification.

PART 2 - PRODUCTS

2.01 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 necessary utilities for the commissioning process.

PART 3 - EXECUTION

3.01 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 undertaken. This includes the complete installation of all equipment, materials, piping, ductwork, controls, etc., per the contract documents and related directives, clarifications, and 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. Start of acceptance procedures before system completion does not relieve the contractor from completing those systems as per the schedule.

3.02 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. 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. 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.

3.03 DEFICIENCY RESOLUTION:

A. In some systems, misadjustments, 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, the 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.

3.04 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.

3.05 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 to participate in the initial and the alternate peak season tests of the systems as required to demonstrate performance.

3.06 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.

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. For the accuracy of the automatic controls commissioning instrumentation, refer to Section 23 08 00.

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-contractor□s 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.

3.07 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 information provided in the manufacturers' 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 shut down.
      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) Trouble shooting suggestions.
      6) Other pertinent data applicable to the operation of particular systems or requirement.
   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 which 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 name 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.

3.08 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.

3.09 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 and 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 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

1.01 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.

C. The work of this section shall be integrated with the existing BMS provided by Advantex Solutions. Please contact Giovanni Natale from Advantex Solutions Inc. Contact Information: P-718-278-2290; C-917-682-2521; Email - GNatale@Advantexsolutions.com).

1.02 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 unless otherwise indicated, all as hereinafter specified. Control equipment shall be as manufactured by Distech Controls. All controls and the Building Management System (BMS) 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. The system shall be a BACNET MSTP system.

C. The system shall have a graphic system which is compatible with the system currently installed in accordance with the specification, which is a Distech Controls system, installed and maintained by Advantex Solutions Inc. Please contact **Giovanni Natale** from Advantex (P-718-278-2290; C-917-682-2521; Email - GNatale@Advantexsolutions.com).

D. The control system shall include all necessary thermostats, damper motors, relays, etc., and all necessary equipment for a complete control system, regardless of whether or nor specifically mentioned, including electric relays and contactors required for control interlocking.

E. The control system shall include all control and interlock wiring from freezestats, firestats and relays, to motor controllers, contactors, etc. All control circuits shall be 120 volts.

F. 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.

G. Replace all existing AC unit steam preheat coil valves, chilled water cooling coil valves. All valves are 2-way valves.

Note: On the larger AC units, the preheat coil has multi-sections and a separate control valve is required for each individual coil section.

H. Provide mixed air averaging temperature sensors on all AC units wired to the existing BMS control panels. Provide any additional input/output modules for the temperature sensor. For larger AC units over 10,000 cfm provide two (2) temperature sensors.

I. Install new automatic low leakage control dampers as specified herein. Dampers shall include minimum and maximum outside air intake dampers, minimum and maximum exhaust air dampers and return air dampers. Provide all required mounting brackets, linkages, etc. for the new electronic damper actuators. Provide jackshafting for those dampers having multiple sections so sections work in unison, as one overall damper.

J. Provide new air flow measuring stations to measure supply air flow, return air flow from space, minimum and maximum outside air flows and exhaust air flows. See air flow measuring section of specifications for type of air flow station. Provide any additional input/output expansion BMS modules as required in the local BMS control panel. Include all required conduit and wire and transformers for air flow stations.

K. Air flow measuring devices shall be installed by ATC contractor under the supervision of the air measuring device manufacturer's representative. 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.

L. Provision shall be made under this section for opening and closing dampers and for normal air handler operation including isolation smoke dampers located in the supply and return ducts at the AHU.

M. Terms ATC subcontractor, BMS subcontractor and temperature control Contractor refer to the Contractor providing work under this section of the specification. The BMS subcontractor or automation system Contractor referred to in this and other sections shall be one and the same Contractor as the ATC subcontractor.

N. All sensors, transmitters, thermostats, to be mounted in pipes or ducts shall be mounted in such pipe or ducts by the ATC Contractor. The final installation of these devices, i.e. connection, shall be the responsibility of this section.

O. Wiring between the existing fire alarm system (FAS) and the automatic temperature control system shall be under this section. The BMS contractor shall be responsible to terminate the FAS wiring in the BMS panel and to VFDs.

P. All temperature sensors, humidity sensors, pneumatic to electric transducers, actuators and DDC controllers and all associated wiring including power wiring, damper (excluding fire and smoke) wiring and wiring to control duct terminal units, i.e. automatic dampers, 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 emergency power panel under this section.

Q. The BMS 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.

R. As-built sequence of operation shall be provided in BMS software. When viewing a control schematic on the BMS, the operator shall have the option of having the system display the sequence of operation.

S. Provide a display controller or panel-mounted computer with display screen with touch control or keypad, as specified herein, at each AHU and other systems provided with control under this contract. The touch/display screen shall allow FIT maintenance staff to monitor systems temperatures, pressures, and status and to modify setpoints.

1.03 QUALITY ASSURANCE

A. Only firms regularly engaged in manufacture and installation of this equipment with characteristics and capacities 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 complete in all respects by competent mechanics, regularly employed by the manufacturer of the control system.

D. The air monitoring (airflow measuring) device manufacturer shall review the final installation of all these devices and provide a check list and written approval of the installation.

1.04 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 description. 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 finished floor.

1.05 RELATED WORK UNDER ELECTRICAL WORK

A. All wiring to the fire alarm control panel. See Supplementary General Requirements for Mechanical and Electrical Work. Any power wiring not shown on the electrical plans and required for the automatic control systems shall be provided by the ATC subcontractor under this section.

1.06 COORDINATION

A. Refer to Section 01 31 46 - Special Requirements for Mechanical and Electrical Work.

1.07 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 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

2.01 GENERAL

A. The system shall be a 100% BACNET MSTP system.
1. Standalone Digital Controls Units shall provide control of HVAC. Each controller shall have its own control programs and will continue to operate in the event of a failure or communication loss to its associated Network Control Unit (NCU).
2. Memory:
Control programs shall be stored in battery backed-up RAM and EEPROM. Each controller shall have a minimum of 32K of user RAM memory and 128K bytes of EEPROM.
3. Communication Ports:
RCUs shall provide a communication port to the field bus. In addition, a part shall be provided for connection of a portable service tool to support local commissioning and parameter changes with or without the NCU online. It shall be possible from a service port on any RCU to view, enable/disable, and modify values of any point or program on any controller on the local field bus, any NCU or any RCU on a different field bus.
4. Input/Output:
Each RCU shall support the addition of the following types of inputs and outputs:
- Digital Inputs for status/alarm contacts
- Counter Inputs for summing pulses from meters
- Thermistor Inputs for measuring temperatures in space, ducts and thermowells
- Analog inputs for pressure, humidity, flow and position measurements
- Digital Outputs for on/off equipment control

- Analog Outputs for valve and damper position control, and capacity control of primary equipment

5. Expandability:
   Input and output capacity shall be expandable through the use of plug-in modules. A minimum of two modules shall be added to the base RCU before additional power is required.

6. Networking:
   Each RCU will be able to exchange information on a peer to peer basis with other Control Units during each field bus scan. Each RCU shall be capable of storing and referencing global variable (on the LAN) with or without any workstations online. Each RCU shall be able to have its program viewed and/or enabled/disabled either locally through a portable service tool or through a workstation connected to an NCU.

7. Indicator Lamps:
   RCUs will have as a minimum, LED indication of CPU status, and field bus status.

8. Real Time Clock (RTC):
   An RCU shall have a real time clock in either hardware or software. The accuracy shall be within 10 seconds per day. The RTC shall provide the following information: time of day, month, year, and day of week. Each RCU shall receive a signal, every hour, over the network from the NCU which synchronizes all RCU real time clocks.

9. Automatic Restart After Power Failure:
   Upon restoration of power, the RCU shall automatically and without human intervention, update all monitored functions, résumé operation based on current, synchronized time and status, and implement special start-up strategies as required.

10. Alarm Management:
    For each system point, alarms can be created based on high/low limits or conditional expressions. All alarms will be tested by each scan of the RCU and can result in the display of one or more alarm messages or reports.

    Up to 8 alarms can be configured for each point in the controller enabling the escalation often alarm priority (urgency) based upon which alarm(s) is/are triggered.

    Alarm messages can be sent to a local terminal or modem connected to an NCU or to the Operator’s Workstation(s).

    Alarms will be generated based on their priority. A minimum of 255 priority levels shall be provided.

    If communication with the NCU is temporarily interrupted, the alarm will be buffered in the RCU. When communications return, the alarm will be transmitted to the NCU if the point is still in the alarm condition.

11. Air Handler Controllers.

    AHU Controllers shall be capable of meeting the requirements of the sequence of operation found in the Execution portion of this specification and for future expansion.

    AHU Controllers shall support all the necessary point inputs and outputs as required by the sequence and operate in a standalone fashion.

    AHU Controllers shall be fully user programmable to allow for modification of the application software.

An LCD display shall be provided for readout of point values and to allow operators to change setpoints and system parameters.

12. Unitary Controllers

The I/O of each Unitary Controller shall contain the sufficient quantity and types as required to meet the sequence of operation found in the Execution portion of specification. In addition, each controller shall have the capability for time of day scheduling, occupancy mode control, after hour operation, lighting control, alarming, and trending.

13. Display Controllers

Provide display controllers for all systems to allow for local user interfacing with the system controls.

Display controllers are standalone, touch screen-based operator interfaces. The controller shall be designed for flush mounting in a finished space, with minimum display size of 9 x 9 inches.

Software shall be user programmable allowing for custom graphical images that simulate floor plans, menus, equipment schematics along with associated real time point values coming from any NCU on the network.

The touch screen display shall contain a minimum of 64 possible touch cells that permit user interaction for changing screens, modifying setpoints or operating equipment.

Systems that do not offer a display controller as specified must provide a panel mounted computer with touch screen capability as an alternative.

2.02 ELECTRIC WIRING

A. All electric wiring, materials and installation shall be in accordance with the latest revision of the National Electric Code, the New York City Electrical Code and other applicable Local Code, and shall carry the UL label where applicable. All exposed wiring shall be installed in EMT galvanized steel conduit, □" minimum, and shall be a minimum of #14 AWG. Concealed wiring shall be installed in EMT, □" minimum. All specials, such as junction boxes and connectors, shall be of type designed for use with conduit. Concealed wiring for low voltage systems can be run without conduit in enclosed fully accessible ceilings and in the raised floor plenum, provided that wire is plenum rated and that it is neatly run, supported and permanently tagged. Contractor shall submit support and tagging procedures for approval. Wiring shall be plenum rated. Low voltage wire in gypsum board and other inaccessible ceilings shall be run in conduit.

2.03 FREEZE PROTECTION DUCTSTATS

A. An electric freeze protection ductstat with 20 feet low temperature sensing capillary, and with manual reset, shall be located across the entering face of each cooling coil or bank of coils in the air conditioning units or in the discharge of each heating coil in the heating and ventilating units, which shall, on a fall in temperature below 35EF., shut down its respective supply fan and close the outdoor air damper. Set point temperature shall be adjustable. Case of instrument shall be located outside of supply unit, within 10 feet of supply fan motor. The ductstat shall be double pole type allowing for BMS indication and direct hard wiring to the motor starter or VFD. Provide ductstat for each coil section for total coverage.

B. For systems with return air fans, on fan shut down, the return fan shall continue running or shall start, if not running, and return air damper shall open and outside and relief air dampers shall close.

2.04 LOCAL PANELS AND ENCLOSURES

A. Provide adjacent to each air supply unit and each mechanical system (air, water and glycol systems), as herein specified, enclosed local control panels of 14 gauge steel or Formica set in an extruded aluminum frame, with welded angle iron brackets, wall or floor type, and with hinged locked door, in which shall be mounted the associated temperature, humidity and pressure controls, relays, etc., and on which shall be flush mounted the associated switches, thermometers, etc., as previously and hereinafter described. The basic background color of the panel shall be as approved by the Architect. Each local panel shall include a display and keypad for display of all temperature humidities for static pressures, etc. and for operator setpoint adjustments and control adjustments.

B. Details of each panel shall be submitted for approval prior to fabrication. Locations of each local panel provided are to be convenient for adjustment and service and within five (5) feet of system motor. All such locations are to be approved prior to installation. Submitted coordinated drawings showing panel locations for approval. Provide engraved nameplates beneath each panel face mounted control device and air gauge, clearly describing the function of said device and the range of operation. Provide a removable laminated or engraved color coded graphic system illustration 20" x 12" minimum size on each panel face. Provide a common key for all local panels. Provide and wire a 15 watt fluorescent light canopy, with switch, for each panel, to terminal strip in control panel.

C. Instrumentation within the panel shall be identified. All electrical components within the panel shall be 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.

D. All controllers installed outside of the building shall be provided with NEMA 4 weatherproof enclosures.

2.05 VARIABLE AIR VOLUME SYSTEM CONTROL

A. Variable air volume system control shall be DDC. Components as listed herein shall be as manufactured by Tek-Air System Inc., or Air Monitor Corp. or approved equal.

B. Control Components

1. Static pressure transmitter
   Velocity pressure transmitter
   Return, supply and outside air volume transmitter

2. The major components:
   a. Static Pressure Transmitter:
      The static pressure transmitter shall be capable of transmitting a linear 4 to 20 MA output signal proportional to differential (static) pressure input signals within the following performance and application criteria:
      1) Calibrated Span: Not greater than twice the static pressure at maximum flow rate, nor more than 15 times the static pressure at minimum flow rate.
      2) Calibrated Accuracy ∀ 2.0% of span.

3) Repeatability: Within 0.5% of output.
4) Dead Band of Hysteresis: Not detectable or measurable.
5) Linearity: 1.5% of span.
6) Response Time: At or near the speed of sound.
7) The transmitter output shall not be affected by direction of mounting or external vibration and shall be furnished with a factory calibrated span. Static pressure transmitter shall be Exactor Series 200 by Air Monitor Corporation or approved equal.

b. Velocity Pressure Transmitter:

The velocity pressure transmitter shall be capable of transmitting a 4 to 20 mA output signal proportional to differential (velocity) pressure input signals within the following performance and application criteria:

1) Calibrated Span: Not greater than twice the velocity pressure at maximum flow rate, nor more than 16 times the velocity pressure at minimum flow rate.
2) Calibrated Accuracy: ∀ 1.5% of span, or 2.5% of output, whichever is less.
3) Repeatability: Within 0.1% of output.
4) Dead Bank of Hysteresis: Not detectable or measurable.
5) Linearity: 1.0% of span.
6) Response Time: At or near the speed of sound.
7) The transmitter output shall not be affected by direction of mounting, or external vibration, and shall be furnished with a factory calibrated span.

C. Duct Air Monitor Device (DAMD or AFM)

1. Provide airflow measuring stations in the supply and return fan inlets, the supply and return ducts and the minimum outside air intake airstream, as indicated on the drawings and as outlined herein and as required to meet the sequence of operations. Installation in the fan inlets and the duct system shall be installed under this section under the supervision of the device manufacturer. The manufacturer shall submit written certification that all devices are installed properly.
2. Duct Mounted Airflow Measuring Stations: Provide where indicated or required to meet the sequence of operation, airflow measuring devices of the vortex shedding type, capable of continuously monitoring the airflow volume of the duct or fan served and electronically transmitting a signal linear to the airflow volume. All duct-mounted airflow measuring devices shall be capable of measuring velocity over the full range of 350 to 7000 fpm. Devices shall consist of multiple velocity sensors, supported on probe bars. Air flow stations at outside air intakes shall be capable of measuring air flow with velocities as low as 75 fpm and a high as 1,000 fpm and shall be as specified herein.

   Where ductwork configuration is such that upstream and downstream minimum duct diameters cannot be met for the use of one station, Contractor shall provide two or more stations as required and shall totalize the stations.

   Individual airflow sensors shall be of rugged construction, and shall not require special handling installation. Sensors shall be mounted on support bars as required to achieve an equal area traverse. Support bars over one foot in length shall be supported on both ends. All mounting hardware required shall be furnished by the airflow sensor manufacturer.

   Individual velocity sensors shall not be effected by dust, temperature, pressure or humidity. Sensors for the return and exhaust systems shall be capable of operating with air temperatures up to 320EF. The sensors shall be passive in nature with no active parts within the air stream. The output from individual sensors shall be linear with respect to

airflow velocity and shall be capable of sensing airflow in one direction only. The velocity sensors shall not require calibration, and the transmitter shall have no drift over time.

Velocity measurements from individual sensors shall be summed in the integral, companion transmitter. The transmitter output shall be 4-20 ma, power shall be 24 volts AC, provided under this section and shall be fully isolated from ground. Transmitters shall be calibrated for the appropriate full scale cfm. Measurement system accuracy shall be plus or minus 1.5% of rate plus 0.5% of calibrated full scale. Transmitters shall have a turndown of at least ten to one.

Airflow stations shall be Vortek station as provided by Tek-Air Systems, Inc. of Northvale, NJ or as approved equal.

3. Outside Air Low Velocity Airflow Monitoring System (Use for all outside air flow measurement)
   a. Fabrication
      1) Model: IAQ-Tek as manufactured by Tek-Air Systems Inc., Danbury, CT - Represented by Accuspec, Inc. Phone: 203-261-8100, Fax: 203-261-1981.
      2) Velocity Sensing Probes:
         a) Large Area Impact Probe:
            1) Use: Large area impact probes designed to be mounted in areas where turbulence is expected such as in the discharge of louvers, inside rain hoods, after filter banks, before coils, or upstream of outdoor air intake dampers. Probes shall generate a differential pressure in response to changes in air velocity.
            2) Velocity Range: Probe shall operate over the range of 1000 to 75 fpm. Turndown in any specific application shall not exceed eight to one (minimum is 8% of maximum).
            3) Quantity: Probes are to be provided in the quantity recommended by the manufacturer for the specific area to be monitored.
            4) Mounting: Probes are to be provided with any special hardware required to assure secure mounting. Probes can be mounted to within 6" downstream of the intake louver and as close as 6" upstream from the damper without affecting stated accuracy. Probe shall be mounted to minimize extreme angular velocities. Installer to follow manufacturer’s mounting instructions.
            5) Orientation: Probe must be located facing into air stream. Pressure connection barbs must be upright.
            6) Material: Kydex - T52000 compound with UL ratings of UL-94-V0 and UL-94-5VB.
            7) Pressure Connections: ¼ inch barbed connections shall be provided for high and low pressure sensing.
            8) Cleaning: Probes shall be able to withstand periodic wash-down with water. If probes cannot be cleaned in this manner, provide upstream filter assemblies to protect the probes from dirt.
            9) Humidity: High levels of water vapor, including entrained rain and fog, shall not damage or otherwise affect the operation of the unit (when mounted per manufacturer’s instructions).
         b) Duct Insertion Probes: TFP’s

1) Use: Bar type insertion probes, suitable for traverse mounting in ducts. Probes shall generate a differential pressure in response to changes in air velocity.
2) Velocity Range: 4000 to 200 feet per minute. Turndown in any specific application shall not exceed eight to one (minimum is 8% of maximum).
3) Quantity: Probes are to be provided in the quantity recommended by the manufacturer for the specific area to be monitored.
4) Mounting: Probes shall be mounted in accordance with the manufacturer's recommendations.
5) Orientation: Perpendicular to air stream.
6) Material: Extruded aluminum, anodized.
7) Pressure Connections: ¼ inch compression shall be provided for high and low pressure sensing.
8) Probe Length: 6 to 120 inches as required.

3) Electronics:
a) Outdoor Air Transducer:
1) Style: Differential pressure type, high accuracy, complete with auto-zero valve and ambient temperature sensor.
2) Range: Differential pressure range shall be selected for the corresponding air velocity range being measured.
3) Temperature range: Transducer shall be capable of operating over the range of -40 to 120 degrees F without any temperature induced errors including zero or span shift.
4) Environment: Transducer shall be mounted in a sealed NEMA 4 enclosure, suitable for mounting in the outdoor air plenum.
5) Pressure Connections: ¼" barbed connections shall be provided for high and low pressure sensing.
6) Electrical Connections: The manufacturer shall provide a weather tight connection cable with weatherproof Amphenol type connector. Cable shall be plenum rated.
7) Orientation: Vertical.
8) Humidity: Transducer shall be protected from condensation in sensing chamber and connection tubing when transducer temperature is lower than the dewpoint of the measured air stream (when mounted per manufacturer's instructions).

b) Monitor Electronics:
1) Style: Microprocessor based electronics including integral display and operator keypad.
2) Function: Receive signals from transducer assembly, calculate outdoor air volume and temperature, display information to user, and transmit information to building automation system.
3) Perform self-diagnostics, and alarm on low outdoor air volume.
4) Display: A 4-line by 20-character alphanumeric LCD operator's display shall be provided and shall be backlit for use in low light areas.
5) Temperature range: Monitor shall be capable of operating over the range of +30 to 110 degrees F
6) Environment: Monitor shall be mounted in a sealed NEMA 4 enclosure, suitable for mounting outdoors if required.

Enclosure shall include clear window to allow viewing of monitor display without opening the door.

7) Calculations: Monitor shall perform calculations including: differential pressure to velocity, velocity to volume conversions, and correct for altitude, intake air temperature, transducer auto zero routine, and span shift.

8) Analog Outputs: Monitor shall provide industry standard 4-20mA outputs for corrected volume and outdoor air temperature. Scaling of volume output shall be adjustable by the user. Diagnostic functions shall be provided to assist in troubleshooting connections.

9) Contact Outputs: A SPDT contact shall be available which will be normally energized and shall indicate either an alarm condition or unit problem.

10) Setup Wizards: The monitor shall include preprogrammed setup wizards to lead the building automation contractor, test and balance contractor, and/or user through the steps necessary to commission the system.

b. Source Quality Control

1) Factory Tests: Factory test transducer and monitor for proper operation.

c. Examination

1) Inspect areas to receive airflow monitors. Notify the Engineer of conditions that would adversely affect the installation or subsequent utilization of the airflow monitors. Do not proceed with installation until unsatisfactory conditions are corrected.

d. Installation

1) Install airflow probes and transducers at locations indicated on the drawings and as required per the sequence of operation, in accordance with manufacturer's installation instructions.

2) Install monitor electronics at locations indicated on the drawings and in accordance with manufacturer's installation instructions.

3) Install probes such that pressure connections are at the top of the mounted probe. Probes should be installed such that the best coverage or areas being measured can be achieved. Factory assistance shall be available.

4) Install the transducer such that it is located at a slightly higher elevation than the highest probe's ports. Transducer shall be mounted so that the pressure connections are on the bottom of the enclosure. Connecting tubing should be pitched downward and away from the transducer so that any accumulated moisture can drain back towards the probe. Tubing should be installed so that there are no pockets where moisture might accumulate.

5) Cable connecting the transducer and monitor shall be installed in a neat and workmanlike manner. Penetrations through the air handler walls shall provide some means to prevent chafe.

2.06 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 be respond to a change of plus or minus □ deg F. Control point shall be adjustable 15deg F above and below intended setting, with a minimum scale of at least 50 deg F. 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.

2.07 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.

B. All throttling 2-way water valves shall be sized for pressure drop equal to respective coil pressure drop at flow rates indicated on the drawings with a minimum pressure drop of 10 feet. All 3-way water valves shall be sized for a minimum pressure drop of 5 feet. All water valves shall be single seated, except where water pressure and flow require double seated valves.

C. The electric valves mounted outdoor shall be covered with a NEMA 4 actuator enclosure rated for outdoor use.

D. All steam control valves shall be single seated and have linear flow characteristics. No single valve shall be larger than 2½". Wherever the flow rate is such as to require a valve larger than 2½", then two valves in parallel shall be used, with one no larger than 2½". The valves shall operate sequentially. Trim shall be stainless steel for all steam valves.

2.08 AUTOMATIC CONTROL DAMPERS

A. The automatic dampers shall be furnished by the BMS contractor and installed by the Sheet Metal Contractor. The Control Contractor shall furnish and install the automatic damper operators for all automatic dampers for all the air handling units.

B. Automatic Dampers and Smoke Dampers
1. Dampers shall have blades not more than 8" wide. Linkage and hardware shall be zinc plated steel. Damper blades and rods shall be installed in horizontal position. Any dampers over 72" wide shall have jack shafts.
2. In aluminum and stainless steel ductwork, damper material shall match the ductwork, with blades of 16 gauge aluminum, or 16 gauge stainless steel.
3. 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 □" closed cell neoprene gasketing around perimeter of the frame and at interlocking blade edges, to form an airtight seal.
4. All dampers shall be constructed to provide a maximum leakage of 1%, with an approach velocity of 1500 fpm flow, when closed against a pressure difference of 4 inches of water. Submit leakage and flow characteristic data for all dampers Greenheck Model FSD 311M

low leakage 8 cfm/ft² @ 4" w.g. Leakage Class I as standard with end switch actuators and all the options listed on the drawings.

5. All outside air dampers shall automatically return to closed position in the event of loss of electricity or air.
6. Furnish and install, at locations shown on plans, or in accordance with schedules, control dampers that meet the following minimum construction standards: Frame shall be 16 gauge (1.6) galvanized steel structural hat channel with tabbed corners for reinforcement to meet 13 gage (2.4) criteria. Blades shall be 14 gage (2.0) equivalent thickness galvanized steel, roll formed airfoil type for low pressure drop and low noise generation. Blade edge seals shall be suitable for -76°F to + 350°F mechanically locked into the blade edge. Adhesive or clip-on type seals are unacceptable. Jamb seals shall be flexible metal compression type to prevent leakage between blade end and damper frame. Blade end overlapping frame is unacceptable.

   Bearings shall be corrosion resistant, permanently lubricated stainless steel sleeve type turning in an extruded hole in the damper frame. Axles shall be square or hexagonal positively locked into the damper blade. Linkage shall be concealed out of air stream, within the damper frame to reduce pressure drop and noise. Submittal must include leakage, maximum air flow and maximum pressure ratings based on AMCA Publication 500. Dampers shall be in all respects equivalent to Greenheck Model FSD 311M.

2.09 ELECTRIC VALVE & DAMPER OPERATORS/ACTUATORS

A. All electric operators shall be of totally enclosed type in rustproof housings of pressed steel or approved cast metal. 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 provided with a NEMA 4X weatherproof enclosure. All electric operators shall be as manufactured by Belimo or approved equal.

1. Electronic/electric actuation shall be provided using Belimo or approved equal.
2. The actuator shall be Belimo type direct coupled (over the shaft), enabling it to be mounted directly to the damper or valve shaft without the need for connecting linkage. The fastening clamp shall use a □V" bolt and □V" shaped, toothed cradle to attach to the damper shaft for maximum holding strength. Single bolt or set screw type fasteners are not acceptable.
3. The actuator shall have electronic overload or digital rotation sensing circuitry to prevent damage to the actuator at the end of rotation or magnetic clutch are not acceptable.
4. For power failure/safety applications, a mechanical, spring return mechanism shall be used. Non-mechanical forms of fail-safe are not acceptable except for a central, emergency, backup power source.
5. All spring return actuators shall be capable of both clockwise or counterclockwise spring return operation by changing the mounting orientation. Spring return actuators should be capable of mounting directly onto a jackshaft up to 1.05" in diameter.
6. Proportional actuators shall accept a 2 to 10 VDC or 4 to 20 mA and provide a 2 to 10 VDC position feedback signal.
7. 24 VAC/DC actuators shall not require more than 10 VA for AC or 8 watts for DC applications.
8. All actuators shall have an external manual gear release or manual crank to aid in installation and allow manual positioning when the actuator is not powered.
9. All actuators shall have an external direction of rotation switch to aid in installation and provide proper control response.

10. Actuators shall be provided with a factory mounted 3-foot electrical cable and conduit fitting to provide easy hook up to an electrical junction box.
11. The actuators shall be listed under Underwriters Laboratories Standard 873 and Canadian Standards Association Class 813.02. They must be manufactured under ISO 9001 quality certification.

B. Actuators shall have a 2-year manufacturer's warranty, starting from the date of installation.

2.10 DAMPER POSITION SWITCHES

A. Shall be crank mounted and provide two snap-action SPDT contacts. Each switch shall be adjustable with a minimum differential of 9E.

B. Approved manufacturer: Barber-Colman AM-321 or equivalent.

2.11 TEMPERATURE AND HUMIDITY TRANSMITTERS

A. All temperature or humidity transmitters shall be capable of measuring space or duct temperature or humidity and transmitting an electric signal (4 to 20 MA) directly proportional to the temperature. Temperature transmitter shall be of the thermistor type. The range of the temperature transmitters shall be 50EF. for room air sensing, and 100EF. or 200EF. for all other sensing, as approved. All humidity transmitters shall have a range of 80% RH. Each transmission system shall have an accuracy of 1% of scale range. All transmitters shall be located at point of measurement, with instrument case located outside of unit or ductwork with capillaries and sensing bulbs. Finish and final location of room transmitters shall be approved by the Architect. Room transmitters shall be stainless steel plate type with no display and no adjustment.

B. Transmitter shall provide one point field calibration for both RH and temperature.

C. Humidity sensors shall use thin film capacitance technology or an approved equal high accuracy technology. Sensors shall remain calibrated within ∀ 0.5% RH/year in normal air conditioning environments.

D. Humidity sensing accuracy shall be ∀ 2% RH in the 0 to 90% and the 10EC to 40EC temperature ranges.

E. Temperature accuracy shall be 0.5EC in the -5EC to 50EC temperature range.

F. Wall mount housing shall be ABS plastic (color to be selected by the Architect.) Duct mounted housing shall be cast aluminum. Duct mounted sensor protection shall be stainless steel.

G. Provide two humidity calibrators and two equivalent temperature calibrators to allow facility staff to check & calibrate transmitters.

H. The final location of temperature sensors shall be coordinated with the Architect.

2.12 TEMPERATURE TRANSMITTERS

A. Transmitters shall be of 2-wire, 4-20 mA output type with a solid state or thermistor type element having an accuracy of ∀1% of span. Transmitter shall include protection against reverse polarity

and supply voltage transients. A span and zero adjustment shall be provided with each transmitter to allow for recalibration as necessary.

1. Room sensors
   a. Sensor covers shall be provided with tamper resistant screws.
2. Duct sensors
   a. Single point duct mounted sensors shall have a minimum 9" rigid probe and be used when the duct size is less than 24". Duct mounted housing shall be cast aluminum.
   b. Averaging duct mounted sensors shall have a minimum 12.5' long averaging element and be used when the duct size is greater than 24".
3. Liquid immersion sensors
   a. Liquid immersion sensors shall have a stainless steel probe and a stainless steel well. Length of the sensor well shall be selected based on the diameter of the pipe to provide accurate, reliable sensing of the liquid temperature. Provide well with lag extension equal to depth of pipe insulation.
4. Outside sensors
   a. Sensing elements shall be mounted in aspirator box as per master outside air transmitter section above.

2.13 HUMIDITY TRANSMITTERS

A. Transmitters shall be of 2-wire, 4-20 mA output type with a resistance or capacitance element having an accuracy of ∀2% between 20-95% Rh. Transmitter shall include protection against reverse polarity and supply voltage transients. An accuracy adjustment shall be provided with each transmitter to allow for recalibration as necessary.

1. Duct mounted
   a. Sensor shall have a minimum 6" rigid probe with a pressure cast aluminum weatherproof box with gasketed cover.
2. Wall mounted room sensor
   a. The room sensor shall be provided with tamper resistant screws.
3. Outside mounted
   a. The sensing element shall be mounted inside aspirator box as per master outside air transmitter section above.

2.14 FLOW TRANSMITTERS

A. Airflow

1. The sensor shall be a 4-20 mA output type with the accuracy of ∀1% with flow straighteners in circular duct applications. In rectangular duct applications, the accuracy shall be ∀2% with flow straighteners.
2. Flow station shall be constructed of steel with flanged face for easy mounting. The flow straighteners shall be constructed of aluminum or steel.
3. Approved manufacturer: Tek-Air, or Air Monitor or an approved equal.

2.15 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□" 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 discharge air temperature

2.16 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.

2.17 ROOM THERMOSTATS

A. All proportioning thermostats shall have 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.

2.18 FIRE PROTECTION DUCTSTATS

A. A manual reset fire protection ductstat shall be provided in the air inlet to each return air fan, and exhaust fan within 10 feet of fan motor, to stop the return fan, exhaust fan, and its respective supply fan, whenever the temperature exceeds 125°F.

2.19 AIR FILTER DIFFERENTIAL ALARM

A. An air differential pressure transmitter shall be provided to transmit to the BMS the differential pressure drop across each air filter, pre-filter, after filter, bag filter, etc. The BMS shall be programmed to alarm when the filter requires changing at the final or dirty filter setpoints as listed or shown on the filter schedule or as specified by the manufacturer. Differential pressure transmitter shall be Modus Model □ T30.

1.	Ranges	0-1" wc, 0-2" wc, 0-3" wc
2.	Output	4-20 mA
3.	Accuracy	∀1% of range
4.	Maximum pressure	8x pressure range
5.	Operating voltage	10 to 35 VDC

2.20 CURRENT SWITCHES

A. Current switches shall be provided for all HVAC equipment to indicate run status to the BMS. HVAC equipment shall include, but not be limited to, all supply, return, exhaust, relief and exhaust fans, pumps, etc. Current switches shall be split case type, single pole double throw, sized for motor amps. Current switches shall be Veris Hawkeye Model H608, Neilsen Kuljian Model D150 or RE Technologies Model SCSI.5A.

B. Provide 2-pole model or relay for status to BMS and fire alarm panel.

2.21 CONTROL TRANSFORMERS

A. A 120/24 VAC control transformer shall be provided in each DDC control panel, application specific controller panel, zone controller panel (VAV) terminal equipment control panel to power the DDC equipment and controllers located therein. Common transformers serving more than one dedicated panel shall not be allowed. Transformers shall be UL listed, properly fused to protect DDC equipment and sized by the controls Contractor. For equipment requiring 24 VDC power, provide similar transformer converter as required to power the DDC equipment.

2.22 CO_2 SENSORS

A. The CO_2 sensor shall be designed for demand control ventilation and shall be the 8002 non-dispersive infrared sensor made by Telaire [805-964-1699] or approved equal.

B. The diffusion gas chamber in the sensor shall incorporate a reflective, gold plated light pipe or waveguide surrounded by a gas permeable teflon based hydrophobic diffusion filter that prevents particulate and water contamination of the senor.

C. The sensor shall provide simultaneous analog outputs in volts and milliamps and shall have a gold bifurcated relay that can be operated as normally open or closed.

D. The sensor shall incorporate elevation correction adjustment and ABC Logic (Automatic Background Calibration) software for self-correction of drift to better than ∀10 ppm per year. The sensor shall have an accuracy of ∀75 ppm or 7% of the reading (whichever is greater). All adjustments to the sensor, including output scaling, elevation adjustment, relay setpoint, relay dead-band, proportional or exponential output, and single-point calibration shall be made via computer connection to an onboard RJ45 jack. Provide all required software to allow facility staff to perform calibration. The 8002 product shall also be adjusted using the on-board pushbuttons and display.

E. For ease of installation, the sensor shall have a detachable base with all field wiring terminals on the base.

F. Sensors shall be wall mounted room sensors provided with tamper resistant screws.

PART 3 - EXECUTION

3.01 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.

3.02 INSTALLATION

A. Install 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.

3.03 FIELD QUALITY CONTROL

A. Upon completion of installation of the automatic temperature control system and after motors have been energized with normal power source, test system to demonstrate compliance with requirement. When possible, field correct malfunctioning controls then retest to demonstrate compliance. Replace controls which cannot be satisfactorily corrected. Refer to Section 23 05 93 - Testing and Balancing.

3.04 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 in complete operating condition, subject to the approval of the Architect. Complete instructions shall be given to the operating personnel. There shall be two day's instruction given for Winter cycle and two day's instruction for Summer cycle operation.

3.05 SEQUENCE

A. Control sequence shall be as specified herein and/or as indicated on the Drawings. Schematic diagrams shown as the contract Drawings are intended to illustrate desired sequence of operation and are not intended to illustrate the means by which this is to be achieved. All required components whether illustrated or not shall be provided. 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 sensitivity, throttling range, tabulated settings for instruments in sequence, amps at which instruments are set, controlled variable coincide, and automatic reset becomes inactive.

B. A separate tabulation shall be provided of control settings of all automatic controls including components supplied 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.

C. All setpoints indicated in the sequences of operation shall be fully adjustable through the BMS by the Operator.

3.06 CONSTANT VOLUME UNIT WITH ECONOMIZER DAMPERS, STEAM PRE-HEAT COIL, CHILLED WATER COOLING COIL AND DDC CONTROLS AC-1W, AC-2W, AC-3W, AND AC-5D

A. General System Overview
   1. Mechanical System Summary: The AC unit consists of supply and return fans with variable frequency drives (VFD), economizer dampers, steam preheat coil, chilled water cooling coil. The unit shall operate in various modes; System-OFF, Morning Warm-Up, Morning-Purge, Cool-down, Unoccupied Mode or Occupied Mode.
   2. Safety Devices. Safeties shall be in force at all times and all modes of operation, including all operating modes of the VFDs including VFD bypass operation.

a. Supply Duct Overpressure Control: If the static pressure in the supply duct exceeds the positive static pressure switch setpoint for any reason, the supply fan shall stop and shall remain in the System-OFF Mode until the safety pressure switch is manually reset. After the alarm is cleared, the AC unit shall resume its normal operation according to the appropriate mode. A change-of-state alarm shall be generated at the BMS. Note that this fan safety shall be hardwired to shut the fan off in all modes of operation.

b. Return Duct Suction Pressure Control: If the static pressure in the return duct exceeds the negative static pressure switch setpoint the return fan shall stop and shall remain in the System-OFF Mode until the safety pressure switch is manually reset. After the alarm is cleared, the AC unit shall resume its normal operation according to the appropriate mode. A change-of-state alarm shall be generated at the BMS. Note that this fan safety shall be hardwired to shut the fan off in all modes of fan-control operation.

c. Clogged Filter Alarm: There shall be installed an indicating, differential pressure transmitter across the filters which shall indicate the combined pressure drop across the filters at the BMS. A clogged filter alarm shall be generated at the BMS when the pressure drop exceeds the combined pressure drops as recommended by the filter manufacturer for replacement.

d. Freezestat located downstream of the preheat coil shall shut down the fans and indicate an alarm at the BMS when the temperature is below 40°F.

3. Fire Alarm Shut Down: This sequence of operation shall be in force at all times and under all modes of operation.

a. During a fire alarm condition, the existing Fire Alarm Control Panel (FACP) shuts down the supply and return fans and the system shall operate and remain in the System-OFF Mode until the alarm condition is cleared. The BMS contractor shall extend existing fire alarm shutdown wiring from existing supply and return fan starters to new supply and return fan VFDs for fan shutdown. When the unit fans are shut down by a fire alarm condition, all fire/smoke and smoke dampers shall close as commanded by the FACP. After the fire alarm shutdown is cleared, all smoke and fire/smoke dampers shall be commanded open by the FACP and the unit shall resume its normal operation according to the appropriate mode.

4. BMS I/O Points: Provide the BMS input/output (I/O) points as specified.

B. Operating Modes. The operating modes of the AC unit shall be automatically determined by the combined actions of the DDC/BMS Scheduler, control and safety devices and the Fire Alarm System.

1. Mode Selection and Fan Operation:

a. The operator shall be able to manually select the operating mode through an H-O-A switch (labeled OCC-UNOCC-AUTO) mounted on the local control panel and wired into the digital controller. In the automatic-position the AC unit is indexed automatically by the DDC Scheduler between the various modes of operation described herein. In the OCC-position the AC unit shall remain in the Occupied Mode. In the UNOCC-position the AC unit shall remain in the Unoccupied Mode.

b. When the H-O-A switch is placed into either the “OCC” or the “UNOCC” position an advisory is generated at the BMS.

c. Return air fan (RF) shall be electrically interlocked through the BMS with the supply fan (SF) of the AC unit.

d. Summer/Winter Mode Selection and Economizer Mode Selection: The AC unit shall be automatically indexed to operate in either the Summer Mode or Winter Mode based on the outside ambient temperature.

1) Winter Mode: If the outside temperature is less than or equal to 45ºF (adjustable), the unit shall be indexed to the Winter Heating Mode.
2) If the outside temperature is greater than 45°F (adjustable) but less than 50°F (adjustable), the unit shall be in whatever Mode was the last Mode of operation (heating or cooling).
3) Summer Mode: If the outside temperature is greater than or equal to 50°F (adjustable) but less than 65°F (adjustable), the unit shall be indexed to the Summer Cooling Mode.
4) Economizer Mode: When the calculated global outside air enthalpy is less than the controller's calculated return air enthalpy, the AC unit shall be indexed to the Economizer Mode. When the outside air enthalpy is greater than the return enthalpy, the AC unit shall be indexed to Summer Mechanical Cooling Mode. If the outside temperature is greater than or equal to 65ºF (adjustable), the unit shall be indexed to the Mechanical Cooling Mode. Upon a BACNET Network communication failure, the AC unit shall default to the seasonal Occupied Mode.

e. Fan Acceleration/De-acceleration: When the supply fan and return fans are started, the fans shall be slowly accelerated up to the required speed according to the ramp adjustments in the VFDs. The ramp-up time shall be set to (180) seconds (adjustable). When the fans are de-energized they shall be de-energized immediately without de-acceleration.

f. Supply and Return Fan Control:
1) The supply fan shall be started and stopped as described in these sequences.
2) The supply fan VFD speed shall be placed under control of the BMS controller to maintain its setpoint.
3) The return fan VFD speed shall be placed under control of the BMS controller to maintain its setpoint.
4) Upon proof of supply fan operation, in all modes of fan operation, the control sequence shall proceed according to the appropriate Mode. If the supply fan and return fan do not prove ON, a BMS alarm shall be issued.

2. System-OFF Mode:
a. The AC unit supply and return fans shall be OFF; the AC unit economizer dampers shall be commanded to their respective fail-safe positions, outside air and exhaust air dampers closed, return air damper open; cooling, coil valve shall be closed.

3. Unoccupied Mode:
a. Winter Mode: The AC unit supply and return fans shall operate at reduced unoccupied air flows of 30% (adjustable) of normal occupied air flow. The AC unit shall be controlled to maintain a night set-back temperature (NSB) setpoint of 55°F (adjustable).
1) When the return air temperature falls below the NSB setpoint, the supply fan and return fan speeds shall be increased to occupied speed; all associated exhaust fans shall remain OFF; the economizer dampers shall be in the full-return position; with the return damper open and the outside air and exhaust dampers closed.
2) Upon proof of air flow, the preheat coil shall be energized and the steam preheat valve shall be modulated to maintain a discharge temperature of 85°F (adjustable) until the return air temperature rises above the NSB setpoint plus its differential of 5°F (adjustable), after which the preheat coil valve shall close. The supply and return fans shall reduce to unoccupied speeds.

4. Morning Warm-up: Pre-occupancy morning warm-up mode shall be required as sensed by the space temperature sensor one hour (adj.) before the system is indexed from the unoccupied to the occupied mode for the following conditions.
   a. When the return air temperature is below the occupied setpoint less a differential of 5˚F (adjustable), then the warm-up sequence shall be initiated. Otherwise, the AC unit shall remain in unoccupied mode until the beginning of the Occupied Mode.
   b. Warm-up Mode: The supply fan and return fan speeds shall be increased to occupied speeds; all associated exhaust fans shall remain OFF; the economizer dampers shall be in the full-return position; with the return damper open and the outside air and exhaust dampers closed.
   c. Upon proof of air flow, the preheat coil shall be energized and the steam preheat valve shall be modulated to maintain a discharge temperature of 85°F until the space temperature rises above the occupied setpoint plus its differential of 2°F, after which the preheat coil shall de-energize and the steam preheat valve shall close. Once the warm-up mode cycle is satisfied, the unit shall be indexed to occupied mode.
5. Morning Purge and/or Cool-down: Pre-occupancy space cooling shall be required as sensed by the combination return air temperature and humidity sensor one hour before the system is indexed from the unoccupied to the occupied mode for the following conditions.
   a. Pre-Occupied Morning Purge Cycle:
      1) The DDC Controller shall calculate return air dewpoint from the combination of the return air temperature and relative humidity sensor readings to the broadcast value of the calculated outside air dewpoint. If the outside air dewpoint is less than the inside dewpoint, a pre-occupied morning purge cycle shall be initiated for a (15) minute duration (adjustable).
      2) During the pre-occupied morning purge cycle, 100% outside air shall be introduced into the building to purge the building air before occupancy. The outside air and relief air dampers are to be indexed to their fully open position, and the return air damper to the fully closed position.
      3) The central air conditioner supply and return fans shall be indexed to full CFM with cooling locked out until the morning purge cycle is terminated. The pre-occupied morning purge cycle shall be terminated after a 15 minute cycle (adjustable). The pre-occupied morning purge cycle, if initiated, shall be followed by a pre-occupied cool-down cycle.
   b. Pre-Occupied Cool-down Cycle:
      1) After the purge cycle if the outside air dewpoint is greater than the inside dewpoint, the morning purge cycle shall be locked out and mechanical cooling shall be used in a pre-occupied cool-down mode to bring the return air temperature down.
      2) During the pre-occupied cool-down cycle, the outside and relief exhaust air dampers shall be closed with the return damper fully opened. The AC unit supply and return fans shall be indexed to provide their full CFM. The chilled water control valve shall be modulated to provide their full capacity while the DDC controller limits the discharge air temperature to be no less than 2˚F (adjustable) less than the calculated space dewpoint. The pre-occupied cycle shall be terminated when the return air temperature is at or below 78˚F (adjustable).
      3) Once the pre-occupied pull-down cycle is satisfied, the unit shall be indexed to occupied economizer cooling or occupied mechanical cooling to maintain the required occupied space dry-bulb temperature of 78˚F (adjustable) and occupied space relative humidity of 50% (adjustable) as sensed by the return duct temperature sensor and return duct humidity sensor. The outside air

dampers shall be set to their minimum ventilation position during the occupied mechanical cooling cycle. The DDC Controller shall compare the controller's calculated return air enthalpy to the calculated global outside air enthalpy to determine if economizer cooling or mechanical refrigeration shall be initiated.

6. Occupied Mode: When the AC unit DDC controller is indexed to the occupied mode, the unit supply and return fans shall provide their full occupied air flow CFM via their respective variable frequency drives (VFD) as follows.
   a. The supply fan VFD speed shall be commanded to its fixed speed as determined and set by the Test & Air Balance Contractor.
   b. The return fan VFD speed shall be commanded to its fixed speed setting as determined and set by the Test & Air Balance Contractor.
   c. Upon proof of supply fan operation, the control sequence shall proceed as follows. If the fans do not prove ON, an alarm shall be issued to the BMS.
7. Winter Occupied Mode: The economizer dampers are controlled in sequence with the modulated preheat coil steam control valve to maintain the desired supply fan discharge air temperature setpoint. The minimum outside air and minimum exhaust/spill dampers shall be open.
   a. Winter Temperature Control Sequence:
      1) On rise in supply fan discharge air temperature above the occupied setpoint temperature of 55°F (adjustable), the economizer dampers shall be modulated to maintain the discharge set point. On a drop in discharge air temperature the reverse sequence shall occur.
      2) The modulating economizer dampers shall be subject to an adjustable mixed-air low-limit controller set to 45°F (adjustable) which shall overcall the supply air temperature control signal, modulating the outside and exhaust air dampers closed and return air damper open.
      3) On drop in supply fan discharge air temperature below the discharge air setpoint temperature of 55°F (adjustable), enable and modulate preheat coil steam control valve as required to maintain discharge air setpoint.
      4) The supply air temperature setpoint shall be reset from 55ºF to 60ºF (adjustable) as outside air temperature decreases from 65ºF to 35ºF (adjustable). At Operator's option, allow for operation at a fixed setpoint.
8. Summer Occupied Mode: The minimum outside air and exhaust/spill air and return air dampers are open and maximum outside and exhaust/spill air dampers are closed while chilled water cooling coil valve is controlled to maintain the supply fan discharge air setpoint.
   a. Summer Temperature Control Sequence:
      1) On a rise in supply fan discharge air temperature above the occupied cooling temperature setpoint of 55°F (adjustable), chilled water cooling coil valve shall be modulated to maintain its occupied supply fan discharge air temperature setpoint. On a drop in temperature the reverse sequence shall occur.
9. Heating Coil Low Limit Control: When supply fan is on, pre-heating coil discharge sensor shall act as a low limit, and overcall the fan discharge temperature control to gradually close outside air damper and open heating coil valve, if pre-heating coil discharge temperature drops below its setting of 45°F (adjustable).

   When supply fan is off, outside air dampers shall close and pre-heating coil valve shall remain under control of pre-heating coil discharge sensor to maintain 45°F adjustable.

Provide separate temperature transmitter and control valve outputs for each preheat coil section.

10. Existing Fire Smoke Damper Control
    a. The existing pneumatic controls of the existing pneumatically actuated fire smoke dampers shall remain and shall be carried over and incorporated into the new temperature control system.
11. Existing Pneumatic Damper Actuators and Control Valves
    a. The existing pneumatic damper actuators and pneumatic control valves shall be replaced with new electric damper actuators and control valves.
    b. Remove existing pneumatic control tubing lines, Remove existing pneumatic control panels and replace with new DDC/BMS control panels.
12. Smoke Purge
    a. On smoke purge initiation from the existing smoke purge control panel, the exhaust air damper shall open and the return air damper shall close, the outside air dampers shall close and the respective return fan shall start from new pressure electric (P/E) switch on existing smoke purge pneumatic signal line and the fan's variable frequency drive (VFD) shall ramp up to full speed subject to high static pressure control.
    b. Coordinate all work with existing fire alarm and smoke purge systems and vendor.
13. Occupied/Unoccupied Reduced Air Flow Cycles
    a. Provide a reduced air flow program that shall lower the supply and return fan variable frequency drives (VFD) speeds and reduce fan air flow down to 30% (adjustable) of normal full air flow during unoccupied cycle.
    b. This reduced air flow shall be on time programs individually set up for each AC unit or air handling unit based on day of week and time of day and class schedules.
    c. Initial schedules shall be programmed by the ATC/BMS contractor in coordination with building engineers and operators. ATC/BMS shall train school building engineers operation on how to set up and change schedules.
    d. During occupied cycle, fan FVDs shall operate at full air flow speed.
14. Mixed Air Temperature Control
    a. Provide new mixed air temperature transmitters for all AC units as shown on the Temperature Control Diagrams. The temperature transmitters shall be of the 20 foot long averaging capillary type as specified herein.
    b. For the larger cfm AC units, provide a minimum of two (2) transmitters per AC unit for 20 foot long, capillaries and for transmitters with 12 foot long capillaries, provide a minimum of four (4) transmitters on AC units. The AC units' modulating economizer outside, return and exhaust air dampers shall be subject to a mixed air low limit controller set at 45°F (adjustable) which shall overcall the supply air temperature control signal, modulating the maximum outside and exhaust dampers closed and return air damper open. For AC units with multiple mixed air temperature transmitter, the transmitter sensing the coldest temperature shall control.
15. Air Flow Measurement Stations
    a. The supply air flow measuring station shall control the supply fan VFD to maintain constant supply air flow to compensate for the air filters getting dirty and loading up, by increasing the fan speed.
    b. The return air flow measuring stations shall be used for air balancing and to maintain a slightly positive pressure in the spaces. Coordinate air flow settings and readings with the air balancer.

c. The outside air flow measuring stations shall control the outside air dampers and return air dampers to maintain the minimum outside air flow as required for ventilation.

3.07 RETURN AIR RESET OF SUPPLY AIR TEMPERATURE:

A. In Winter Mode the AC unit shall be controlled to maintain a supply air temperature setpoint reset from return air temperature as shown in the table below.

Return Air Temperature	Supply Air Temperature
75 deg F and above	60 deg F (adjustable)
68 deg F and below	67 deg F (adjustable)
Between 75 deg F and 68 deg F	Shall be linear between 60 deg F and 67 deg F

B. In Summer Mode the AC unit shall be controlled to maintain a supply air temperature setpoint reset from return air temperature as shown in the table below.

Return Air Temperature	Supply Air Temperature
75 deg F and above	55 deg F (adjustable)
70 deg F and below	64 deg F (adjustable)
Between 75 deg F and 70 deg F	Shall be linear between 55 deg F and 64 deg F

3.08 VARIABLE FREQUENCY DRIVES (VFD)

A. Provide minimum of six (6) hard wired□ input-output points to each of the variable frequency drives that are under automatic control by the BMS as follows:
1. Start/stop = Digital Output
2. Speed adjustment signal = Analog Output
3. Speed feedback signal = Analog Input
4. Common fault alarm = Digital Input
5. Run status = Digital Input
6. VFD in bypass mode status indication = Digital Input

B. In addition to the hard wired points, provide an □open protocol□ communication □third party□ interface over local area network trunk cable from local BMS controller panel to the VFD, to permit BMS to monitor control all the VFD points. Coordinate the communications protocol, e.g., BACNET, Modbus, N2, etc. and communications interface ports RS-232 or RS-485, etc. with the VFD manufacturer. Refer to VFD specification section for additional details

3.09 CHILLED WATER (COOLING COIL) PROTECTION SYSTEM

A. Provide winter cooling coil protection mode that shall stroke the cooling coil control valve to its full 100% open position to allow chilled water to flow through the cooling coil to help prevent freeze up of the cooling coil.

B. The protection mode shall be manually initiated from the central BMS by the Building Engineer or automatically when outside air temperature falls below 40°F (adjustable). Chilled water pumps shall also be started.

C. Provide alarm at BMS if cooling coil valve does not open when called for.

3.10 FIRE ALARM SHUTDOWN WIRING

A. Disconnect existing fire alarm shutdown wiring from existing supply and return fan starters and reconnect to new supply and return fans' variable frequency drives (VFD). Provide all required conduit and wiring for disconnect and reconnect to new VFDs.

B. Verify, test and record that new fan VFDs are shut down from existing fire alarm system.

C. Coordinate with Owner and existing fire alarm vendor and/or service contract vendor.

3.11 CAFETERIA/KITCHEN EXHAUST FAN: "SMOG HOG"

A. The cafeteria/kitchen exhaust fan shall be started and stopped from the building management system (BMS) for the following modes of operation and the associated fan VFD speed or air flow settings:
1. Occupied Mode – Cooking: Exhaust fan at full flow.
2. Occupied Mode – Not Cooking: Exhaust fan at 50% air flow (adjustable).
3. Unoccupied Mode: Exhaust fan off or at 0% air flow.

B. The BMS contractor shall program the BMS for the various modes, i.e. occupied-unoccupied, cooking-non-cooking and coordinate time schedules with the kitchen operating staff and FIT engineering.

C. All VFD speeds and cfms shall be adjustable from the BMS.

D. BMS contractor shall train FIT personnel on modifying time schedules and VFD speed settings.

3.12 DEMAND CONTROL VENTILATION

A. Provide demand control ventilation (DCV) for AC units.

B. DCV shall include providing outside air flow measuring stations and carbon dioxide (CO_2) sensors in each AC unit's return air and outside air, wired to the local BMS/DDC AC unit control panels. Sequence of operation shall be as follows:
1. Minimum Outside Air Volume Control: As the supply and return air volumes are reduced, the BMS shall modulate exhaust, return and outside O.A.I. dampers to maintain a fixed minimum outside air volume. Minimum outside air flow shall be measured by air flow measuring stations located in the outside air stream. At the BMS operator's option, minimum outside air volume shall be switched from a fixed minimum cfm (adjustable) to demand ventilation control for AC unit.
2. Under demand ventilation control, the amount of minimum outside air shall be varied and shall be set as required to maintain the difference between carbon dioxide (CO_2) level in return air and the outside air CO_2 level as measured by a sensor located outside the building, below its differential setpoint (adjustable). The setpoint for each CO_2 zone sensor shall be distinct and individually or globally adjustable and shall be initially set for a differential

of 700 ppm. While providing demand ventilation control the minimum outside air cfm shall not exceed the design setpoint level (adjustable) and shall not go lower than a low limit setpoint cfm equal to the difference between the supply and return fan cfm (adjustable).

3. At the end of each startup, warm up or cool down, the system shall operate for one hour with a pre-set fixed minimum outside air before allowing CO_2 demand ventilation control. (This will allow for purge of the space and self-calibration of CO_2 sensors prior to occupancy.)

3.13 PUMP CONTROL: CHILLED WATER BOOSTER PUMPS

A. The VFD for each of the pumps shall be provided with a hand-off-auto (HOA) switch so that when the HOA switch is in auto position the pumps shall be controlled through the BMS. With the HOA switch in hand position, the pump shall run independent of the DDC/BMS control requirements. With the HOA in the off position, the pump shall not operate.

B. The BMS shall provide a schedule for operation of each pump. When the schedule indicates the pump is on it shall be enabled and shall be controlled as described herein.

- When the chilled water system is ON based in the SUMMER mode and the chillers being turned ON, both booster pumps shall be turned ON at minimum speed of 20% (adjustable).
- The pumps speed shall be gradually increased to 100%.
- The pumps speed shall be controlled based on the chilled water valve from the critical Air Handling Unit as follows:

Each booster systems has a list of Air Handling Units served by the booster system.

West Courtyard	P-7A, P-8A	AC-1W, AC-2W, AC-3W

The booster control system shall monitor the position of the chilled water valves of the units assigned to the booster system (from the table above). The critical AHU chilled water position is the maximum of all the CHW valve positions from the list.

- When the critical CHW valve position is below 90% (adjustable), the booster pump speed shall be decreased at a rate of 1% every 1 minute (adjustable);
- When the critical CHW valve position is above 95% (adjustable), the booster pump speed shall be increased at a rate of 1% every 1 minute (adjustable);
- When the critical CHW valve position is between 90% (adjustable) and 95% (adjustable), the booster pump speed shall remain constant.
- When the two (2) booster pump speed decrease to 25% (adjustable), the lag pump shall be turned OFF and only one booster pump shall be controlled to maintain the critical CHW valve position.
- When one booster pump speed is at 85% (adjustable), the second booster pump shall be started and two (2) booster pump speed shall be controlled to maintain the critical CHW valve position.
- When the system operates with one pump at the minimum speed 25% (adjustable) and the by-pass pressure differential is above the setpoint, the bypass shall start opening to maintain the by-pass pressure differential setpoint at 2 PSI (adjustable)

Pump 24D and 25D are sensor-less technology and they are controlled from the BMS. All the info from BACNET shall be available.

Building D, 4th floor	P-24D, P-25D	AC-5D

- When the AC-5D CHW valve position is below 90% (adjustable), the booster pump speed shall be decreased at a rate of 1% every 1 minute (adjustable);
- When the AC-5D CHW valve position is above 95% (adjustable), the booster pump speed shall be increased at a rate of 1% every 1 minute (adjustable);
- When the AC-5D CHW valve position is between 90% (adjustable) and 95% (adjustable), the booster pump speed shall remain constant.
- When the two (2) booster pump speed decrease to 25% (adjustable), the lag pump shall be turned OFF and only one booster pump shall be controlled to maintain the AC-5D CHW valve position.
- When one booster pump speed is at 85% (adjustable), the second booster pump shall be started and two (2) booster pump speed shall be controlled to maintain the critical CHW valve position.
- When the AC-5D CHW valve position is below 5%, the booster pump shall be turned OFF.
- When the AC-5D CHW valve position is above 20%, one booster pump shall be turned ON.

C. Where multiple pumps are provided, the BMS shall provide lead lag control of the pumps. Each pump shall be alternated as the lead pump so as to equalize operating time of the pump. If the "lead" pump fails, the "lag" pump shall automatically start and BMS will get alarm.

3.14 ADJUSTING AND INSTRUCTIONS

A. The BMS/ATC sub-contractor shall train the Owners operating personnel for a minimum of the number of days indicated in Section 01 31 46 with personal on-the-job instruction provided by a competent Engineer or technician representing the contractor. This instruction shall be at a time to be selected by the Owner and is the minimum requirement. Where additional training time is specified elsewhere in this specification, that time shall be in addition to the above requirements.

B. The operators shall be trained in the operation and preventative maintenance of the entire system. The operators shall be trained to recognize malfunctions of the control system by head-end observations printed copy, visual and audible signals and by noting building conditions (head-end or field panel reading, actual equipment performance). The operators shall be thoroughly familiarized with all software and specific programs regarding this project.

C. Four sets of each of the following are to be provided.

D. Written operating and preventive and system maintenance instructions.

E. Specific data sheets and maintenance schedules.

F. Software listing for each point of connection, showing location, function, identification, etc. (two sets only).

G. As-built drawings for all controls and control wiring that include all items required under "Submittals", with one set to laminated and mounted at a location(s) to be chosen by the Owner. Back-up system loading disk for use in programming the head-end and the standalone field panels (one set each).

H. Install Graphics of each control sub-system with all points shown on at least one graphic.

I. Provide testing and system performance trends in accordance with descriptions in submittals.

J. The BMS contractor shall warrant the continuous future availability of service for the system, with servicing to be provided by a factory trained service representative. As part of the warranty agreement (and any subsequent service contract agreements) the Contractor shall, at the discretion of the Owner, provide technical instructions on trouble shooting, maintenance, and servicing this system to the Owner s employees. This instruction shall take place on-site, during routine corrective maintenance visits by the Contractor.

K. REPRODUCIBLE DRAWINGS: The BMS contractor, upon completion of the installation, shall furnish to the Owner (at no additional charge) a complete set of reproducible “as-built” drawings. Reproducible drawings will consist of one set of black line (full-size) and one set installed on disk, AUTOCAD.DWG. Provide a separate set of drawings for each AHU and system.

3.15 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. 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. 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%

3.16 CONTROL SYSTEM DEMONSTRATION

A. Demonstrate the operation of the Control Systems hardware, software, and all related components and systems to the satisfaction of the operating staff. Schedule the demonstration with Owner s representative 2 weeks in advance. Demonstration shall not be scheduled until all hardware and software submittals is approved.

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. 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 work stations, as specified.

F. Demonstrate that remote communication abilities are in accordance with these Specifications.

G. Demonstrate correct calibration of input/output devices.

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. Demonstrate that access is sufficient to perform required maintenance.

N. Control System Demonstration shall be completed and approved prior to Substantial Completion.

3.17 ON SITE CONTROL SYSTEM OPERATOR TRAINING

A. Provide services of controls contractor s qualified technical personnel for the amount of days and hours indicated in Section 01 31 46 to instruct Owner's personnel in general operation and maintenance of the control systems.

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 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. Brief walk-through of the building, including identification of all controlled equipment and systems and condensed demonstration of Digital System Controller (DSC) capabilities.
2. 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.
3. DSC programming
4. Review 9 sequences of operation and how it is accomplished by DSC programming.
5. Fail modes and procedures to take in the event of a power failure.
6. Standalone modes and procedures to take in the event of various communication failures.
7. Demonstration of set-point optimization and fine-tuning concepts.
8. Demonstration of DSC features, diagnostics, program upload / download.
9. Demonstration of I/O hardware testing, calibration, and replacement.
10. Demonstration of all remaining miscellaneous workstation features.
11. Graphic workstation screens.
12. Review of Owner selected topics.
13. Question and answer period.

3.18 ATC/BMS ACCEPTANCE PERIOD

A. After approval of the ATC/BMS Demonstration and prior to Contract Close Out, the BMS 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/BMS 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 BMS. 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, 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.

3.19 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/BMS 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

3.20 ATC/BMS OPPOSITE SEASON ACCEPTANCE PERIOD

A. During the warranty period, but not later than 6 months from completion of the Acceptance Period, BMS 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. Warranty period shall start when all work is complete and accepted by the Owner.

END OF SECTION 23 09 00

SECTION 23 09 01

BUILDING AUTOMATION SYSTEM

PART 1 - GENERAL

1.01 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.

C. The work of this section shall be integrated with the existing BMS provided by Advantex Solutions. Please contact Giovanni Natale from Advantex Solutions Inc. Contact Information: P-718-278-2290; C-917-682-2521; Email - GNatale@Advantexsolutions.com).

1.02 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. The graphics for the new AC units installed under this projects shall be completed by the ADVANTEX Solutions under this contract and integrated into the existing BMS system.

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 expansion of the automation system necessitates greater computer processing power, it shall be possible to transfer all existing software and data base, both vendor supplied and user-defined, to a new more powerful computer.

G. Systems which require the existing user-defined data base 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.

K. 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. The source of emergency 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 Emergency Power Distribution Panel(s).

1.03 QUALITY ASSURANCE

A. Only firms regularly engaged in 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 system produced and installed by the manufacturers, which are listed in Section 23 05 12 "General Provisions for HVAC Work".

E. Provide equipment which performance, under specified conditions, is certified by the manufacturer.

1.04 SUBMITTALS

A. Refer to Section 01 31 46 - Special Requirements for Mechanical and Electrical work and submit shop drawings.

1.05 COORDINATE

A. Refer to Section 01 31 46 - Special Requirements for Mechanical and Electrical Work.

1.06 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

2.01 TRANSMISSION NETWORK

A. Distributed Communication Processor
1. The system shall use an intelligent Distributed Communication Processor (DCP). This processor shall be microprocessor based and shall interface with Central Processing Unit and Remote Processing 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 Processing Units.
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 transmission network shall utilize a twisted shielded pair. The transmission speed shall be a minimum of 1200 baud and operate in a half-duplex mode.
4. The system shall support multiple multidrop trunks. Each multi-drop trunk shall support a minimum of 20 Remote Processing Units.
5. 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 EIA interfaces. With the addition of modems, the multidrop trunk shall interface to unconditioned voiceband 3002 telephone lines for remote building tie-into the automation system.
6. Transmission technique shall allow trunk cable to be installed in conduit with other system signals as well as switched 120 VAC or 240 VAC.

2.02 FIELD HARDWARE

A. Remote Processing Units
1. The system shall utilize intelligent distributed Remote Processing Units (RPU's to interface sensors being monitored and equipment being controlled by the automation system. Each RPU shall be microprocessor based and perform the following functions:
   a. Acquire, process and transfer information to the CPU.
   b. Accept, process and execute commands from the CPU or other input devices.
   c. Record evaluate and report changes of state and/or value that occur among points associated with the RPU.
2. Each RPU shall use multi-point function cards to carry out the control and monitoring functions as specified in the point list. For each RPU location, electronics shall be provided for at least 12 spare points.
3. Each RPU shall perform continuous diagnostics, and any malfunction shall be annunciated at the operator's console as well as visually indicated at the RPU.
4. Failure of any RPU on the system shall not affect the proper operation of the CPU and other RPU's.
5. The system shall be capable of phased startup. That is any RPU shall be capable of properly communicating with the CPU while remaining RPU's are being installed.
6. Surge transient protection shall be provided in each RPU for the purpose of suppressing induced voltage transients.

7. Each RPU shall contain a function card cage and backplane which can accommodate up to 128 points. Each RPU shall contain a power supply sized to drive the function cards, interface relays and sensors for the maximum allowable points.
8. Any RPU which used volatile memory shall have a minimum of four-hour uninterruptible battery backup unless the automation system has an automatic down loading capability.
9. If the CPU or transmission network fails but power to the RPU does not, the RPU shall continue to monitor all changes of state and/or value and shall retain the most recent values. The RPU shall also maintain all analog set points and command positions.
10. RPU's shall have all metal cabinets. Each RPU including cabinet, power supply, function cards and termination modules shall be approved by U.L. Each RPU shall have a pin-hinged door and master keyed lock. RPU's shall be capable of proper operation in an ambient environment of 32 deg F to 120 deg F and 10% to 90% RH.

B. Function Cards/Termination Modules
1. Each RPU shall be capable of accepting at least 8 multi-point function cards. It shall be possible to insert any function card into any of the available card slots. There shall be four types of function cards corresponding to industry nomenclature. They are:
   a. Digital In for monitoring status, alarms and accumulating pulses.
   b. Digital Out for commanding two and three state devices.
   c. Analog Out for positioning set points.
2. Each function card shall be microprocessor based with sufficient memory to retain characterization data for its associated points.
3. Characterization of point data shall be accomplished on-line at the operators console. The operator shall be able to individually characterize points on each function card through a procedure whereby the operator down-line loads the specific point parameters from the CPU through the operator's keypad to the RPU. This downline loading shall also occur automatically after a power outage to a RPU.
4. Function cards that require foil path cuts, jumpers, or similar physical modifications to customize them for particular applications will not be acceptable.
5. To reduce downtime, each function card shall have a built-in self-test diagnostic and be able to visually indicate its operational status at the RPU as well as failure annunciation at the operator's console.
6. The failure of any one function card shall not deter the reporting or command capability of other function cards in the same of other RPU's.
7. Each function card shall have an associated termination module where the field wiring or tubing shall be connected. All termination modules shall have plug connectors interfacing them to their respective function cards through the card cage backplane.
8. Any termination modules requiring on-site hardwire interconnection to their function cards shall not be acceptable.
9. Digital input signals shall be terminated through plug-in isolation relays. These shall be form "C" type relays, located in the RPU.
10. Analog input signals shall be terminated on screw type terminals. Each analog input shall have the capability to accept 2 or 4 wire inputs.
11. Digital output signals shall be accomplished through plug-in form "C" relays, located in the RPU.
12. Analog output signals shall be accomplished through □" pneumatic tubing fittings.

C. Sensors
1. All analog sensors shall utilize industry standard 4-20 milliamp signals to facilitate owner expansion. Sensors based on proprietary equipment shall not be acceptable.

2. All analog signals shall be converted for digital transmission to the CPU at the function card.
3. All sensoring wiring whether it be analog or digital, input or output, shall be capable of sharing single conduit runs without affecting signal performance. All signal wiring shall also be capable of sharing single conduit runs with switched AC of 120 VAC or 240 VAC.

2.03 SOFTWARE

A. The Automation System Subcontractor shall provide all software required for efficient operation of all the automation system functions required by this Specification. Software shall be modular in design for flexibility in expansion or revision of the system.

B. The software shall include a computer-vendor supplied and supported, unmodified real-time disk operating system. Systems which use an operating system which has been modified or is proprietary to the Automation System Subcontractor shall not be acceptable. The Automation System Subcontractor shall supply all the building automation system software. The building automation system software shall be written in high level language such as FORTRAN IV or Pascal.

2.04 REAL-TIME OPERATING SYSTEM

A. The operating system shall be a general-purpose real-time operating system and shall provide the following features of their equivalent:
1. Program Control: The real-time operating system executive shall control the timing and sequencing of all programs.
2. Multiple Tasking Capability: Multiple Tasking Capability shall be provided to allow the operating system and real-time control programs to run concurrently with the programs assembling or compiling, debugging, loading or executing.
3. Memory Protection: The operating systems shall manage a scheme of storage protection which shall enable assembling, compiling, debugging and execution of programs without direct effect on the real-time programs.
4. Real-Time Clock Routine: The real-time clock routine shall maintain the current date and 24-hour clock time resolved to the nearest second. The real-time clock shall control or be used as reference for time-initiated command signals and printouts and shall be easily resettable by the operator from the operator's console.
5. Input/Output Control: The operating system shall include routines to coordinate all input/output functions of the computer system.
6. Disk File Input/Output: The operating system shall provide routines for disk file input/output including routines to perform the following:
   a. Open file for input and/or output of data.
   b. Input from or output to a disk file sequentially.
   c. Input from or output to a disk file a; record at a time in random order.
7. Powerfail and Automatic Restart: A powerfail routine shall provide an orderly shutdown of the automation system when the power failure to the computer is detected, and which shall automatically restart the automation system when power is restored.
8. Programming Support Capabilities: The operating system shall be capable of supporting the following programs for user program development, compiling, loading and executing.
   a. Fortran Compiler: Compile the source language into machine language object code that can be loaded and executed directly into the instruction set of the CPU. This compiler shall be directly compatible with FORTRAN IV.

b. Assembler Program: This program accepts and translates symbolic instructions into machine instructions. The assembler also generates object code.
c. Source Editor: This program allows an operator to edit source programs in assembler and Fortran languages as well as other ASCII text data.
d. Loader Program: This program combines relocatable object modules produced by the assembler and the Fortran compiler into an executable program.
e. Disk Utility Program: Routines for manipulating program and data files stored on the disk including the following shall be available:
   1) Creating new files.
   2) Deleting old files.
   3) Copying files.
   4) Creating file directories.
f. Memory Dump and Modify Program: Provides the capability to modify or dump the contents of selected locations in main memory.
g. Debug Program: This program aids in the debugging of assembler and FORTRAN programs.
h. System Generation Provides the capability for reconfiguring the software system to accommodate new software or hardware functions.
i. System Save and Restore: Provides the capability to save and restore a copy of the software programs and the system data base to facilitate reloading.
j. Diagnostic Software: Diagnostic software provides the capability to test the computer memory and peripherals.

2.05 BUILDING AUTOMATION SYSTEM SOFTWARE

A. The building automation system software shall be provided in four categories which are defined as:
   1. Operator access to system data base.
   2. User control over system configuration.
   3. Facility monitoring functions.
   4. Energy management control functions.

B. Each category of software shall consist of interactive software modules written in FORTRAN IV. Each module shall have an associated priority level and shall execute as determined by the program controller as defined in the real-time operating system.

C. Systems with software written in other than Fortran IV shall be provided with a cross-compiler to FORTRAN IV.

D. Operator Access to System Data Base:
   1. Operator/System Communication: The building automation system shall use English language for each point identification. This shall be full English words with the option to abbreviate at the users discretion. To facilitate different building operators, the system shall accept multiple English language identifiers as well as foreign language identifiers for each point on the system. These shall be known as "User Names". For example:
      ADMINISTRATION BUILDING AHU 1
      SUPPLY FAN 1
      AIR HANDLING UNIT 1
      shall all identify the same desired point. In addition, system formatting shall be provided which shall allow for software grouping of related points.
   2. Input Format:

a. Allowable operators as defined under operator access shall be able to control system functions by their inputs at appropriate operator terminals.
b. The system shall recognize all inputs as functions or commands to be performed. The system's handling of operator inputs such as requests to start a motor, output a log, change a time program, acknowledge an alarm, or do any of the other commands described in this specification, shall be in a similar format.
c. All operator interaction with the automation system shall be performed as follows: The operator entry shall begin with the commands he desires the system to perform, followed by the username and any data, such as limit values, program times, etc. Manual commands such as start, stop, log, etc. have no data values associated. Example: COMMAND ON AHU 1.
d. Upon entry of a command to the point or points desired as described above, the system shall, before performing any command, respond with an echo of the request on the device (Cathode Ray Tube or keyboard printer) being used. This echo feedback shall include the command requested, the username and any entered data.
e. Should an operator make an error in entry, the system shall output an advisory message detailing the nature of the error. Advisory messages shall be in full English with a unique advisory for each type of operator input error. Typical operator error advisories might be:
    1) System input format is incorrect.
    2) Invalid command entered.
    3) Analog limit is outside specified range.
    4) Point does not respond to the command entered, such as a "start" command to a temperature sensor.
    5) Operator's entry did not contain sufficient information.
    6) Invalid operator password.

3. Output Format:
a. The system shall operate on a System Format basis, regardless of the manner of hardware configuration in which data is required. A system of points shall consist of a logical grouping of data points related to a piece of mechanical equipment, an energy distribution system, or an architectural area. For example, in some cases it may be desired to display a space temperature with its associated air handling unit, and in other cases to display all space temperatures on a floor or in a building as a single system. The Automation System shall allow such determinations to the made without regard to a point or group of points physical hardware locations(s). Likewise, the system shall accommodate future changes of system groupings and operations without field hardware changes whatsoever.
b. All output displays and logs shall contain a header line indicating the following information:
    1) time
    2) console identifier
    3) date
    4) initials of on-duty operator
    5) day
    6) owner definable information

Example:
12:45 06/23/83 FRI MASTER CONSOLE SMD 76EF 42% RH

c. All output displays or logs of a system point or group of points shall contain as a minimum the following information:
    1) username of point
    2) associated engineering units

3) point descriptor
4) alarm descriptor
5) current value/status

Example:
EAST MECHANICAL ROOM AHU SUPPLY TEMP 85EF

d. User names, point descriptors, and engineering units shall be operator definable on a per point basis. Systems which use fixed vendor-supplied look up tables shall not be acceptable.

4. Split Screen Formatting:
   a. To further simplify operator interpretation of displayed data, the display software shall divide the operator's video display into at least 5 areas. The 5 areas shall be defined as:
      1) Time Line - continuous display of time, date, day, console identifier, operator's initials and other owner-defined data.
      2) Operator Command Line - accept operator English work commands.
      3) System Response Line - acknowledgement of commands carried out or operator error advisories.
      4) Data Display Area - display the current value of a point or group of points.
      5) Alarm Area - Reserved for the display of critical alarm reporting.
   b. It shall be possible for the above defined areas to display independently of and concurrently with each other.
5. Operator Access Restriction:
   a. Operator access to the automation system shall be via user-defined passwords providing at least five access levels.
   b. Each operator shall gain access to the system by entering a unique name and password combination.
   c. Properly signing-on by an operator shall produce a hard copy report indicating the name of the operator, time, and date that operator has signed on.
   d. Invalid operator attempts to enter the system shall also produce a hard copy report as defined above and additionally indicate the nature of the unsuccessful sign-on.
   e. To return the system to a secured mode, the operator shall sign off the system.
   f. Signing off the system shall also produce a hard copy report of the operator's name, time and date.
   g. The automation system shall automatically sign off an operator should that operator not sign off after a specified period of time.
   h. In addition to producing hard copy reports of valid or invalid sign-on and sign-off attempts, the automation system shall store in nonvolatile memory a historical record for a minimum of 30 system entries, valid and invalid. This information shall only be available to the operator with the highest access level.
   i. All information pertaining to operator access shall be user-defined while the system is on-line and fully operational.
   j. Typical operator access levels are:
      1) LEVEL 0 - Normal operator functions such as log and display request, alarm acknowledgement.
      2) LEVEL 1 - All Level O functions plus analog limit changes, point lockouts and comment functions.
      3) LEVEL 2 - All lower level functions plus modification to calculations and system messages.
      4) LEVEL 3 - All lower level functions plus changes to point descriptors, user names.

5) LEVEL 4 - All lower level functions plus access to add, modify or delete any and all user-defined parameters and access levels.

k. It shall be possible for the user to define the distinctions between various access levels.

l. Systems that utilize fixed vendor defined operator access levels shall not be acceptable.

6. Dynamic Color Graphics: The automation system shall include a software program allowing an operator to create, modify or delete dynamic color graphics on-line.

a. Generation of Graphics:

1) Through the use of a high level English language, an operator shall be able to create, modify or delete dynamic color graphics while the automation system is on-line and fully operational.

2) A complete set of standard symbols and building systems shall be stored in the computer system memory to aid in creating graphic displays.

3) Each system, symbol or graphic character shall be able to display in any one of the eight colors.

4) Each system, symbol or graphic character shall be able to display in variable size.

5) A mechanism shall be provided for copying graphics of similar requirements. Example: Dual-duct air handling system (2-thus). After the first graphic is created, a one-line input shall make an identical copy.

b. Dynamic Data Display:

1) Dynamic data shall be located for display at any location on the CRT screen. Each graphic shall be able to accommodate any combination of dynamic (analog or binary) information, graphic symbols and text displayed on the entire screen. The number of dynamic points being displayed and updated shall be limited only by the area of the CRT screen. A graphic shall be constructed to include any dynamic points regardless of the physical location of these points.

2) Dynamic data shall update automatically without manual initiation at user-defined intervals. Update intervals shall have resolution down to one second.

c. Manual or Automatic Operation:

1) Each graphic shall be manually or automatically displayed.

2) In the manual mode an operator shall display a graphic by inputting the appropriate graphic name.

3) In the automatic code, a graphic shall display as a result of:

a) An alarm occurrence

b) A change of state

c) Specific time, day, or date

d. Dynamic Graphics Capacity: The automation system shall have the capacity to store a minimum of 170 unique dynamic color graphics. Graphics shall be stored on hard disk.

E. User Control Over System Configuration:

1. Data Base Creation and Modification:

a. The intent of this specification is to allow the owner to independently do his own modifications to the system.

b. All changes shall be done utilizing standard procedures and must be capable of being done while the system is on-line and operational.

c. To aid an operator, instructive prompting software shall be provided. An operator shall be required to simply answer to "yes" and "no" type questions as well as provide information such as English user names, desired engineering units, point descriptors, etc.

d. The owner must have the minimum capability to:
   1) Add and delete points.
   2) Modify any point parameter.
   3) Change, add or delete English language descriptors.
   4) Change add or delete engineering units.
   5) Change add or delete points in start/stop programs, trend logs, etc.
   6) Select analog alarm limits.
   7) Characterize each function card to accept different analog inputs, pulsed or steady state digital signals.
   8) Adjust analog differentials.
   9) Create custom relationships between points. A general purpose user language shall be provided, such that the user can implement software interlocks, master/slave relationships, and calculations.

e. The operator shall be able to modify all points within the data base. This modification shall include adding, deleting and modifying required additional or ranges, engineering units, mode of operation, etc. The addition of a new field point may be totally accomplished from the keyboard once the proper field hardware devices are installed, or the change function may modify existing field hardware to serve a new purpose.

f. As points are added to the field, they may be grouped into new system and building displays or they may be substituted for existing points within existing systems or added to existing systems.

2. Multiple Console Support:
   a. The automation system software shall support a minimum of six operator consoles. A console shall be defined as at least one input/output device.
   b. Once the hardware terminal devices are installed, the operator shall be able to modify the system software to accommodate the new or reconfigured devices. This modification shall take place while the system is on-line.
   c. It shall be possible to limit the capabilities of any console on the system.
   d. It shall be possible to further assign on a per point basis the ability to command, display or alarm a point at a specific console.

3. Custom Equations and Point Relationships: The system shall provide a comprehensive processor which allows a user (chief engineer, supervisor, etc.) to develop custom operational sequences, unique control algorithms, interactive point relationships, custom calculations, etc. This capability shall use on-line dynamic system data.
   a. Mathematical and Logical Functions:
      1) The processor shall provide as a minimum the following mathematical operators:
         a) addition, subtraction
         b) multiplication, division
         c) square root, exponentials
         d) linear equations, quadratic equations
      2) The processor shall provide as a minimum the following logical operators:
         a) and, or
         b) equal to, not equal to
         c) less than, greater than

b. System Inputs: Any of the system connected points such as temperature, pressure, humidity, flow rate, start/stop, status and alarm points shall be valid real time inputs. Also, inputs shall include real time, day of week, date, constants and results of other calculations.
c. Result Performance:
   1) As a result of evaluating any combination of mathematical or logical functions and dynamic system data, the automation system shall perform as a minimum system changes such as:
      a) Issuing and off commands
      b) Increasing/decreasing system set points
      c) Initiating logs and displays
      d) Activating/inactivating application programs
      e) Enabling/disabling alarm functions.
d. Processor Implementation:
   1) Operator entries to this comprehensive processor shall be through the operator's terminal in an English language format. A step-by-step interactive prompting routine shall be provided to guide operator entries.
   2) Systems requiring binary, hexadecimal, machine language, or coded numeric input shall not be acceptable.
e. Applications:
   1) The following is a brief list of the types of operational sequences, control algorithms, point relationships and custom calculations required by this comprehensive processor:
      a) If outside air is above 70deg F, close OSA dampers.
      b) If freeze stat is in alarm, start circulating pump.
      c) Start pump one, wait two minutes, start pump two.
      d) Display operator instructions on alarm.
      e) Calculate energy input to monitored equipment.
      f) Calculate BTU output of boiler.
      g) Calculate differential temperature.
      h) Calculate degree days.
      i) Calculate department energy allocation costs.

F. Facility Monitoring Functions:
   1. Report and Logs:
      a. 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.
      b. 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.
      c. 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:
         1) Current value of a discharge temperature in a particular air handler.
         2) Current value of all discharge temperatures in a specific building.
         3) Current value of all discharge temperatures in a multi-building complex.
      d. As a minimum, the following report categories shall be provided:
         1) Summaries
         2) Access Reports

3) Historical Trends
4) Data Base Management Reports
5) Profile Reports
6) System Diagnostic Report
7) Totalization Logs
8) Energy Management

2. Summaries:
   a. All Point
      1) A summary shall be provided detailing the current values of any and all points associated with the automation system.
   b. Building or System or Custom Group
      1) A summary shall be provided detailing the current values of any and all points within a building or system as detailed by the Owner.
   c. Motor Status
      1) 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.
   d. Alarm
      1) A summary shall be provided to detail the status of any and all the points currently in alarm.
   e. Alarm Limit
      1) 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.
   f. CPA Set Point
      1) A summary shall be provided detailing the set point for any and all CPA points supported by the system.
   g. Point Lockout
      1) A summary shall be provided of the most recent status of any and all locked out (disabled for alarm reporting) points by the system or operator.
   h. Message
      1) A summary shall be provided detailing the contents of any and all messages within the system.
   i. Graphics
      1) A summary shall be provided detailing the instruction listings for any and all dynamic color graphics.
3. 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.

4. Totalization Logs
   a. A log shall be provided including any and all points as defined in the point list. Log shall include username(s)and associated totalized values.
5. Access Reports
   a. Access Level Assignments
      1) 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.
   b. System Entry

1) 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.

6. Data Base Management Report
   a. A report shall be provided including a report of the current system data base.
7. System Diagnostic Report
   a. 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.
8. Energy Management Reports
   a. A report shall be provided for each application program as detailed in the appropriate section of this specification.
9. Alarm Processing
   a. The automation system shall have the following alarm processing features, all of which shall be owner defined through the input keyboard.
      1) Alarm Reporting
   b. Each alarm as determined by the system shall cause the following information to be logged:
      1) Current time, date and initials of on-duty operator.
      2) User name assigned to point.
      3) Point descriptor.
      4) Current value or status.
      5) Appropriate engineering units.
      6) Alarm designator -nature of alarm - high or low.
      7) Operator instructive message.
   c. 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 by the operator while the system is online and fully operational.
   d. The operator shall have the ability to direct the alarm report and message to any output device on the system.
   e. Any point which goes into alarm and has a graphic display associated with that point shall automatically display that graphic for operator review.
   f. An operator shall be able to define any alarm as being critical or non-critical.
   g. All critical alarms shall be displayed in a separate area of the operator's terminal.
   h. In the event of multiple alarms, all alarms shall be buffered according to priority until displayed or printed.
   i. All operator acknowledgement 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.
10. Analog Limits
    a. 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.
    b. Each high and low limit shall have an associated user defined limit differential to prevent nuisance alarms caused from floating about the alarm limit.
    c. Any analog point shall be disable from alarm reporting if it is associated with a previously defined master point which is turned off.
11. Binary Alarms
    a. Each binary point detected as being in alarm shall report as previously defined in alarm reporting.

b. 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.

12. Analog/Binary Totalization
    a. The automation system software shall support both analog and binary totalization.
    b. The operator shall be able to:
        1) enable to disable individual points from totalizing.
        2) assign upper limits for each point enabled for totalization.
        3) reset a totalized value.
13. Display the current value of an individual point, group of points of all system points.
14. Reporting: Any point's current value exceeding its assigned upper limit shall report as a totalized alarm point.
15. Analog Points: It shall be possible to totalize analog values with appropriate engineering units such as kilowatt hours, gallons, pounds, liters, etc.
16. Binary Points: It shall be possible to totalize the accumulated:
    a. Run time in hours or minutes
    b. Contact status in hours or minutes
       (Example: magnetic contact switch indicates a door open for 45 minutes).

G. 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.

H. Preventive Maintenance Work Orders:
1. The system shall provide preventive maintenance instructive work orders which can be displayed manually or automatically.
2. The operator shall have the capability to create, modify and delete work orders while the system is on-line and fully operational.
3. Operator entries shall be through the operator's keyboard and all entries shall be in English language.
4. A report shall be provided to display or log the contents of any and all work orders in the system.
    a. Capacity:
        1) The system shall have the capacity to store on-line a minimum of 750 operator defined work orders.
        2) Each work order shall have a capacity of not less than 256 characters.
        3) A mechanism shall be provided which allows for lengthy work orders by linking more than one together.
    b. Display:
        1) Work orders shall manually or automatically be displayed on a specified CRT or printed on a specified printer.

2) Manual - The operator shall be able to display or print any and all maintenance work orders by requesting the same.
3) Automatically - The system shall have the capability of displaying or printing maintenance work orders on the following occurrences:
   a) A designated point exceeding a specified run time limit.
   b) A specific time, day or date.
   c) Any combination of time, day and date.
   d) A designated point having gone into "ALARM".

I. Powerfail/Automatic System Restart:
1. Power failures affecting the Central Processing Unit (CPU) shall cause the CPU to go into an orderly shutdown with no less of memory under any circumstances.
2. Upon resumption of power to the CPU, the system shall automatically restart the print-out the time and date of the power failure.
3. The restart program shall automatically restart affected field equipment. Restart shall be of a static nature (restart of operator pre-assigned equipment) or an appropriate state restart (places the building equipment in the proper operational state as of the time of return to commercial power.) The nature of the restart program shall be user-definable.

PART 3 - EXECUTION

3.01 INSPECTION

A. 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 work until unsatisfactory conditions have been corrected.

3.02 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.

3.03 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 an 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 09 93

CONTROLS AND INSTRUMENTATION

PART 1 - GENERAL

1.01 WORK INCLUDED

A. The Control Contractor shall furnish and install a complete Building Automation System including all equipment, accessories, wiring and instrument piping, air compressors, control devices and components required for a complete and functioning system.

B. All materials and equipment used shall be standard components, regularly manufactured for this and/or other systems and shall not be custom designed especially for this project. All components shall have been thoroughly tested and proven in actual use.

C. The building control system shall possess a fully modular architecture, permitting expansion through the addition of more stand-alone control units, sensors, actuators, and/or operator terminals.

D. The equipment, components, and accessories used should be suitable for environment as well as operating condition.

E. The manufacturer's wiring diagram shall identify and color code all internal and external wires.

F. Control equipment, valves, panels, and dampers shall bear the manufacturer's name plate.

1.02 RELATED WORK

A. Work of this section shall comply with the requirements of the Contract Conditions (General and Supplementary), with sections of Division 1 - General Requirements, with the drawings, and all other Contract Documents.

B. Section 01 31 46 - Special Requirements for Mechanical and Electrical Work.

1.03 REFERENCES

A. NFPA 70, NFPA 90A - National Fire Protection Association

B. SMACNA - Low Pressure Duct Work

C. ASHRAE 15

D. ANSI B31.1; ANSI B31.5; ANSI B31.9; ANSI C12

1.04 SUBMITTALS

The Contractor shall submit the following to the Architect/Engineers for approval:

A. Submittals/Drawings

1. The Control Contractor shall submit prior to installation a set of installation drawings and control strategies for review by the consultant and/or owner's representative. These drawings shall include the physical location of building control system equipment and system architecture. The complete sequence of operation of the control system shall be provided.
2. Upon completion of the installation and final system adjustment, the Control Contractor shall provide a full set of as-built drawings of the installation and the control strategies.

B. Manufacturer's Data
1. Dampers, valves, and operators
2. Controllers, including complete wiring and connection diagrams
3. Temperature sensors, including complete wiring and connection diagrams
4. Temperature and pressure indicators
5. Switches, relays, transducers, including complete wiring and connection diagrams
6. Control Panels

1.05 QUALITY ASSURANCE

A. The Control System Contractor shall provide a list of no less than ten similar projects which have building control systems as specified. These projects must be on-line and functional such that the Owner's representative would observe a direct digital control system in full operation.

B. The control system shall be installed complete in all respects by competent mechanics, regularly employed by the manufacturer of the control system.

C. Bids by Wholesalers, Contractors, Franchised Dealers or any firm whose principal business is not that of manufacturing and installing automatic temperature control systems shall not be acceptable.

D. Single source responsibility of supplier shall be the complete installation and proper operation of the BAS and control system, and shall include debugging and calibration of each component in the entire system.

E. All electronic equipment shall conform to the requirements of FCC regulation Part 15, Section 15, governing radio frequency electromagnetic interference and be so labeled.

F. All system components are to be designed, built, and installed to be fault tolerant as follows:
1. Satisfactory operation without damage at 110% above and 85% below rated voltage and at $\pm$3 hertz variation in line frequency.
2. Static, transient, and short circuit protection on all inputs and outputs.
3. Communications lines protected against incorrect wiring, static transients, and induced magnetic interference.
4. All real time clocks and data file RAM shall be battery backed for a minimum of 72 hours in the host, and 8 hours in the SAC panels.
5. Bus connected devices to be AC coupled or equivalent so that any single device failure will not disrupt or halt bus communication.

G. All pressure piping, valves, and accessories should be hydraulically/pneumatically tested to 1.5 times the operating pressure.

H. Performance test should be carried out for all instruments, control equipment, and accessories as required.

I. Factory performance test results should be submitted with the equipment drawings.

1.06 SYSTEM TURN-OVER AND SERVICE

A. Upon completion of the installation, the Control System Contractor shall start up the system and perform all necessary testing and run diagnostics to ensure proper operation. 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. The acceptance test shall consist of verifying the ability of the SAC panels to communicate with each other, communicate with the central system (located in the power plant), verifying calibration of each sensor and/or transmitter, verifying the operation of each control point and verifying the operation of the control algorithms. The contractor shall provide all equipment and support to demonstrate these items.

1.07 TRAINING/OWNER'S INSTRUCTION

A. The Control System Contractor shall provide two copies of an operator's manual describing all operating and routine maintenance service procedures to be used with the system. The Control Contractor 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 40 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.

1.08 WARRANTY

A. The building control system, including all hardware, software components and end devices shall be warranted for a period of one (1) year following the date of beneficial use. Any manufacturing defects arising during this period shall be corrected without cost to the owner.

1.09 APPROVED MANUFACTURERS

A. Distech Controls

PART 2 - PRODUCTS

2.01 BUILDING CONTROL SYSTEM

A. Automatic Temperature Control Valves
1. Except as noted otherwise, provide minimum ANSI Class 125, cast iron (for steel piping systems) valves installed with stems horizontal or above. Valves for MTHW service shall be ANSI class 300 cast steel valves suitable for operation at 350 F. Valves shall have flanged end connections, except valves smaller than 2.5 inches may be threaded end connections with a union on all but one side of the valve. Cast iron components shall conform to ASTM A 126, Class B or C.

2. All valves shall be caged, guided and provided with equal percentage modulating plugs, stainless steel trim for MTHW and renewable composition disc especially compounded for hot, or cold water service to assure tight seating and operators equipped with molded rubber diaphragm. Three-way valves shall be equipped with modulating type plug assemblies, and shall have one seat machined integral with the body and the other three-way valve end. Pilot positioners shall be furnished as designed for all valves to obtain sequence of operation. Unless otherwise noted, valves shall be sized as required to guarantee sufficient size to meet the heating or cooling requirements with specified pressure drops. Water valves shall be sized for 5 psi pressure drop or as noted.

B. Automatic Dampers, Smoke Dampers, And Combination Smoke/Fire Dampers

1. Automatic dampers, smoke control dampers and combination smoke/fire dampers shall be furnished by the control manufacturer and shall be set in place by the contractor for Heating, Ventilating and Air Conditioning Work under the supervision of the control manufacturer. HVAC contractor shall supply damper dimensions to the control manufacturer and shall be responsible for the damper sizing. Is shall be this contractor's responsibility to provide installation instructions for combination fire/smoke dampers to ensure compliance with U.L. 555 and NFPA 90A. All sleeves for combination fire/smoke dampers by sheet-metal contractor. This contractor to co-ordinate actuator mounting and location to accommodate sleeves.
2. Temperature control dampers shall have 16-gauge galvanized frames of not less than 5" 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 6" wide. Linkage and hardware shall be zinc plated steel concealed in the frame. Damper blades and rods shall be installed in horizontal position.
3. 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.
4. 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 stainless steel sleeve type. All dampers shall be provided with continuous silicone rubber gasketing at interlocking blade edges to form an airtight seal. Provide flexible metal, compression type stainless steel jamb seals.
5. Round dampers shall be of the butterfly type consisting of a circular blade mounted to a shaft. Inside frame surface shall be clean and smooth with no blade stops or similar inward projections.
6. Frames shall include rolled stiffener beads to allow easy sealing of spiral ductwork joints. Dampers shall include a firm, closed-cell neoprene seal sandwiched between two blades. Leakage through the damper in the closed position shall not exceed .15 SCFM per inch of blade circumference at a pressure differential of 4" w.g. Leakage through the bearings shall be less than □" cfm at 4" static pressure. Damper frame and blade shall be fabricated from galvanized steel. All parts not protected shall be given one coat of aluminum paint.
7. All rectangular dampers shall be constructed to provide a maximum leakage of 5.8 cfm/sq. ft. with an approach velocity of 1,500 fpm flow when closed against 4 inches of water, based upon 24" wide damper. Submit leakage and flow characteristic data for all dampers, and indicate that dampers are AMCA certified.
8. All outside air dampers shall automatically return to closed position in the event of loss of electricity or air.
9. All smoke dampers shall be U.L. labeled under latest edition U.L. 555S requirements low leakage rated at 450^{o} F., 10 CFM/Ft.^{2} at 1" W.C. after test. The damper shall further meet all the requirements for smoke dampers per the 1989 edition of NFPA 90A. Combination smoke/fire dampers shall also meet latest edition U.L. 555 Classification and labeling as

an 1-1/2 hour re-openable fire damper. Provide these dampers with a 212° F. fusible link component which melts in fire conditions and permits the damper to close and latch. All combination dampers must be approved for installation in NYC and have B.S. and A. approval.

C. Automatic, Smoke and Combination Smoke/Fire Damper Operators
1. Damper operators shall be of the piston type, with reinforced synthetic rubber diaphragm, and with bracket arrangement for location outside the airstream wherever possible. All damper operators shall be of sufficient size and number to operate their respective dampers smoothly against friction and air flow. Damper operators shall have external adjustable stops to limit the stroke in either direction if required for proper operation. Smoke damper at unit, outside air, return air and relief air dampers for systems in excess of 2,000 CFM shall close, when fan is off. Smoke damper shall have 30 second delay in closing and 20 second rapid start. All smoke and combination fire/smoke damper operators shall be U.L. listed, (rated at 350° F.) as part of the smoke/fire damper assembly.

D. Freeze Protection Ductstats
1. An electric freeze protection ductstat with 20 feet low temperature sensing capillary and with manual reset shall be located across the entering face of each cooling coil or bank of coils in the air conditioning units or in the discharge of each heating coil in the heating and ventilating units, which shall, on a fall in temperature below 35°F., shut down its respective supply fan and close the outdoor air damper. Case of instrument shall be located outside of supply unit, within 10 feet of supply fan motor. Provide alarm indication at the SAC panel.
2. For systems with return air fans, on fan shut down, the return fan shall continue running or shall start, if not running.

E. Fire Protection Ductstats
1. A manual reset fire protection ductstat shall be provided in the air discharge to each exhaust air fan, 2,000 CFM or larger and at the fan discharge of supply units 2000 cfm or lower within 10 feet of fan motor to stop the fan and its respective supply fan (where appropriate) whenever the temperature exceeds 125°F. Provide alarm indication at SAC panel.

F. Switches
1. Positioning switches shall deliver air gradually to air operated equipment. They shall be relay instruments. An exhaust vent shall be provided to prevent trapping air in the line between switch and instrument when branch pressure is reduced. Operation of the switch shall be manual on the local panel, and a pointer shall indicate switch position.
2. Pressure-electric switches shall have a minimum differential setting of 1 psi when activated by a proportioning signal.

G. Air Gauges
1. Air pressure indicating gauges of at least two inches in diameter shall be furnished and installed to indicate the variable control air pressure from each control device.

H. Pressure and Flow Transmitter/Indicator/Recorder and Temperature Sensors, Transducers
1. These instruments shall be furnished per specification to meet rated capacity.
2. These shall be piped up/wired as applicable with mounting frames and clips required for installation.

I. Wiring

1. Provide complete electric wiring for smoke control operation and temperature control apparatus, including wiring to transformer primaries. Circuits operating at 100 volts or less shall be defined as low voltage and shall be run in flexible conduit, or wireways. Provide switches and fuses for the protection and convenient operation of the system. Protect exposed wiring from abuse and damage in an approved manner. Cable shall not be tapped at intermediate points. Wires, whether individual or in cables, shall be color coded or numbered for identification. Cables terminating in screw type terminal strips shall have pressure type connectors. Wire in physical contact with compression screw will not be acceptable.
2. The entire building control system shall be installed by skilled electricians and mechanics, all of whom are properly trained and qualified for this work.
3. Supervision and checkout of the system shall be by local branch engineers and technicians directly employed by the control contractor.
4. All sensor and control wiring to SAC panels shall be twisted shielded No. 18 gauge. All other control wiring shall be minimum No. 14 gauge copper with 600 volt insulation.
5. All electrical work shall comply with the NYC Electrical Code and shall be installed by licensed journeymen electricians. Wiring shall be installed in NYC approved conduit.
6. Provide all conduit and wiring between SAC panels and telephone closet SAC panel.
7. All wiring of EP and PE switches, relays, thermostats and other control items shall be under this contract.
8. Provide all conduit and wiring between SAC panels and fan coil shunt trip breaker panels in electric closets.
9. Provide all conduit and wiring for ceiling mounted fan coil units and fan speed switches, return air thermostats, etc.

2.02 BUILDING CONTROL SYSTEM

A. The building control system specified herein shall be a direct digital distributed control system which can, without additional equipment, 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 digital computer which accomplishes loop control by calculating a control solution for output to a control device.

B. 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 control the sequence of operation within the building.

C. System Architecture

1. The building control system shall consist of a network of independent, stand-alone control (SAC) units. Each stand-alone control unit shall be capable of performing all specified control functions in a completely independent manner. Host based systems shall not be acceptable. Control units shall be capable of being networked for single point programming and for the sharing of point information and control instructions between panels. All operator communication with the system shall be via operator terminal provided as specified hereafter. 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.

D. Stand-Alone Control (SAC) Unit:

1. Each 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 units shall contain the necessary equipment for direct interface to the sensors and actuators connected to it. Provide phone line modem in SAC panel located in main communications closet of each building.
2. Control strategies shall be owner-definable at each control unit, and for all control units in the system from any one operator terminal. Each control unit shall provide the ability to support its own operator terminal if so desired.
3. Each stand-alone control unit shall include its own microcomputer controller, power supply, input-output modules, modem (as needed) termination modules, and battery. The battery shall be self-charging and be capable of supporting all memory within the control unit if the commercial power to the unit is interrupted or lost for a minimum of eight (8) hours.
4. The stand-alone control unit shall be listed by Underwriters Laboratories (UL) against fire and shock hazard as a signal system appliance unit.

E. Sensors/Input Signals
1. Each stand-alone control unit shall be capable of direct interface to sensors and input devices.
2. It shall be possible for each stand-alone control unit to monitor the following types of inputs:
   a. analog inputs
      - 4-20 mA
      - o-10 vDC
      - thermistors
      - RTD's
      - 3-15 psi
   b. digital inputs
      - dry contact closure
      - pulse accumulator

F. Actuators/Output Signals
1. The stand-alone 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 starters, sizes 1 to 4
      - shunt trip panels
   b. analog outputs
      - 3-15 PSI
      - 4-20 mA
      - 0-16 vDC

G. Building Control Functions
1. Each Stand-Alone Control Unit within the Building Control System shall perform both temperature control functions, smoke control functions, and energy management routines as defined by these Specifications.
2. All temperature control functions shall be executed within the stand-alone control unit. Loop control shall be executed via direct digital control algorithms. The user shall be able to customize control strategies and sequences of control, and shall be able to define appropriate control loop algorithms and choose the optimum loop parameters for loop control. Control loops shall support any of the following control modes:

a. Two-position (on-off, slow-fast, etc.)
b. Proportional (P)
c. Proportional, plus integral (PI)
d. Proportional, integral, plus derivative (PID)

3. It shall be possible to fully create, modify or remove control algorithms within a specific stand-alone control unit while it is operating and performing other control functions. Input for these changes may be made directly into the stand-alone control unit or via the network from any other control unit. Each control loop shall be fully user definable in terms of:
   a. sensors/actuators that are part of the control strategy
   b. control mode
   c. gain
   d. control action
   e. sampling time
4. In order to minimize wiring and sensor costs, provide stand-alone control units that are able to share point information such that control sequences or control loops executed at one control unit may receive input signals from sensors connected to other stand-alone control units within the network. If the network communication link fails or the other stand-alone control unit malfunctions, the control loop shall continue to function using the last value received from the stand-alone control units. Provide protocol necessary to allow the panel needing the point information to have a local buffer updated periodically. The need to wait on the network shall be avoided. The buffer to be updated by change of value and on time interval, as required.
5. Each stand-alone control unit shall be capable of performing the following energy management routines as a minimum:
   a. time of day scheduling
   b. start/stop time optimization
   c. peak demand limiting
   d. supply air reset
   e. event initiated programs
6. In addition, the owner shall be able to create customized control strategies based upon arithmetic, Boolean or time delay logic. The arithmetic functions shall permit simple relationships between variables (i.e. +, -, -, x) as well as more complex relationships (i.e. square root, exponential).
7. Each stand-alone control unit shall be capable of performing the following control functions as a minimum:
   a. discharge air control
   b. heating and chilled water coil control
   c. humidity control
   d. equipment start/stop
   e. mechanical equipment control
   f. smoke control functions (as defined in these specifications)
   g. hot water systems control
   h. chilled water systems control
8. The system shall permit the generation of job-specific control strategies that can be activated in any of the following ways:
   a. continuously
   b. at a particular time-of-day
   c. on a predefined date
   d. when a specific measured or controlled variable reads a selected value or state
   e. when a piece of equipment has run for a certain period of time

9. Upon a loss of commercial power to any stand-alone control unit, the other units within the network shall not be affected, and the loss of operation of that unit shall be reported at the designated operator's terminal. All control strategies and energy management routines defined for the stand-alone control unit shall be retained during a power failure via the battery with the unit for a minimum of eight (8) hours. Upon resumption of commercial power, the control unit shall resume full operation without operator intervention. The unit shall also automatically reset its clock such that proper operation of timed sequences is possible without the need for manual reset of the clock.
10. Should a loss of power exceed memory back-up, the building operator shall be able to manually restore all system programs off of memory storage in the Building Engineers Operators Console.

H. Operator Interface
1. 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; diagnosing the system malfunctions and programming of the system. Operator communication shall be through the black and white CRT, hand-held terminal or printer. Any one of these devices shall allow operator communications.
2. The building control system shall permit complete operation of any stand-alone control unit within the network, from any operator terminal within the system.
3. 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.

I. User Programmability
1. All temperature control strategies and energy management routines shall be definable by the operator through the operator's terminal. It shall be possible for the operator to program and modify system functions independently after receiving the training from the control contractor as previously specified. The system shall be provided complete with all equipment and documentation necessary to allow a trained operator to independently perform the functions listed below:
   a. read the value of a measured variable (i.e. temperature)
   b. start or stop equipment
   c. monitor the status of equipment being controlled
   d. read the set point of a control loop
   e. determine the control strategies that have been defined for a specific piece of equipment
   f. generate displays of control strategies
   g. add/delete control loops to the system
   h. add/delete points to the system
   i. create, modify or delete control strategies
   j. assign sensors and/or actuators to a control strategy
   k. tune control loops through the adjustment of control loop parameters
   l. enable or disable control strategies
   m. generate hard copy records of control strategies on a printer
   n. select points to be alarmable and define the alarm state(s)

J. Self-Diagnostic and Alarm Reporting
1. Each stand-alone control unit shall contain self-diagnostics that continuously monitor the proper operations 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.

2. The system shall also allow on-line diagnosis via telephone modem from a remote location.

K. Transmission Network

1. The control system shall include a multi-drop digital transmission network that provides the communication link between all the stand-alone control units, and main campus operators console via modem.
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 transmission network shall utilize a twisted shielded pair. The transmission speed shall be minimum of 4800 baud and operate in a half-duplex mode.
4. The system shall support multi-drop trunks. Each multi-drop trunk shall support a minimum of 32 Remote Units.
5. Each multi-drop trunk shall have an allowable line length of at least 20,000 feet without signal degradation. All multi-drop trunks shall be interfaced to the system via standard EIA interfaces.
6. Transmission techniques shall allow trunk cable to be installed in conduit with other system signals as well as switched to 120 VAC or 240 VAC.
7. Surge protection shall be provided where the transmission cable enters or leaves a building. Electrical noise suppression shall be provided on all control devices (i.e. relays, transducers, etc.)

L. Sensors

1. All analog sensors shall utilize industry standard 4-20 milli-amp signals to facilitate Owner expansion. Sensors based on proprietary equipment shall not be acceptable.
2. All analog signals shall be converted for digital transmission to the CPU at the function card.
3. All sensoring wiring, whether it be analog or digital, input or output, shall be capable of sharing single conduit runs without affecting signal performance. All signal wiring shall also be capable of sharing single conduit runs with switched AC or 120 VAC or 240 VAC.
4. Sensors shall meet the following minimum specifications:
   a. Room Temperature (RTD Type):
      Temperature Monitoring Range .....+20°/+120°F
      Accuracy:
         RTD Element.....∀0.5°F
         Sensor .....∀0.7°F
   b. RTD Duct Sensor (Fan Discharge, and Return Air):
      Temperature Monitor Range .....+20°/120°F
      Accuracy:
         RTD Element.....∀0.5°F
         Sensor .....∀0.7°F
   c. RTD Averaging Type Duct Sensor (Mixed Air, Heating, and Cooling Coil):
      Temperature Monitoring Range .....+20°/+120°F
         Sensor .....∀1.1°F
   d. RTD Immersion Sensor (hot water, chilled water and glycol heating):
      Temperature Monitoring Range
      (LTHW).....+20°/+220°F
      (MTHW).....+100°/+400°F
      Accuracy:

RTD Element.....∀0.5°F
Sensor.....∀0.9°F

e. Outside Air Temperature (RTD):
Temperature Monitor Range.....-30°/+120°F
Accuracy:
RTD Element.....∀0.5°F
Sensor.....∀1°F

f. Room/Duct/Outside Air Dew Point sensor (High Accuracy) (For Enthalpy Control):
Dew Point Monitoring Range.....-40°/+115°FDP
Accuracy:
Dew Point Element.....∀1.1°FDP
Sensor.....∀1.5°FDP
RH% Range.....12%-99%

g. Room Relative Humidity Sensor (High Accuracy):

h. Humidity Range 0-100%

i. Accuracy:
(Over Full Range of Instrument).....∀2%

j. Sensing Element Crystallite Fibre Strain Gage Beam

k. Companion Transmitter:
RFI Susceptibility.....∀3% of Scale

2.03 SOFTWARE

A. The Control System Subcontractor shall provide all software required for efficient operation of all the control system functions required for this Specification. Software shall be modular in design for flexibility in expansion or revision of the system. Software shall be loaded into the system via a compact "floppy" disk from the operator's terminal. The operator's terminal shall also be capable of copying the system software on a "floppy" disk for archival purposes.

PART 3 - EXECUTION

3.01 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.

3.02 INSTALLATION

A. Install in accordance with manufacturer's written instructions and with recognized 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.

C. All pneumatic piping is to be run concealed in occupied spaces and in other spaces, wherever possible. Where exposed, piping is to be securely fastened at regular intervals, and run in a neat workmanlike manner. Tests on piping are to be made from time to time during the progress of

installation to ensure against leaks. No air lines shall be hidden within duct insulation or supported with wire or tape.

3.03 AIR HANDLING UNITS (AHU-1W, AHU-2W, AHU-3W)

A. WINTER MODE

- The Air Handling Units Supply Air Temperature set point default values shall be reset as follows:

Return Air Temperature	Supply Air Temperature (AHU-1W, AHU-2W)
75 deg F and above	60 deg F (adjustable)
68 deg F and below	67 deg F (adjustable)
Between 75 deg F and 68 deg F	Shall be linear between 60 deg F and 67 deg F

AHU-3W (100% Outdoor Air) Supply Air Temperature Setpoint 60 deg F (adjustable). The Supply Air Temperature Setpoint shall be reset automatically to maintain the Kitchen temperature setpoint.

- FREEZE PROTECTION
  - When the Outdoor Air Temperature is below 36 deg F (adjustable), the Freeze Protection Mode shall be ON. The chilled water pumps shall be ON and the chilled water valves shall be 100% OPEN.
  - When the Outdoor Air Temperature is above 37 deg F (adjustable), the Freeze Protection Mode shall be OFF. The chilled water pumps shall be OFF and the chilled water valves shall be 0% CLOSED.
  - When the Outdoor Air Temperature is between 36 deg F (adjustable) and 37 deg F (adjustable), the Freeze Protection Mode shall maintain the previous state.

B. SUMMER MODE

- The air handling Units shall be as follows: Supply Air Temperature set point shall be reset:

Return Air Temperature	Supply Air Temperature (AHU-1W, AHU-2W)
75 deg F and above	55 deg F (adjustable)
70 deg F and below	64 deg F (adjustable)
Between 75 deg F and 70 deg F	Shall be linear between 55 deg F and 64 deg F

AHU-3W (100% Outdoor Air) Supply Air Temperature Setpoint 55 deg F (adjustable). The Supply Air Temperature Setpoint shall be reset automatically to maintain the Kitchen temperature setpoint.

C. OCCUPIED/UNOCCUPIED SCHEDULE Operation CAMPUS WIDE:

The schedule shall be individual for each AC, AHU unit. The operator shall be able to change the schedule for each individual AC unit. However, the default values shall be as follows.
Between 6:00 AM and 10:00 PM Monday through Friday, the schedule shall be OCCUPIED.

- The Min Outdoor Air damper shall be 100% OPEN.
- The Supply and Return Fans shall be 100% of their speed.

Between 10:01 PM and 5:59 AM Monday through Friday and Saturday and Sunday all day, the schedule shall be UNOCCUPIED. In addition, between 11:00 PM and 4:00am the AC units shall be OFF (supply and return fan shall be OFF)

- The min Outdoor Air Damper shall be 0%, CLOSED.

- The Supply and Return Fans shall be at minimum of their speed.
- The system shall be in control to maintain the supply air temperature setpoint.

D. ECONOMIZER OPERATION CAMPUS WIDE:

- When the Outdoor Air Temperature is above 70 deg F (adjustable) the ECONOMIZER shall be OFF.
- When the Outdoor Air Temperature is below 69 deg F (adjustable) the ECONOMIZER shall be ON.
- When the Outdoor Air Temperature is between 69 deg F and 70 deg F, the ECONOMIZER shall maintain the current mode.
- When the Outdoor Air Temperature is below 20 deg F (adjustable)), the ECONOMIZER shall be OFF. **This feature is ONLY for the operator to prevent very cold air to get into the unit and set the Freezestats and shut the unit OFF.**

E. AHU MODE OPERATION

THE RETURN FAN SHALL ALWAYS FOLLOW THE SUPPLY FAN. IF THE SUPPLY FAN SPEED IS OVERRIDDEN TO A VALUE, THE RETURN FAN SHALL AUTOMATICALLY FOLLOW THE SUPPLY FAN SPEED.

UNIT MODE:

- When the Supply Air Temperature is 3 deg F (adjustable) below the setpoint, the unit shall be in **HEATING** mode;
- When the Supply Air Temperature is 3 deg F (adjustable) above the setpoint, the unit shall be in **ECONOMIZER** mode;
- When the Supply Air Temperature is within 3 deg (adjustable) of the setpoint, the unit shall maintain the current mode.
- If the return enthalpy is less than the OA enthalpy or if the ECONOMIZER mode is OFF due to High Limit, the unit shall be in **COOLING** mode.

HEATING mode:

- The Max Outside air damper shall be closed. The chilled water valve shall be closed.
- The preheat/reheat valves shall modulate (open or close) to maintain the Supply Air Temperature at the setpoint; **THE VALVE SHALL MODULATE VERY SLOW.**

ECONOMIZER mode:

- When the Outdoor Air enthalpy is below the Return Air enthalpy, the ECONOMIZER shall be ON and the system shall adjust the Outdoor Air dampers too maintain the Supply Air Temperature. When the Outdoor Air dampers are at 100% OPEN and there is still a request for cooling, the chilled water valve shall be modulated to maintain the Supply Air Temperature.
- When the Outdoor Air enthalpy is above the Return Air enthalpy, the economizer shall be OFF.
- The preheat/reheat valve shall not be allowed to OPEN.

COOLING mode:

- The Max Outside air damper is closed.
- The preheat/reheat valves shall not be allowed to open.
- The cooling valves shall modulate (open/close) to maintain the Supply Air Temperature at the setpoint.
- When the ECONOMIZER mode is ENABLED, the unit mode shall change to ECONOMIZER mode and shall continue to modulate the chilled water valve and the Outside Air Damper to maintain the Supply Air Temperature at the setpoint.

MIXED AIR Temperature:

The mixed air temperature shall limit the opening of the MAXIMUM OUTSIDE AIR DAMPER to maintain a MIXED AIR setpoint of 45 deg F (adjustable).
When the Mixed Air Temperature is below 45 deg F (adjustable), the opening of the Max Outside Air Damper shall be limited to maintain a Mixed Air Temperature of minimum 45 deg F (adjustable).

PREHEAT Temperature:

When the SUPPLY fan is OFF, each Preheat Valve shall modulate to maintain a Preheat Temperature Setpoint of 45 deg (adjustable). This will also cover when the unit is OFF for Freeze protection.
OUTDOOR AIR:
The following points shall be shown on every Air Handling Units Graphics:

- OA Temperature;
- OA Relative Humidity;
- OA Enthalpy;
- OA CO2 (where applicable);
- OA Air Flow;
- OA Damper Position.

OA Air Flow = Supply Air Flow x ((Mixed Air Temperature – Return Air Temperature) / (Outdoor Air Temperature – Return Air Temperature))

3.04 WATER LOOPS SEQUENCE OF OPERATION

All the pumps shall be on a lead/lag schedule and they should change every 168 hours adjustable. Each water loop page shall show the pressure differential on that system. Chilled water shall show all the AHUs DP installed on the loop.

A. SUMMER MODE

- The cooling system shall be ON (heat exchangers, chillers, and chilled water pumps).
- As the chillers are manually started, the booster chilled water pumps will operate ONLY when the chillers are ON.

Chilled water operation

- When the chilled water system is ON based in the SUMMER mode and the chillers being turned ON, both booster pumps shall be turned ON at minimum speed of 20% (adjustable).
- The pumps speed shall be gradually increased to 100%.
- The pumps speed shall be controlled based on the chilled water valve from the critical Air Handling Unit as follows:

Each booster systems has a list of Air Handling Units served by the booster system.

West Courtyard	P-7A, P-8A	AHU-1W, AHU-2W, AHU-3W

The booster control system shall monitor the position of the chilled water valves of the units assigned to the booster system (from the table above). The critical AHU chilled water position is the maximum of all the CHW valve positions from the list.

- When the critical CHW valve position is below 90% (adjustable), the booster pump speed shall be decreased at a rate of 1% every 3 minutes (adjustable);
- When the critical CHW valve position is above 98% (adjustable), the booster pump speed shall be increased at a rate of 1% every 3 minutes (adjustable);
- When the critical CHW valve position is between 90% (adjustable) and 98% (adjustable), the booster pump speed shall remain constant.
- When the two (2) booster pump speed decrease to 20% (adjustable), the lag pump shall be turned OFF and only one booster pump shall be controlled to maintain the critical CHW valve position.
- When one booster pump speed is at 85% (adjustable), the second booster pump shall be started and two (2) booster pump speed shall be controlled to maintain the critical CHW valve position.
- When the system operates with one pump at the minimum speed 20% (adjustable) and the by-pass pressure differential is above the setpoint, the bypass shall start opening to maintain the by-pass pressure differential setpoint at 1 PSI (adjustable)

3.05 SMOKE CONTROL OPERATION

A. Division 16 Electrical Contractor will furnish and install a complete building fire alarm system, annunciator system and emergency fan shut down wiring.

B. ATC Contractor to furnish and install one or more multi-pole relays for each fan motor starter, to interface with fire alarm emergency fan shut down wiring. The intent of these relays is to provide dry type contacts to activate the various sequences of operation described herein. ATC Contractor shall be responsible for all logic devices, wiring, relays etc. required to accomplish the sequences of operation as noted below.
   1. All HVAC fans shall be shut down automatically through the emergency fan shut down system. Duct smoke detectors however, shall only cause its own fan system to stop (supply, return and exhaust) and close the related system main smoke dampers.
   2. All main fan systems smoke dampers and all duct mounted smoke dampers shall automatically close when fans are stopped through the fire alarm system.

3.06 LOCATION AND CONTROL OF SMOKE DAMPERS

A. Provide a normally closed smoke damper in each duct crossing a smoke barrier, as indicated on the Drawings, at the point where the duct crosses the barriers and at supply fan discharge. Whenever supply fan stops, smoke damper at the fan discharge shall close. Provide end switch at main after intake and smoke damper and 30 second (adjustable) time delay to prevent supply and exhaust fan start-up until combination dampers have opened, and 20 second time delay to prevent combination dampers from closing until fan stopped. All combination fire/smoke dampers on each floor, shall be connected to EP switches on that floor, which shall close the dampers when the respective air handling system is shut down by Div. 26 fire alarm emergency fan shut-down system. EP switches shall be □", 3-way air valve, connected to the damper air piping system. EP switch shall be furnished and installed under this Section of the Specifications.

3.07 FIELD QUALITY CONTROL

A. Upon completion of installation of the automatic temperature control system and after motors have been energized with normal power source, test system to demonstrate compliance with requirements.

B. When possible, field correct malfunctioning controls, then retest to demonstrate compliance. Replace controls which cannot be satisfactorily corrected. Refer to Section 23 05 93 "Testing and Balancing".

C. Checkout of the installation shall be conducted by the Contractor with a representative of the Owner and Architect. The checkout shall consist of verifying the ability of the S.A.C. panels to communicate with the operator's console, verifying calibration of each sensor and/or transmitter, and verifying the operation of each control point.

D. All software processes shall be thoroughly demonstrated to the Owner's representative and Architect. Alarm conditions shall be simulated for conformance. Analog control points shall be exercised through their entire range. All control interlocks and sequences shall be completely verified. The checkout shall be a thorough and exhaustive review of the installation to assure proper operation of the total system.

3.08 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 in complete operating condition, subject to the approval of the Architect.

B. The Control System contractor shall provide two copies of an operator's manual describing all operating and routine maintenance service procedures to be used with the system. The Control System contractor 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 93

SECTION 23 20 00

PIPING FOR HVAC

PART 1 - GENERAL

1.01 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.

1.02 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.

1.03 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).

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.

1.04 SUBMITTALS

A. Refer to Section 01 31 46, "Special Requirements for Mechanical and Electrical Work", and submit shop drawings.

1.05 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. Contractor shall also show all structural grids and support points on these drawings.

1.06 WARRANTY

A. Refer to Section 01 31 46, "Special Requirements for Mechanical and Electrical Work".

PART 2 - PRODUCTS

2.01 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 name or symbol of 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 butt 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 heavy weight 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 sand cloth and treated with an approved non-corrosive flux before 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. Pipe shall be hot-dripped 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 solder 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. 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.

J. 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.

K. Weld ells shall have a center line radius not less than diameter of the pipes.

L. 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.

M. Instrumentation connections □ ½" and smaller on all systems shall be provided by welding threaded 2000# forged steel half couplings to the pipe.

N. All pipe to be welded shall be cut off clean and beveled. All welding shot shall be removed.

O. Composition of welding electrodes shall be in accordance with manufacturer's recommendations.

P. 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.

Q. 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.

R. 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.

S. 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.

T. Assume responsibility for the quality of welding done and repair or replace any work not in accordance with these specifications.

U. In addition, all pipe welding procedures and procedures for qualification of pipe welding operators shall comply with the requirements of the American Welding Society.

V. 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.

W. Pipe Schedule: Pipe for the various services shall be as follows:

Service	Material	Schedule
Low Pressure Steam (15 psig & below)	Steel	40 or standard
Low Pressure Condensate	Steel	40 or standard
Low Pressure Condensate	Brass	Standard
Low Pressure Condensate	Yoloy J&L Steel	40 or standard
Low Pressure Cond. (within 20 feet) Heat Exchanger		80
Overflow & Drain	Galv. Steel	40
Overflow & Drain	Copper	Type K
Cold Water	Brass	Standard
Cold Water	Copper	Type "TP"
Hot Water (Heating) and Reheat	Steel	40 or standard
Chilled Water & Dual Temperature Water	Steel	40 or standard

X. 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”.

2.02 MECHANICAL PIPE COUPLINGS

A. Rigid Mechanical pipe couplings similar to Victaulic QuickVic™ 107H may be used at this sections option for the following above ground services.
   1. Mechanical couplings are permitted only in chilled water and condenser water systems where exposed (such as in mechanical equipment rooms) and outdoors.

B. Grooved couplings with reverse angle pads shall engage and lock in place the grooved or shouldered pipe, pipe fittings and grooved end valves in a positive watertight couple. QuickVic™ couplings shall be Installation Ready stab-on design, for direct stab installation onto roll grooved pipe without prior field disassembly and no loose parts.

C. Grooved couplings shall consist of two places of ASTM A395 and A536 ductile iron with reverse angle pads. Coupling gaskets shall be a Grade EHP synthetic rubber, red or green color coded with a central cavity pressure responsive design, or other grades suitable for the intended service.
   1. Flexible type couplings shall be used in seismic areas and locations stress relief and vibration attenuation are required. Flexible couplings shall be Victaulic Style 177 QuickVic™ or Style 77 standard.

D. Coupling assembly shall be securely held together by two track-head, oval-neck, steel bolts. Bolts and nuts shall be heat-treated carbon steel and shall be in accordance with ASTM A-183-60 and A-449. Coupling on outdoor piping shall have galvanized bolts and nuts.

E. AGS grooved mechanical couplings 14" through 60" shall consist of two ASTM A536 ductile iron housings cast with a wide key profile and flat bolt pads for metal-to-metal contact, designed to fit into a deeper, wedge-shaped groove; wide-width synthetic rubber Grade EPDM gasket of a FlushSeal design, and plated steel bolts and nuts. Victaulic Style W07 (rigid) and Style W77 (flexible).

F. All pipe fittings used in connection with pipe couplings shall have grooved or shouldered ends and shall be cast of ductile iron conforming to ASTM A-395 Grade 65-45-15, and ASTM A-536 Grade 65-45-12, forged carbon steel conforming to ASTM A-234 Grade WPB, or fabricated carbon steel from ASTM-A-53 standard wall.

G. Grooved couplings and fittings for copper tubing shall be used on hard drawn ASTM B-88 copper tubing. Grooved couplings and fittings shall be copper tubing sized. Flaring of pipe ends to IPS dimensions will not be permitted.
   1. Grooved fittings shall be wrought copper per ASTM B75 or B152 and ANSI B16.22, or bronze sand casting per ASTM B584-87 copper alloy CDA 836 per ANSI B16.18. Fittings shall be copper tubing sized. (Flaring of pipe ends to IPS dimensions will not be permitted.
   2. Grooved couplings shall be ASTM A395 and A536 ductile iron, coated with copper colored alkyd enamel. Coupling housings shall be angle-pattern bolt pad type to provide system rigidity. Couplings shall be copper tubing sized. Coupling gaskets shall be grade EPDM, UL classified in accordance with ANSI/NSF 61 for potable water service. Couplings shall be Installation Ready stab-on design, for direct □stab□ installation onto roll grooved copper tube without prior field disassembly and no loose parts. Victaulic Stule 607 QuickVic™.

H. Before assembly of couplings, lubricate the gasket exterior including the lips and/or pipe ends housing interiors, to prevent pinching the gasket. Lubrication shall assist proper gasket seating and alignment while easing installation. Petroleum based lubricants must not be used on Grade "E" or Grade "M" gaskets. Lubricant shall be supplied by, or approved for use with the gasket, by the coupling manufacturer.

I. Pipe grooving shall be in accordance with the manufacturer's specifications.

J. Pipes, fittings, BFV's, check valves, plug valves and strainers shall be provided with groove or shouldered ends in accordance with coupling manufacturers latest published literature. Flanged or threaded end valves may be used with grooved adapters.

K. Couplings and fitting shall be designed for a system pressure specified elsewhere and in conformance with manufacturer's published data.

L. Entire coupling installation shall be done in accordance with manufacturer's latest published literature.

M. After completion of pipe coupling installation, Contractor shall furnish to the Owner's representative a signed certificate of compliance with the manufacturer's installation instructions.

N. Couplings shall be standard weight as a minimum requirement.

O. All grooved couplings, fittings, valves and specialties shall be the products of a single, ISO 9001 certified, manufacturer. Grooving tools shall be of the same manufacturer as the grooved components.

P. Install the Victaulic AGS piping system in accordance with the latest Victaulic installation instructions. Use Victaulic grooving tools with AGS roll sets to groove the pipe. Follow Victaulic guidelines for tool selection and operation. Coupling installation shall be complete when visual metal-to-metal contact is reached. AGS products shall not be installed with standard grooved end pipe or components. Installing AGS products in combination with standard grooved end products could result in joint separation and/or leakage.

Q. A Victaulic factory-trained field representative shall provide on-site training to contractor’s field personnel in the proper use of grooving tools and installation of grooved piping products. Factory-trained field representative shall periodically review product installation. Contractor shall remove and replace any improperly installed products.

2.03 FITTINGS

A. Fittings shall be specified under "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 as 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 treading dies, and the joints shall be made up with lubricant. Strap wrenches, or equivalent, shall be used in making up brass pipe. Wrenches which 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
*Select Yoloy, Bronze or Steel				
Low Pressure Condensate	2" & below 2½" & above	C.I. Steel	125# Sch. 40	Welding
Pumped Condensate Returns (discharge)	ALL	C.I.	250#	Screwed
Cold Water	ALL	Bronze Wrought Copper	125# 125#	Brazed Solder
Overflow and Drain	ALL	Wrought Copper	125#	Solder Grooved
Cold Water	ALL	Bronze	125#	Brazed

Service	Size	Material	Weight	Type
		Wrought Copper	125#	Solder Grooved
Hot Water (Heating)	2" & Below 2½" & Above	CI Steel	125# Sch. 40	Screwed Welding
Chilled Water and Dual Temperature Water	2" & Below 2½" & Above	CI Steel DI	125# Sch. 40	Screwed Welding Grooved
Vent (Water Discharge)	ALL	Wrought Copper	125#	Solder

2.04 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
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. □ 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	⅜ inch	6'-0"
1½" and 2 inch	⅜ inch	10'-0" (copper 8'-0")
2½ inch 3 inch	½ inch	10'-0" (copper 8'-0")
4 inch 5 inch	⅝ inch	12'-0"
6 inch	¾ inch	12'-0"
8 inch & above	⅞ 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 ¼".

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.

W. Rigid type grooved mechanical couplings shall be complete with reverse-angle bolt pads to meet support and hanging requirements corresponding to ANSI B31.1, B31.9, and NFPA 13.

2.05 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

3.01 INSPECTION

A. Contractor shall examine location where the piping is to be installed and 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.

3.02 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 pipe lines 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 bull head 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 "air lines" (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 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 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. Vent piping from the high temperature hot water system shall comply with all requirements of high temperature hot water piping specified hereinbefore. This shall also apply for the high temperature water safety valve discharge piping.

EE. Grooved ends shall be clean and free from indentations, projections, and roll marks in the area from pipe end to groove.

FF. 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.

3.03 FIELD QUALITY CONTROL

A. Upon completion of installation of piping (partial or complete) test piping to demonstrate compliance with requirements. Where possible, 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

1.01 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.

1.02 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.

1.03 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 "General Provisions for HVAC Work".

C. Provide equipment whose performance, under specified conditions, is certified by the manufacturer.

1.04 SUBMITTALS

A. Refer to Section 01 31 46 - Special Requirements for Mechanical and Electrical Work, and submit shop drawings.

1.05 COORDINATION

A. Refer to Section 01 31 46 - Special Requirements for Mechanical and Electrical Work.

1.06 GUARANTEE

A. Refer to Section 01 31 46 - Special Requirements for Mechanical and Electrical Work.

PART 2 - PRODUCTS

2.01 HORIZONTAL SPLIT CASE PUMPS

A. The casing shall be cast iron, double suction, horizontally split. Pumps shall be assembled on heavy duty fabricated structural steel base plates, which bases must include drip rim with tapped

drain connections which shall be piped to nearest floor drain. It shall incorporate replaceable bronze casing rings locked in place and protected against rotation by two monel pins; a vent in the highest point in the casing and a drain in the lowest point; standard 125# ANSI suction and discharge flanges. Impellers shall be bronze, double suction, enclosed type and cast in one piece, hydraulically and statically balanced, keyed to the shaft. Impeller and casing castings shall be clean and show no visual signs of non-homogeneity. Pumps shall have capacities as scheduled on the Drawings. Pumps shall be selected to operate at or near their point of peak efficiency thus allowing for operation at capacities of approximately 25% beyond design capacity. In addition, the design impeller diameter shall be selected so that the design capacity of each pump (GPM and TDH) shall not exceed 90% of the capacity obtainable with maximum impeller diameter at the design speed for that model. Efficiency and unit design BHP shall be quoted and guaranteed. Maximum head shall occur at and only at the no-flow condition. Stuffing box housing be deep enough to allow for a single John Crane type (1) mechanical seal. Each pump shall be flexibly coupled to a motor, Class B insulation, DP enclosure. Shaft shall be stainless steel. Bearings shall be single row, ball type and oil lubricated. Maximum BHP shall not exceed nominal motor nameplate rating.

In all cases, motor sizes shall be selected to be completely non-overloading over the entire performance range of the particular pump involved. A flexible coupling with coupling guard shall be used. Provide John Crane cyclone separator to ensure clean water flushing of the seal faces.

B. Pumps shall have replaceable case wear rings.

C. Seals to be capable to withstand system condition for water temperature and chemical treatment content as hereinafter specified under "Water Treatment".

D. Casings shall be provided with suitable steel lifting lugs.

E. Pump shall be drawn down slightly on foundation bolt nuts. Provide a form or dam around the contour of the bed plate. Pour grout through holes, provided for this purpose, in sufficient quantity to reach a level of □" to 1" above the bottom of the bed plate. Allow grouting to set thoroughly then proceed with pipe connection.

F. Provide OSHA rated steel coupling guard.

G. Motor efficiencies must meet or exceed that specified in Section 01 31 46.

H. All pumps in VFD applications must have flexible couplings and inverter-duty motors.

2.02 END SUCTION PUMPS

A. The casing and suction head of the pump shall be of cast iron material and end suction, vertical split type. Casing and suction head shall be equipped with 125# ANSI flanges. Pumps shall be assembled on heavy duty fabricated structural steel base plates, which bases must include drip rim with tapped drain connections, which shall be piped to nearest floor drain. The impeller shall be of the enclosed type and shall be bronze. The impeller shall be statically and hydraulically balanced and keyed to the shaft. Efficiency and unit maximum BHP shall be quoted and guaranteed. Maximum head shall occur at and only at the no flow condition. The shaft shall be of steel material and removable shaft and shall be stainless steel. Bearings shall be single row, ball type and oil lubricated.

B. Pumps shall have replaceable case wear rings.

C. Stuffing box housing shall be deep enough to allow for a single John Crane type (1) mechanical seal. Each pump shall be flexibly coupled to a motor, Class B, DP enclosure. A flexible coupling with coupling guard shall be used. Except where otherwise noted, bearings shall be grease lubricated. Seals to be capable to withstand system condition for water temperature chemical treatment content as hereinafter specified under "Water Treatment". Provide John Crane cyclone separator to ensure clear water flushing of the seal faces.

D. Pumps shall have capacities as scheduled on the Drawings. Pumps shall be selected to operate at or near their point of peak efficiency thus allowing for operation at capacities of approximately 25% beyond design capacity. In addition, the design impeller diameter shall be selected so that the design capacity of each pump (GPM and TDH) shall not exceed 90% of the capacity obtainable with maximum impeller diameter at the design speed for that model or as approved.

E. Casings shall be provided with suitable steel lifting lugs.

F. Pump shall be drawn down slightly on the foundation bolt nuts. Provide a form or dam around the contour of the bed plate. Pour grout through holes, provided for this purpose, in sufficient quantity to reach a level of □" to 1" above the bottom of the bed plate. Allow grouting to set thoroughly, then proceed with pipe connections.

G. Provide OSHA rated steel coupling guard.

H. Motor efficiencies must meet or exceed that specified in Section 01 31 46.

I. All pumps in VFD applications must have flexible couplings and inverter-duty motors.

PART 3 - EXECUTION

3.01 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.

3.02 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 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.

3.03 FIELD QUALITY CONTROL

A. Upon completion of installation of equipment and after motor has been 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.

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

1.01 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.

1.02 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 cleaning as shown on the drawings and hereinafter specified.

1.03 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, "General Provisions for HVAC Work".

C. Provide equipment whose performance, under specified conditions, is certified by the manufacturer.

1.04 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.

1.05 COORDINATION

A. Refer to Section 01 31 46 - Special Requirements for Mechanical and Electrical Work.

1.06 GUARANTEE

A. Refer to Section 01 31 46 - Special Requirements for Mechanical and Electrical Work.

PART 2 - PRODUCTS

2.01 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% dioctysulfocuccinate 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.

2.02 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.

C. Steam Systems:
1. Clean steam and condensate piping by sending steam through the piping for a period of not less than 16 hours. Isolate and bypass steam traps. Mix the condensate with cold water in a barrel or container so that the temperature of the mixture does not exceed 120°F. and discharge to the sewer.

D. Chilled 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.

E. 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.

2.03 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

3.01 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.

3.02 INSTALLATION

A. Coordinate with other work as necessary to interface installation of water treatment equipment with other components of systems.

B. Check alignment and, where necessary (and possible), realign shafts of motors and equipment within tolerances recommended by manufacturer.

3.03 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 31 13

SHEET METAL DUCTWORK

PART 1 - GENERAL

1.01 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.

1.02 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.

1.03 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.

1.04 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.

1.05 COORDINATION

A. Refer to Section 01 31 46 - Special Requirements for Mechanical and Electrical work.

1.06 GUARANTEE

A. Refer to Section 01 31 46 - Special Requirements for Mechanical and Electrical work.

B. 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.

1.07 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

2.01 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.

2.02 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.

2.03 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.

2.04 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.

2.05 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 roof drain, 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

2.06 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.

2.07 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 ¾", 125 lb., bronze, screwed hex bushing, secured to the duct with a bronze hex locknut on the inside of the duct. A ¾" 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 1□ 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 airtight 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.

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 □ 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 □ 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. angels, 1½" in. pocket lock 22 gauge with 1½" x 1½" x ⅛ in. angels. Joints max. on 8 ft. centers with 1½" x 1½" x ⅛ in. angels max on 2 ft. centers.

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.	
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 high pressure systems shall conform to the following:
1. High pressure ductwork is defined as over 5” inches of water.
2. Duct construction shall consist of gauges and reinforcing framing specified in latest ASHRAE Guide for High pressure ductwork, or as per SMACNA Manual but not less than the following weights and construction.

Construction for Rectangular High Pressure Duct		
Dimension of Longest Side Inches	Galvanized Sheet Gage (All 4 Sides)	Transverse Reinforcing Between Joints and at Joints
Up thru 12	22	Inside slip joint, double S slip, welded flange, standing seam, flanged joint, pocket lock, compassion angle flanged joint with 1¼ x 1¼ x ⅛ angles. No tie rods required at joints. Joints max. on 8 ft. center.
13 thru 18	22	Between Joints: 1 tie rod at 40 in. intervals on centerline of ductside or without tie rods with 1 x 1 x 16 gage angle @ 48 in.
		At Joints: Inside slip joint, double S slip and welded flange, each with 1 x 1 x 16 gage angle. Standing seam, flanged joint, pocket lock, companion angle flanged joint with 1¼ x 1¼ x ⅛ angles. Joints max. on 8 ft. center.
19 thru 24	22	Between Joints: 2 tie rods @ 40 in. or without tie rods with 1 x 1 x ⅛ angle @ 48 in.
		At Joints: 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 angles. Joint max. on 8 ft. centers.
25 thru 36	22	Between Joints: Without tie rods with 1¼ x 1" x ⅛ angle @ 32 in. or 1½ x 1½ x ⅛ angle @ 40 in.

Construction for Rectangular High Pressure Duct		
Dimension of Longest Side Inches	Galvanized Sheet Gage (All 4 Sides)	Transverse Reinforcing Between Joints and at Joints
		At Joints: Inside slip joint, double S slip, welded flange, each with 1½ x 1½ x ⅛ angles. Standing seam, flanged joint, pocket lock, companion angle flanged joint with 1¼ x 1¼ x ⅛ angles. Joints max. on 8 ft. center.
37 thru 48	22	Between Joints: Without tie rods with 2 x 2 x ⅛ angle @ 30 in. angles.
		At Joints: Inside slip joint, double S slip, welded flange, each with 2 x 2 x ⅛ angles. Reinforced standing seam with 2 x 2 x ⅛ angle, companion angle flanged joint with 1½ x 1½ x ⅛ angles. Joint max. on 8 ft. center.
49 thru 60	20	Between Joints: 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.
		At Joints: Inside slip joint, double S slip, welded flange, each with 2 x 2 x 3/16 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 2 x 2 x ⅛ angles. Joint max. on 8 ft. center.
61 thru 72	20	Between Joints: 1½ x 1½ x ⅛ angle @ 24 in. with tie rods in center or without tie rods with 2½ x 2½ x 3/16 angle @ 24 in.
		At Joints: 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 flanged joint with 1¼ x 1¼ x ⅛ with tie rod in center. Joints max. on 8 ft. center.
73 thru 84	18	Same as for 61 thru 72.
85 thru 96	18	Between Joints: 1½ x 1½ x ⅛ angles @ 24 in. with tie rod in center.
		At Joints: 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 1¼ x 1¼ x ⅛ angles with tie rod in center. Joints max. on 8 ft. center.
97 and over	16	Between Joints: 2 x 2 x ⅛ angles @ 24 in. with tie rods @ 48 in. along angle.
		At Joints: 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. Joint max. on 4 ft. center.

3. Transverse reinforcing must be applied on all four sides and tied together at each corner by welding to prevent air leakage and shall be installed with ⅛" thick 3M gasket EC-1202. Gaskets shall have overlapped corners and cover entire frame. Connecting angles shall be bolted to each other with stove bolts, spaced not more than 6" apart. In addition, each such angle frame shall be itself welded at the corners for rigidity.

4. In addition to the above all high 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 2½ x 2½ x 3/16 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.

2.08 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. All dampers shall be made accessible from building construction. Access doors in building structure shall be furnished or provided as herein before specified.

2.09 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/Ft^2 at 1" w.g.; 8 CFM/Ft^2 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.

2.10 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 1½ x 1½ 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 (⅛) 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 Greenheck 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.

2.11 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 as manufactured by Greenheck (see drawings) 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/Ft^2 at 1-inch w.g.; 8 CFM/Ft^2 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 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 control air or 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 manufacturer’s 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.

2.12 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. 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.

G. Manufacturer to provide an installed neoprene gasket around perimeter of access door for airtight seal.

H. Systems 3” w.g. or less shall utilize a hinged, cam, or hinged & cam square-framed access door.

I. Systems 4” 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.

2.13 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.

2.14 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 (Option for Elastomeric Closed-Cell Liner): Furnish and install as herein specified and/or shown on the drawings (except where otherwise noted), 2" thick, closed cell liner, K-Flex LS sheet with PSA as manufactured by Nomaco, K-Flex, AP Armaflex, AP Armaflex SA or approved equal, meeting ASTM C-534, ASTM D-1056-00-2C1 and ASTM C-1534-02 and shall have an anti-microbial ingredient. Lining shall meet the requirements of NFA 90A with a FHC of 25/50 and flammability UL 94-5V and ASTM E-84 foam core 25/50 at 1" and below, psa 0/10, R value 3.8 (1").

D. Liner shall be applied to clean, dry ductwork by peeling the release liner away and applying uniform pressure to the sheet. Compression joints with adhesive applied should be used on all butt edges. Seal all final edges with a heavy coat of adhesive to seal off air between lining and duct, unless the material has a factory applied edge coating. Follow manufacturer’s installation instructions. All exposed edges of lining shall be installed with sheet metal nosing 1½" wide, two gauges heavier than duct.

E. Duct sizes indicated on drawings are clear inside dimensions. Increase sheet metal sizes as required to install acoustic lining.

F. Sound Absorbent Duct Lining for 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 “□” 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.

	Open Area
7/64" round holes on 3/16" staggered centers	29%
⅛" round holes on 7/32" staggered centers	29%
⅛" round holes on ¼" staggered centers	23%
.085" round holes on 5/32" staggered centers	29%
1/16" round holes on ⅛" staggered centers	22.5%

5. Duct sizes indicated on drawings are clear inside dimensions. Increase sheet metal sizes as required to install acoustic lining.

2.15 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

3.01 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.

3.02 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 ensure 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".

3.03 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 ⅛" 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.

3.04 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

1.01 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.

1.02 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.

1.03 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, "General Provisions for HVAC Work".

C. Provide equipment whose performance, under specified conditions, is certified by the manufacturer.

1.04 SUBMITTALS

A. Refer to Section 01 31 46 - Special Requirements for Mechanical and Electrical Work and submit shop drawings.

1.05 COORDINATION

A. Refer to Section 01 31 46 - Special Requirements for Mechanical and Electrical Work.

1.06 GUARANTEE

A. Refer to Section 01 31 46 - Special Requirements for Mechanical and Electrical Work.

PART 2 - PRODUCTS

2.01 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.

2.02 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.

PART 3 - EXECUTION

3.01 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.

3.02 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.

3.03 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

1.01 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.

1.02 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.

1.03 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 "General Provisions for HVAC Work".

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

1.04 SUBMITTALS

A. Refer to section 01 31 46 Special Requirements for Mechanical and Electrical Work and submit shop drawings.

1.05 COORDINATION

A. Refer to section 01 31 46 Special Requirements for Mechanical and Electrical Work.

1.06 GUARANTEE

A. Refer to section 01 31 46 Special Requirements for Mechanical and Electrical Work.

PART 2 - PRODUCTS

2.01 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.

2.02 ACCEPTABLE MANUFACTURERS

A. Filters:
1. Flanders Precisionaire
2. Camfil
3. American Air Filter
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.

2.03 FILTER CARTRIDGES

A. Panel Filters - Construction Grade

1. Disposable Filters
   a. Shall be constructed of polyester media and be completely disposable. Thickness shall be nominal 2".
   b. Filters shall be U.L. 900 Class 2 listed.
   c. Basis of design: Flanders Precisionaire 325 Ring Panel Industrial Grade Series Filters, MERV 8 or better.

B. Pleated Media Filters (ASHRAE Dust Spot Efficiency of 35% and a MERV 8 rating (2") Filter media shall be high efficiency synthetic media.
   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: Flanders Precisionaire Prepleat 40 HC

C. Medium and High Efficiency Rigid Filters. Separator Type U.L. 900 Class 1. Efficiency levels of 95%. (MERV 15) (2") Filter Construction
   a. Filters shall be the totally rigid type with a wet laid microfine 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: Flanders Precisionaire Precisioncell

2.04 INDIVIDUAL HOLDING FRAMES FOR BUILT UP FILTER BANKS

A. Frames for Pleated Filters and Extended Surface High Efficiency Filters
   1. Two inch deep, 16 gauge galvanized (304 stainless) steel with gaskets and filter retaining clips to maintain a positive pressure seal between the frame and the replaceable filter element and matching rivet holes to facilitate installation.
   2. Provide frames with associated clips to hold specified filters.
   3. Basis of design: Flanders Precisionaire Type 9 Frame

2.05 SIDE ACCESS HOUSINGS, FACTORY ASSEMBLED

A. Housings for 2 in. 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. Basis of design: Flanders Precisionaire Surepleat Housing

2.06 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 tips, 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

3.01 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.

3.02 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.

3.03 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.

3.04 FIELD QUALITY CONTROL

A. Filter cartridges shall be capable of being loaded and unloaded easily through access doors in the housings or access sections.

3.05 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.

3.06 SCHEDULE

A. See air filter schedule on drawings for filter model numbers, CFM and sizing data.

END OF SECTION 23 40 00

SECTION 23 73 01

AIR HANDLING UNITS

PART 1 - GENERAL

1.01 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.

1.02 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.

1.03 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 "General Provisions for HVAC Work".

C. Provide equipment whose performance, under specified conditions, is certified by the manufacturer.

1.04 SUBMITTALS

A. Refer to Section 01 31 46 - Special Requirements for Mechanical and Electrical Work and submit shop drawings.

1.05 COORDINATION

A. Refer to Section 01 31 46 - Special Requirements for Mechanical and Electrical Work.

1.06 GUARANTEE

A. Refer to Section 01 31 46 - Special Requirements for Mechanical and Electrical Work.

PART 2 - PRODUCTS

2.01 AIR HANDLING UNITS

A. Furnish and install air conditioning blower 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. 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 7.5 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 cooling and heating coil section and filter section and shall extend to 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.

C. Fan ratings shall be certified as per ARI. 410-72.

D. The unit cabinet and all accessory sections shall be insulated internally with 1" thick glass blanket insulation which has been vinyl coated on the surface exposed to the airstream. Metal edges (nosing) shall be provided for protecting edges of insulation. The casing panels to which the insulation is secured are to be double flanged, both for structural strength and to provide protection for the edges of the insulation blanket. Full drain pans are to be provided under both fan section and coil section, and are to be of double floor construction, with a minimum of □" of rigid polyurethane cemented in place between the two layers of metal. The inner pans are to be fabricated of not less than 20-gauge stainless steel, mastic coated and are to be pitched, for positive drainage, toward side drain connections.

E. All units incorporating less than 35 sq. ft. of coil face shall use forward curved blade type fans. All units incorporating 35 sq. ft. of coil face or above shall use Air Foil Blades. The fans shall be high performance direct drive plenum fans with DP casings. Motors shall be premium efficiency inverter duty with class F insulation. Fan assembly shall mount on rubber in shear isolators and inlets shall be isolated from equipment casing with flexible canvas connection. Fan shall include air measuring integral to the inlet cone.

F. All fans shall be statically and dynamically balanced and tested at rated speed after being installed in the factory-assembled units.

G. 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.

H. 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.

I. 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.

J. 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. Pleased filter shall be installed on a 2" metal frame.

K. Air filters shall be of the type as specified under paragraph "Air Filters".

L. 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.

M. All units shall be direct driven. Drive service factor shall be 1.5 times motor nameplate horsepower.

N. 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.

O. Mixing box for rooftop units only, shall have parallel blades interconnected inside and return air dampers. Damper blades have parallel bends for stiffness and are welded to □ 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. tsp and 2000 fpm velocity. Damper motors shall be BELIMO.

P. Prefabricated roof curbs min. 24" high shall be provided by unit manufacturer for all rooftop units. Curb shall be insulated.

Q. 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.

R. 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.

S. Rooftop mounted units shall be completely insulated with 0.6 in. thick isocyanate foam faced with an additional aluminum foil vapor barrier. All casing panels shall be gasketed and the entire unit shall be given an external finish coat of air dry enamel.

T. 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.

U. 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.

V. 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.

W. 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.

X. Control dampers/ Smoke dampers shall be factory installed including the actuators.

PART 3 - EXECUTION

3.01 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.

3.02 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.

3.03 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.

3.04 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

1.01 RELATED DOCUMENTS

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.

1.02 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.

1.03 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 "General Provisions for HVAC Work".

C. Provide equipment whose performance under specified conditions is certified by the manufacturer.

1.04 SUBMITTALS

A. Refer to Section 01 31 46 - Special Requirements for Mechanical and Electrical Work and submit shop drawings.

1.05 COORDINATION

A. Refer to Section 01 31 46 - Special Requirements for Mechanical and Electrical Work.

1.06 GUARANTEE

A. Refer to Section 01 31 46 - Special Requirements for Mechanical and Electrical Work.

1.07 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

2.01 ACCEPTABLE MANUFACTURERS SHALL BE LIMITED TO THE FOLLOWING:

A. Toshiba Industrial Series Q9+ (Bldg. Standard) in NEMA 4X enclosure.

2.02 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.

2.03 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: NEMA 1 (IP20): -10°C to 40°C (14°F to 104°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.

2.04 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 an 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, freezestats, 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

2.05 PRODUCT OPTIONS

A. Three Contactor Manual Bypass shall be provided when indicated by the schedule. VFD and bypass package shall be NEMA 1 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”, “Drivel 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 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.

2.06 FABRICATION

A. All standard and optional features shall be included in a single NEMA 4X rated enclosure with a UL certification label.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install VFD where indicated, in accordance with manufacturer's written instructions and NEMA ICS 3.

B. Tighten accessible connections and mechanical fasteners after placing VFD.

C. Provide a nameplate label on each VFD, identifying rated horsepower, full load amperes, model number, service factor and voltage/phase rating.

D. Long Lead Filters shall be provided on the output side of the drive, in a separate Nema 4X Enclosure, for motor protection in long motor lead length situations over 150 Feet.

3.02 MANUFACTURER'S FIELD SERVICES

A. Provide Start up report verifying that the manufacturer’s representative has visited the jobsite and approved the contractor’s installation of the VFD’s. The report shall include all programming changes made by the technician.

END OF SECTION 23 82 13

SECTION 23 82 17

COILS

PART 1 - GENERAL

1.01 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.

1.02 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.

1.03 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 “General Provisions for HVAC Work".

C. Provide equipment whose performance, under specified conditions, is certified by the manufacturer.

1.04 SUBMITTALS

A. Refer to Section 01 31 46 - Special Requirements for Mechanical and Electrical Work and submit shop drawings.

1.05 COORDINATION

A. Refer to Section 01 31 46 - Special Requirements for Mechanical and Electrical Work.

1.06 GUARANTEE

A. Refer to Section 01 31 46 - Special Requirements for Mechanical and Electrical Work.

PART 2 - PRODUCTS

2.01 STEAM COILS

A. Coil shall be the inner distributing tube type, fabricated with steel headers, copper tubing and aluminum fins.

B. Inner tubes shall have directional orifices, designed to achieve a 180 degrees F change in direction of steam flow from its path inside the inner tube, for distributing the steam within the outer tube.

C. All tubes shall be pitched inside the casing, toward the connection end, to insure proper drainage of condensate. Design of coils shall be such that they are capable of operating at steam pressures up to 200 PSI and at temperatures up to 400 degrees F.

2.02 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 .024-inch-thick wall copper tubing. Fins are to be .009-inch-thick aluminum for heating coils and .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.

PART 3 - EXECUTION

3.01 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.

3.02 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.

3.03 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 23 82 18

ELECTRIC DUCT HEATING COILS

PART 1 - GENERAL

1.01 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.

1.02 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 electric heating coils as shown on the drawings and hereinafter specified.

1.03 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 "General Provisions for HVAC Work".

C. Provide equipment whose performance, under specified conditions, is certified by the manufacturer.

1.04 SUBMITTALS

A. Refer to Section 01 31 46 - Special Requirements for Mechanical and Electrical Work and submit shop drawings.

1.05 COORDINATION

A. Refer to Section 01 31 46 - Special Requirements for Mechanical and Electrical Work.

1.06 GUARANTEE

A. Refer to Section 01 31 46 - Special Requirements for Mechanical and Electrical Work.

PART 2 - PRODUCTS

2.01 ELECTRIC DUCT HEATING COILS

A. Furnish and install as indicated heaters as manufactured by Neptronic, Indeeco, or approved equal. Voltage, size, wattage, number of steps and accessories shall be as scheduled.

B. Heaters shall be U.L. listed for zero clearance and meet all the applicable requirements of the Latest Edition of National Electrical Code or other local codes.

C. Heaters shall be made with galvanized or aluminum steel frame.

D. The terminal box shall be provided with solid hinged cover in order to minimize dust infiltration.

E. All resistance coil terminals and nuts shall be made of stainless steel, and terminal insulators and bracket bushings shall be made of high grade ceramic and securely positioned. Resistance wire shall be iron free, 80% nickel and 20% chromium. Bracket supports for the resistance wire shall be reinforced with stiffening ribs and gussets, and spaced no more than four inches apart. Heaters shall be tested dielectrically for 1000V plus twice and rated voltage or 2000V, whichever is higher.

F. Heaters shall be suitable for mounting in a horizontal or vertical duct, as shown on the Drawings, and air flow may be through the heater in either direction.

G. Electric heaters shall be of the slip-in type, unless otherwise noted. Flanged heaters shall be constructed by having a slip-in heater inserted into a flanged frame and flanges shall be independent of the terminal box.

H. Heaters shall be furnished for single or three phase power as scheduled. Three phase heaters shall be furnished with balanced three phase steps. The control voltage shall be 120 volts, internally wired through control transformer fused on the secondary.

I. Overcurrent protection shall consist of built-in and pre-wired dual element fuses with clip reinforcing springs.
   1. With one overcurrent device for each 40 ampere circuit.
   2. And with one overcurrent device for entire heater for those heaters rated 40 amperes or less only.

J. A disc type automatic reset thermal cutout in control lines, shall be furnished for primary protection. Heat limiters in all power lines shall be provided for secondary protection. In addition a disc type manual reset thermal cutout with bulb extending the length of the heater shall be furnished. Manual reset thermal cutout to be in series with automatic reset thermal cutout. All three devices shall be serviceable through the terminal box, without having to remove heater from duct. In lieu of heat limiters, disc type manual reset thermal cut-outs will be acceptable.

K. The following accessories shall be furnished and built in for each heater, except as otherwise noted:
   1. Insulated terminal box
   2. Magnetic contractors (when load exceeds control device ratings)
   3. Transformer with primary fuse protection to supply control voltage, when power supply exceeds 120 volts.
   4. Air flow switch - pressure type.
   5. P.E. switch per step, normally open, or field installed (by Electrical Contractor) electric room thermostat, as scheduled on the Drawings.
   6. Non-fused disconnect with interlocking door handle.

L. Electric duct heaters EDH shall be provided with SCR controllers.

PART 3 - EXECUTION (NOT USED)

END OF SECTION 23 82 18

SECTION 26 05 00

GENERAL PROVISIONS FOR ELECTRICAL WORK

PART 1 - GENERAL

1.01 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.

1.02 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. Occupancy sensors for light control.
16. Dimming system.
17. Low voltage lighting control system.
18. Furnishing, installing and connecting of electric heater cables for pipe tracing and snow melting, including controls.
19. Furnishing, installing and connecting of electric radiant panels/electric space heaters.
20. Power wiring for fan coil, incremental units.
21. 120 Volt supply to EP switches and temperature control and/or data gathering panels.
22. Hardware, such as inserts, bolts, etc., associated with concrete pads.
23. Cutting and core drilling associated with electrical work.
24. Prime painting, where required for electrical equipment and installation.
25. 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.
26. 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.
27. Provision for temporary light and power.
28. 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.

29. Arc Flash Hazard Analysis

1.03 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.

1.04 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.

1.05 SUBMITTALS

A. Product Data and installation requirements: see Section 01 31 46.

1.06 COORDINATION

A. Coordinate arrangement, mounting, and support of electrical equipment:

1. To allow maximum possible headroom unless specific mounting heights that reduce headroom are indicated.
2. To provide for ease of disconnecting the equipment with minimum interference to other installations.
3. To allow right of way for piping and conduit installed at required slope.
4. So connecting raceways, cables, wireways, cable trays, and busways will 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.

1.07 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.

1.08 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.

1.09 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. Light installations and circuit switching.
   5. Any part of the work called for in the Specifications, or Drawings and as designated by the Architect or Engineers.
   6. 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 for 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

PART 3 - EXECUTION

3.01 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

1.01 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

1.02 SUMMARY

A. Section Includes:
1. Copper building wire rated 600V or less.
2. Aluminum building wire rated 600V or less.
3. Metal-clad cable, Type MC, rated 600V or less.
4. Armored cable, Type AC, rated 600V or less.
5. Tray cable, Type TC, rated 600V or less.
6. Connectors, splices, and terminations rated 600V and less.

1.03 CLICK DEFINITIONS

A. VFC(S): Variable-frequency controller. (System)

B. EPDM: Ethylene-propylene-diene terpolymer rubber.

C. NBR: Acrylonitrile-butadiene rubber.

1.04 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.05 INFORMATIONAL SUBMITTALS

A. Qualification Data: For testing agency or manufacturer's authorized service representative.

B. Field quality-control reports.

1.06 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

2.01 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 NEMAWC 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

2.02 ALUMINUM BUILDING WIRE

A. Description: Flexible, insulated and uninsulated, drawn aluminum 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 NFPA 70, 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: Aluminum, complying with ASTM B 800 and ASTM B 801.

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 NEMAWC 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 XHHW-2: Comply with UL 44.

2.03 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
2. Aluminum, complying with ASTMB800 and ASTMB801.

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.

2.04 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
2. Aluminum, complying with ASTMB800 and ASTMB801.

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.

2.05 PHOTOVOLTAIC CABLE, TYPE PV

A. Description: Flexible, insulated and uninsulated, drawn copper current-carrying conductor with an overall insulation layer or jacket, or both, rated 600 V.

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Encore Wire Corporation
2. General Cable
3. Service wire Co
4. Southwire Company

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. 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 and with ASTM B8 for stranded conductors.

E. Conductor Insulation: Comply with UL 44 and UL 703.

2.06 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.

2.07 TRAY CABLE, TYPE TC

A. Description: A factory assembly of insulated current-carrying conductors with or without an equipment grounding conductor in a nonmetallic jacket.
1. Alpha Wire Company
2. Belden Inc
3. Encore Wire Corporation
4. Okonite Company
5. Service wire Co
6. Southwire Company
7. Wesco

B. 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 UL 1277.
4. Comply with ICEA S-73-532/NEMA WC 57 for TypeTC cables used for control, thermocouple extension, and instrumentation.
5. Comply with ICEA S-95-658/NEMA WC 70 for Type TC cables used for power distribution.
6. Conductor and Cable Marking: Comply with wire and cable marking according to UL's "Wire and Cable Marking and Application Guide."

C. Conductors:
1. Copper, complying with ASTM B3 for bare annealed copper and with ASTM B8 for stranded conductors

2. Aluminum, complying with ASTM B800 and ASTM B801].

D. Ground Conductor: Insulated.

E. Conductor Insulation: Type XHHW-2. Comply with UL 44.

2.08 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

3.01 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.

E. PV Circuits: Copper. Solid for No.10 AWG and smaller; stranded for No.8 AWG and larger.

3.02 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 Crawlspaces: 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. Feeders Installed below Raised Flooring:

E. Feeders in Cable Tray:
   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. Exposed Branch Circuits, Including in Crawlspaces:
   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

G. 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

H. Branch Circuits Concealed in Concrete, below Slabs-on-Grade, and Underground: Type THHN/THWN-2, single conductors in raceway

I. 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

J. Branch Circuits in Cable Tray:
   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

K. Cord Drops and Portable Appliance Connections: Type SO, hard service cord with stainless-steel, wire-mesh, strain relief device at terminations to suit application.

L. 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.

3.03 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."

G. Complete cable tray systems installation according to Section 260536 "Cable Trays for Electrical Systems" prior to installing conductors and cables.

3.04 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.

3.05 IDENTIFICATION

A. Identify and color-code conductors and cables according to Section 260553 "Identification for Electrical Systems."

B. Identify each spare conductor at each end with identity number and location of other end of conductor, and identify as spare conductor.

3.06 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."

3.07 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."

3.08 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 service entrance and feeder conductors for compliance with requirements.
   2. After installing conductors and cables and before electrical circuitry has been energized, test service entrance and feeder conductors and conductors feeding the following critical equipment and services for compliance with requirements:
      a. Main Distribution Switchboards, if separate from the Service equipment
      b. Elevator Banks
      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

1.01 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

1.02 SUMMARY

A. Section includes grounding and bonding systems and equipment, plus the following special applications:
   1. Underground distribution grounding.
   2. Ground bonding common with lightning protection system.

1.03 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.

1.04 ACTION SUBMITTALS

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

1.05 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.

1.06 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

2.01 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.

2.02 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

2.03 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.

2.04 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. Cable Tray Ground Clamp: Mechanical type, zinc-plated malleable iron.

H. Conduit Hubs: Mechanical type, terminal with threaded hub.

I. Ground Rod Clamps: Mechanical type, copper or copper alloy, terminal with socket set screw.

J. Lay-in Lug Connector: Mechanical type, copper rated for direct burial terminal with set screw.

K. Signal Reference Grid Clamp: Mechanical type, stamped-steel terminal with hex head screw.

L. Straps: Solid copper, copper lugs. Rated for 600 A.

M. Tower Ground Clamps: Mechanical type, copper or copper alloy, terminal two-piece clamp.

N. U-Bolt Clamps: Mechanical type, copper or copper alloy, terminal listed for direct burial.

O. 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

3.01 APPLICATIONS

A. Conductors: Install solid conductor for No. 8 AWG and smaller, and stranded conductors for No. 6 AWG and larger unless otherwise indicated.

B. Underground Grounding Conductors: Install bare tinned-copper conductor, No. 2/0 AWG minimum.
   1. Bury at least 24 inches (600 mm) below grade.

C. 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.

D. 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.

3.02 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.

EQUIPMENT GROUNDING

B. Install insulated equipment grounding conductors with all feeders and branch circuits.

C. 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.

D. 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.

E. Water Heater, Heat-Tracing, and Antifrost Heating Cables: Install a separate insulated equipment grounding conductor to each electric water heater and heat-tracing cable. Bond conductor to heater units, piping, connected equipment, and components.

3.03 INSTALLATION

A. Grounding Conductors: Route along shortest and straightest paths possible unless otherwise indicated or required by Code. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.

B. Ground Bonding Common with Lightning Protection System: Comply with NFPA 780 and UL 96 when interconnecting with lightning protection system. Bond electrical power system ground directly to lightning protection system grounding conductor at closest point to electrical service grounding electrode. Use bonding conductor sized same as system grounding electrode conductor, and install in conduit.

C. Ground Rods: Drive rods until tops are 2 inches (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.

D. Bonding Straps and Jumpers: Install in locations accessible for inspection and maintenance except where routed through short lengths of conduit.
1. Bonding to Structure: Bond straps directly to basic structure, taking care not to penetrate any adjacent parts.
2. Bonding to Equipment Mounted on Vibration Isolation Hangers and Supports: Install bonding so vibration is not transmitted to rigidly mounted equipment.
3. Use exothermic-welded connectors for outdoor locations; if a disconnect-type connection is required, use a bolted clamp.

E. Grounding and Bonding for Piping:
1. Metal Water Service Pipe: Install insulated copper grounding conductors, in conduit, from building's main service equipment, or grounding bus, to main metal water service entrances to building. Connect grounding conductors to main metal water service pipes; use a bolted clamp connector or bolt a lug-type connector to a pipe flange by using one of the lug bolts of the flange. Where a dielectric main water fitting is installed, connect grounding conductor on street side of fitting. Bond metal grounding conductor conduit or sleeve to conductor at each end.
2. Water Meter Piping: Use braided-type bonding jumpers to electrically bypass water meters. Connect to pipe with a bolted connector.
3. Bond each aboveground portion of gas piping system downstream from equipment shutoff valve.

F. Bonding Interior Metal Ducts: Bond metal air ducts to equipment grounding conductors of associated fans, blowers, electric heaters, and air cleaners. Install tinned bonding jumper to bond across flexible duct connections to achieve continuity.

G. 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.

H. 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.

3.04 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

1.01 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

1.02 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.

1.03 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.

1.04 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

2.01 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.

2.02 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.

2.03 FABRICATED METAL EQUIPMENT SUPPORT ASSEMBLIES

PART 3 - EXECUTION

3.01 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.

3.02 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.

3.03 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.

3.04 CONCRETE BASES

A. Construct concrete bases of dimensions indicated, but not less than 4 inches (100 mm) larger in both directions than supported unit, and so anchors will be a minimum of 10 bolt diameters from edge of the base.

B. Use 3000-psi (20.7-MPa], 28-day compressive-strength concrete. Concrete materials, reinforcement, and placement requirements are specified in "Cast-in-Place Concrete" and "Miscellaneous Cast-in-Place Concrete" portions of the specifications

C. Anchor equipment to concrete base as follows:
1. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
2. Install anchor bolts to elevations required for proper attachment to supported equipment.
3. Install anchor bolts according to anchor-bolt manufacturer's written instructions.

3.05 PAINTING

A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.
1. Apply paint by brush or spray to provide minimum dry film thickness of 2.0 mils (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

1.01 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

1.02 SUMMARY

A. This Section includes raceways, fittings, boxes, enclosures, and cabinets for electrical wiring.
   1. Section 26 05 36 – Cable Trays for Electrical Systems
   2. 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.

1.03 DEFINITIONS

A. EMT: Electrical metallic tubing.

B. ENT: Electrical nonmetallic tubing.

C. FMC: Flexible metal conduit.

D. IMC: Intermediate metal conduit.

E. LFMC: Liquidtight flexible metal conduit.

F. LFNC: Liquidtight flexible nonmetallic conduit.

G. RNC: Rigid nonmetallic conduit.

1.04 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.

1.05 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

2.01 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.

2.02 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. Arnco 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.

2.03 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. Arnco 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.

2.04 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.

2.05 NONMETALLIC WIREWAYS AND AUXILIARY GUTTERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Hoffman.
2. Lamson & Sessions; Carlon Electrical Products.
3. Legrand Wiremold

B. Listing and Labeling: Nonmetallic wireways and auxiliary gutters shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. Description: Fiberglass polyester, extruded and fabricated to size and shape indicated, with no holes or knockouts. Cover is gasketed with oil-resistant gasket material and fastened with captive screws treated for corrosion resistance. Connections are flanged, with stainless-steel screws and oil-resistant gaskets.

D. 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.

E. Solvents and Adhesives: As recommended by conduit manufacturer.

2.06 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:
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.

2.07 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 12as 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

3.01 RACEWAY APPLICATION

A. Outdoors: Apply raceway products as specified below, unless otherwise indicated:
1. Exposed Conduit: Rigid steel conduit, RNC, Type EPC-80-PVC.
2. Concealed Conduit, Aboveground: Rigid steel conduit RNC, Type EPC-80-PVC.
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.
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. Raceways for Optical Fiber or Communications Cable in Spaces Used for Environmental Air - EMT
a. Within existing facilities where coordination of raceway layout presents significant difficulties: Plenum-type, optical fiber/communications cable raceway may be used where approved by the Engineer.
7. Raceways for Optical Fiber or Communications Cable Risers in Vertical Shafts: - EMT
8. Raceways for Concealed General Purpose Distribution of Optical Fiber or Communications Cable: EMT
9. 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. PVC Externally Coated, Rigid Steel Conduits: Use only fittings listed for use with that material. Patch and seal all joints, nicks, and scrapes in PVC coating after installing conduits and fittings. Use sealant recommended by fitting manufacturer.

E. Install nonferrous conduit or tubing for circuits operating above 60 Hz. Where aluminum raceways are installed for such circuits and pass-through concrete, install in nonmetallic sleeve.

F. Do not install aluminum conduits in contact with concrete.

G. Install surface raceways only where indicated on Drawings.

H. Do not install nonmetallic conduit where ambient temperature exceeds 120 deg F.

3.02 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.

EE. Set nonmetallic floor boxes level. Trim after installation to fit flush with finished floor surface.

3.03 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."

3.04 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."

3.05 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 36

CABLE TRAYS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.01 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

1.02 SUMMARY

A. Section Includes:
1. Ladder cable trays.
2. Wire mesh cable trays.
3. Single-rail cable trays.
4. Trough cable trays.
5. Fiberglass cable trays.

1.03 ACTION SUBMITTALS

A. Product Data: For each type of product.
1. Include data indicating dimensions and finishes for each type of cable tray indicated.

B. Shop Drawings: For each type of cable tray.
1. Show fabrication and installation details of cable trays, including plans, elevations, and sections of components and attachments to other construction elements. Designate components and accessories, including clamps, brackets, hanger rods, splice-plate connectors, expansion-joint assemblies, straight lengths, and fittings.

1.04 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Floor plans and sections, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:
1. Include scaled cable tray layout and relationships between components and adjacent structural, electrical, and mechanical elements.
2. Vertical and horizontal offsets and transitions.
3. Clearances for access above and to side of cable trays.
4. Vertical elevation of cable trays above the floor or below bottom of ceiling structure.
5. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
6. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.

7. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

B. Field quality-control reports.

PART 2 - PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

A. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes in cable tray installed outdoors.
1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

2.02 GENERAL REQUIREMENTS FOR CABLE TRAYS

A. location, application, and grounding.
1. Source Limitations: Obtain cable trays and components from single manufacturer.

B. Sizes and Configurations: See the Cable Tray Schedule on Drawings for specific requirements for types, materials, sizes, and configurations.

C. Structural Performance: See articles on individual cable tray types for specific values for the following parameters:
1. Uniform Load Distribution: Capable of supporting a uniformly distributed load on the indicated support span when supported as a simple span and tested according to NEMA VE 1.
2. Concentrated Load: A load applied at midpoint of span and centerline of tray.
3. Load and Safety Factors: Applicable to both side rails and rung capacities.

2.03 LADDER CABLE TRAYS

A. Basis-of-Design Product: Subject to compliance with requirements, provide Legrand/PW, Ladder Trays or comparable product by one of the following:
1. Allied Tube & Conduit; a Tyco International Ltd. Co.
2. Chalfant Manufacturing Company.
3. Cooper B-Line, Inc.

B. Description:
1. Configuration: Two side rails with transverse rungs welded to side rails.
2. Rung Spacing: 6 inches
3. Radius-Fitting Rung Spacing: 9 inches at center of tray's width.
4. Minimum Cable-Bearing Surface for Rungs: 7/8-inch width with radius edges.
5. No portion of the rungs shall protrude below the bottom plane of side rails.
6. Structural Performance of Each Rung: Capable of supporting a maximum cable load, with a safety factor of 1.5, plus a200-lb concentrated load, when tested according to NEMA VE 1.
7. Minimum Usable Load Depth: 4 inches
8. Straight Section Lengths: 10 feet (except where shorter lengths are required to facilitate tray assembly.
9. Width: 9 inches unless otherwise indicated on Drawings or Owner.

10. Fitting Minimum Radius: 12 inches.

2.04 WIRE-MESH CABLE TRAYS

A. Basis-of-Design Product: Subject to compliance with requirements, provide Legrand/Cablofil; Wire Mesh Cable Trays or comparable product by one of the following:
1. Allied Tube & Conduit; a Tyco International Ltd. Co.
2. Chalfant Manufacturing Company.
3. Cooper B-Line, Inc.

B. Description:
1. Configuration: Wires are formed into a standard 2-by-4-inch (50-by-100-mm) wire mesh pattern with intersecting wires welded together. Mesh sections must have at least one bottom longitudinal wire along entire length of section.
2. Materials: High-strength-steel longitudinal wires with "T" weld.
3. Safety Provisions: Wire ends along wire-basket sides (flanges) rounded during manufacturing to maintain integrity of cables and installer safety.
4. Sizes:
   a. Straight sections shall be furnished in standard 118-inch (3000-mm) lengths.
5. Connector Assemblies: Listed Snap in couplers or factory assembled bolted couplers that mechanically join adjacent tray wires to splice sections together or to create horizontal fittings.
6. Hardware and Fasteners: ASTM F 593 and ASTM F 594 stainless steel, Type 316 or Steel, zinc plated according to ASTM B 633.

2.05 SINGLE-RAIL CABLE TRAYS

A. Basis-of-Design Product: Subject to compliance with requirements, provide Legrand/PW; Single-Rail Cable Trays or comparable product by one of the following:
1. Allied Tube & Conduit.
2. Cooper B-Line, Inc.
3. Mono-Systems, Inc.

B. Description:
1. Configuration: Center rail with extruded-aluminum rungs arranged symmetrically about the center rail.
2. Construction: Aluminum rungs mechanically connected to aluminum center rail in at least two places, with ends finished to protect installers and cables.
3. Rung Spacing: 6 inches o.c.
4. Radius-Fitting Rung Spacing: 9 inches at center of tray's width.
5. Straight Section Lengths: 10 feet except where shorter lengths are required to facilitate tray assembly.
6. Width: 6inches unless otherwise indicated on Drawings/Owner.
7. Support Point: Splice fittings shall be hanger support point.
8. Support Spacing: Support each section at midpoint. Support wall-mounted sections a maximum of one-sixth of the section length from each end.
9. Loading Depth: 4 inches.
10. Maximum Loads: 25 lb/ft.
11. Unbalanced Loads: Maintain cable tray rungs within six degrees of horizontal under all loading conditions.
12. Splicing Assemblies: Bolted type using serrated flange locknuts.

13. Hardware and Fasteners: ASTM F 593 and ASTM F 594 stainless steel, Type 316
14. Splices and Connectors: Protect cables from edges of center rail and do not intrude into cable fill area.

2.06 TROUGH CABLE TRAYS

A. Basis-of-Design Product: Subject to compliance with requirements, provide Legrand/PW; Trough Cable Trays or comparable product by one of the following:
1. Allied Tube & Conduit.
2. Chalfant Manufacturing Company.
3. Cooper B-Line, Inc.

B. Description:
1. Configuration: Two longitudinal members (side rails) with a solid sheet over rungs, or corrugated sheet with both edges welded to the side rails.
2. Bottom Type: Corrugations shall be spaced a maximum of 2 inches o.c. and have a minimum flat bearing surface of 1 inches.
3. Structural Performance: Capable of supporting a maximum cable load, with a safety factor of 1.5, plus a 200-lb concentrated load, when tested according to NEMA VE 1.
4. Minimum Usable Load Depth: 4 inches.
5. Straight Section Lengths: 10 feet except where shorter lengths are required to facilitate tray assembly.
6. Width: 9 inches unless otherwise indicated on Drawings/Owner.
7. Fitting Minimum Radius: 12 inches.
8. Class Designation: Comply with NEMA VE 1,
9. Splicing Assemblies: Bolted type using serrated flange locknuts.
10. Hardware and Fasteners: ASTM F 593 and ASTM F 594 stainless steel, Type 316

2.07 FIBERGLASS CABLE TRAYS

A. Basis-of-Design Product: Subject to compliance with requirements, provide Legrand/PW; Fiberglass Ladder or comparable product by one of the following:
1. Allied Tube & Conduit.
2. Cooper B-Line, Inc.
3. Enduro Systems, Inc.

B. Description:
1. Configuration: Two longitudinal members with rounded edges and smooth surfaces, complying with NEMA FG 1.
2. Materials: Straight section structural elements; side rails, rungs and splice plates shall be pultruded from glass-fiber-reinforced vinyl ester resin, complying with NEMA FG 1.
3. Fasteners: Fiberglass-encapsulated, ASTM F 593 and ASTM F 594 stainless steel, Type 316. Design fasteners so that no metal is visible when fully assembled and tightened. Fastener encapsulation shall not be damaged when torqued to manufacturer's recommended value.
4. Minimum Usable Load Depth: 3 inches according to NEMA FG 1.
5. Straight Section Lengths: 10 feet.
6. Width: 9 inches unless otherwise indicated on Drawings/Owner.

2.08 MATERIALS AND FINISHES

A. Steel:
1. Straight Section and Fitting Side Rails and Rungs: Steel complies with the minimum mechanical properties of ASTM A 1011/A 1011M, SS, Grade 33.
2. Steel Tray Splice Plates: ASTM A 1011/A 1011M.
3. Fasteners: Steel complies with the minimum mechanical properties of ASTM A 510/A 510M, Grade 1008.
   a. Hardware Chromium-zinc plated, ASTM F 1136.
4. Finish: Electrogalvanized before fabrication.
   a. Standard: Comply with ASTM B 633.
   b. Hardware: Galvanized, ASTM B 633.
5. Finish: Epoxy-resin paint.
   a. Hardware: Stainless steel, Type 316, ASTM F 593 and ASTM F 594.
6. Finish: Factory-standard primer, ready for field painting, with zinc-plated hardware according to ASTM B 633.

B. Aluminum:
1. Materials: Alloy 6063-T6 according to ANSI H35.1/H 35.1M for extruded components, and Alloy 5052-H32 according to ANSI H35.1/H 35.1M for fabricated parts.
2. Hardware: Stainless steel, Type 316, ASTM F 593 and ASTM F 594.
3. Hardware for Aluminum Cable Tray Used Outdoors: Stainless steel, Type 316, ASTM F 593 and ASTM F 594.

C. Stainless Steel:
1. Materials: Low-carbon, passivated per ASTM A 380, stainless steel, Type, ASTM F 593 and ASTM F 594.
2. Hardware for Stainless-Steel Cable Tray Used Outdoors: Stainless steel, Type 316, ASTM F 593 and ASTM F 594.

2.09 CABLE TRAY ACCESSORIES

A. Fittings: Tees, crosses, risers, elbows, and other fittings as indicated, of same materials and finishes as cable tray.

B. Covers: Louvered type made of same materials and with same finishes as cable tray.

C. Barrier Strips: Same materials and finishes as for cable tray.

D. Cable tray supports and connectors, including bonding jumpers, as recommended by cable tray manufacturer.

2.10 WARNING SIGNS

A. Lettering: 1-1/2-inch high, black letters on yellow background with legend "Warning! Not To Be Used as Walkway, Ladder, or Support for Ladders or Personnel."

B. Comply with requirements for fasteners in Section 260553 "Identification for Electrical Systems."

2.11 SOURCE QUALITY CONTROL

A. Testing: Test and inspect cable trays according to NEMA FG 1 or NEMA VE 1 as appropriate for the materials being specified in the Products section.

PART 3 - EXECUTION

3.01 CABLE TRAY INSTALLATION

A. Install cable trays according to NEMA FG 1.

B. Install cable trays as a complete system, including fasteners, hold-down clips, support systems, barrier strips, adjustable horizontal and vertical splice plates, elbows, reducers, tees, crosses, cable dropouts, adapters, covers, and bonding.

C. Install cable trays so that the tray is accessible for cable installation and all splices are accessible for inspection and adjustment.

D. Remove burrs and sharp edges from cable trays.

E. Join aluminum cable tray with splice plates; use rib-neck carriage bolts and locknuts.

F. Fasten cable tray supports to building structure.

G. Design fasteners and supports to carry cable tray, the cables, and a concentrated load of 200 lb. Comply with requirements in Section 260529 "Hangers and Supports for Electrical Systems.

H. Place supports so that spans do not exceed maximum spans on schedules and provide clearances shown on Drawings. Install intermediate supports when cable weight exceeds the load-carrying capacity of the tray rungs.

I. Construct supports from channel members, threaded rods, and other appurtenances furnished by cable tray manufacturer. Arrange supports in trapeze or wall-bracket form as required by application.

J. Support bus assembly to prevent twisting from eccentric loading.

K. Install center-hung supports for single-rail trays designed for 60 versus 40 percent eccentric loading condition, with a safety factor of 3.

L. Locate and install supports according to NEMA FG 1. Do not install more than one cable tray splice between supports.

M. Make changes in direction and elevation using manufacturer's recommended fittings.

N. Make cable tray connections using manufacturer's recommended fittings.

O. Seal penetrations through fire and smoke barriers. Comply with requirements in Section 078400 "Firestops and Smoke Seals."

P. Install capped metal sleeves for future cables through firestop-sealed cable tray penetrations of fire and smoke barriers.

Q. Install cable trays with enough workspace to permit access for installing cables.

R. Install permanent covers, on vertical tray runs as required by NFPA 70, after installing cable. Install cover clamps according to NEMA VE 2.

S. Clamp covers on cable trays installed outdoors with heavy-duty clamps.

T. Install warning signs in visible locations on or near cable trays after cable tray installation.

3.02 CABLE TRAY GROUNDING

A. Ground cable trays according to NFPA 70 unless additional grounding is specified. Comply with requirements in Section 260526 "Grounding and Bonding for Electrical Systems."

B. Cable trays with electrical power conductors shall be bonded together with splice plates listed for grounding purposes or with listed bonding jumpers.

C. Cable trays with powder-coat paint should have coating mask completely removed at factory supplied grounding location and splice with listed connectors as recommended by manufacturer. After completing splice-to-grounding-bolt attachment, repair the coated surfaces with coating materials recommended by cable tray manufacturer.

D. Bond cable trays to power source for cables contained within with bonding conductors sized according to NFPA 70, Article 250.122, "Size of Equipment Grounding Conductors."

3.03 CABLE INSTALLATION

A. Install cables only when each cable tray run has been completed and inspected.

B. Fasten cables on vertical runs to cable trays every 18 inches.

C. Fasten and support cables that pass from one cable tray to another or drop from cable trays to equipment enclosures. Fasten cables to the cable tray at the point of exit and support cables independent of the enclosure. The cable length between cable trays or between cable tray and enclosure shall be no more than 72 inches.

D. Tie MI cables down every 36 inches where required to provide a 2-hour fire rating and every 72 inches elsewhere.

E. In existing construction, remove inactive or dead cables from cable trays.

3.04 CONNECTIONS

A. Connect raceways to cable trays according to requirements in NEMA VE 2 and NEMA FG 1.

3.05 FIELD QUALITY CONTROL

1. After installing cable trays and after electrical circuitry has been energized, survey for compliance with requirements.

2. Visually inspect cable insulation for damage. Correct sharp corners, protuberances in cable trays, vibrations, and thermal expansion and contraction conditions, which may cause or have caused damage.
3. Verify that the number, size, and voltage of cables in cable trays do not exceed that permitted by NFPA 70. Verify that communications or data-processing circuits are separated from power circuits by barriers or are installed in separate cable trays.
4. Verify that there are no intruding items such as pipes, hangers, or other equipment in the cable tray.
5. Remove dust deposits, industrial process materials, trash of any description, and any blockage of tray ventilation.
6. Visually inspect each cable tray joint and each ground connection for mechanical continuity. Check bolted connections between sections for corrosion. Clean and retorque in suspect areas.
7. Check for improperly sized or installed bonding jumpers.
8. Check for missing, incorrect, or damaged bolts, bolt heads, or nuts. When found, replace with specified hardware.
9. Perform visual and mechanical checks for adequacy of cable tray grounding; verify that all takeoff raceways are bonded to cable trays. Test entire cable tray system for continuity. Maximum allowable resistance is 1 ohm.

B. Prepare test and inspection reports.

3.06 PROTECTION

A. Protect installed cable trays and cables.
1. Install temporary protection for cables in open trays to safeguard exposed cables against falling objects or debris during construction. Temporary protection for cables and cable tray can be constructed of wood or metal materials and shall remain in place until the risk of damage is over.
2. Repair damage to galvanized finishes with zinc-rich paint recommended by cable tray manufacturer.
3. Repair damage to paint finishes with matching touchup coating recommended by cable tray manufacturer.

END OF SECTION 26 05 36

SECTION 26 05 44

SLEEVES AND SLEEVE SEALS FOR ELECTRICAL RACEWAYS AND CABLING

PART 1 - GENERAL

1.01 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

1.02 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.

1.03 ACTION SUBMITTALS

A. Product Data: For each type of product.

PART 2 - PRODUCTS

2.01 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.

2.02 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:
   b. Advance Products & systems
   c. CALPICO, Inc
   d. Metraflex Company
   e. Pipeline Seal and Insulator
   f. 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.

2.03 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:
   b. HOLDRITE
   c. Presealed Systems

2.04 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.

2.05 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

3.01 SLEEVE INSTALLATION FOR NON-FIRE-RATED ELECTRICAL PENETRATIONS

A. Comply with NECA 1.

B. Comply with NEMA VE 2 for cable tray and cable penetrations.

C. Sleeves for Conduits Penetrating Above-Grade Non-Fire-Rated Concrete and Masonry-Unit Floors and Walls:
   1. Interior Penetrations of Non-Fire-Rated Walls and Floors:
      a. Seal annular space between sleeve and raceway or cable, using joint sealant appropriate for size, depth, and location of joint.
      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.

3.02 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.

3.03 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

1.01 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.

1.02 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.

1.03 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

2.01 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 260573.19 "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

2.02 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. Raceways and Cables Carrying Circuits at More Than 600 V:
   1. Black letters on an orange field.
   2. Legend: "DANGER - CONCEALED HIGH VOLTAGE WIRING."

C. Warning Label Colors:
   1. Identify system voltage with black letters on an orange background.

D. 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."

E. Equipment Identification Labels:
   1. Black letters on a white field.

2.03 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.

2.04 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.

2.05 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

2.06 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.

2.07 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.

2.08 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.

2.09 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

3.01 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.

3.02 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.

3.03 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. Switchgear.
      e. Switchboards.
      f. Transformers: Label that includes tag designation indicated on Drawings for the transformer, feeder, and panelboards or equipment supplied by the secondary.
      g. Substations.
      h. Emergency system boxes and enclosures.
      i. Enclosed switches.
      j. Enclosed circuit breakers.
      k. Enclosed controllers.
      l. Variable-speed controllers.
      m. Push-button stations.
      n. Power-transfer equipment.
      o. Contactors.
      p. Remote-controlled switches, dimmer modules, and control devices.

q. Battery-inverter units.
r. Monitoring and control equipment.
s. UPS equipment.

END OF SECTION 26 05 53

SECTION 26 05 73.19

ARC-FLASH HAZARD ANALYSIS

PART 1 - GENERAL

1.01 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

1.02 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 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.

1.03 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."

1.04 ACTION SUBMITTALS

A. Product Data: For computer software program to be used for studies.

B. If formal completion of studies will cause delay in equipment manufacturing, obtain approval from Architect 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.

1.05 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.

1.06 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.

1.07 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 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 program 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 program 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

2.01 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.

B. Comply with IEEE 1584 and NFPA 70E.

2.02 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. Transformer kilovolt ampere (kVA) and voltage ratings, including derating factors and environmental conditions.
   4. Motor and generator designations and kVA ratings.
   5. Switchgear, switchboard, motor-control center, panelboard designations, and ratings.

D. Study Input Data: As described in "Power System Data" Article.

E. 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.

F. 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.

G. Fault study input data, case descriptions, and fault-current calculations including a definition of terms and guide for interpretation of computer printout.

2.03 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 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 shall be machine printed, with no field-applied markings.

PART 3 - EXECUTION

3.01 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.

3.02 ARC-FLASH HAZARD ANALYSIS

A. Comply with NFPA 70E and its Annex D for hazard analysis study.

B. 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 85 percent of maximum short-circuit current according to IEEE 1584 recommendations.
3. Calculate arc-flash energy at 38 percent of maximum short-circuit current according to NFPA 70E recommendations.
4. Calculate arc-flash energy with the utility contribution at a minimum and assume no motor contribution.

C. Calculate the arc-flash protection boundary and incident energy at locations in electrical distribution system where personnel could perform work on energized parts.

D. Include medium- and low-voltage equipment locations, except equipment rated 240 V ac or less fed from transformers less than 125 kVA.

E. Calculate the limited, restricted, and prohibited approach boundaries for each location.

F. 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).

G. 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.

H. Base arc-flash calculations on actual overcurrent protective device clearing time. Cap maximum clearing time at two seconds based on IEEE 1584,

I. Obtain all data necessary for conduct of the arc-flash hazard analysis.

1. Verify completeness of data supplied on one-line diagram on Drawings. Call discrepancies to Engineers's attention.
2. For new equipment, use characteristics from approved submittals under provisions of action submittals and information submittals for this Project.
3. For existing equipment, whether or not relocated, obtain required electrical distribution system data by field investigation and surveys conducted by qualified technicians and engineers.

J. Each piece of equipment listed below shall have an arc-flash label applied to it:
1. Motor-control center.
2. Low-voltage switchboard.
3. Switchgear.
4. Medium-voltage switch.
5. Medium voltage transformers
6. Low voltage transformers
7. Panelboard and safety switch.
8. Control panel.
9. Starter.
10. Contactor.
11. Variable Frequency Drive.

K. 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.

3.03 APPLICATION OF WARNING LABELS

A. Install arc-flash warning labels under the direct supervision and control of Power System Analysis Specialist.

3.04 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 73.19

SECTION 26 24 16

PANELBOARDS

PART 1 - GENERAL

1.01 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

1.02 SUMMARY

A. Section Includes:
1. Distribution panelboards.
2. Lighting and appliance branch-circuit panelboards.
3. Load centers.
4. Electronic-grade panelboards.

1.03 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.

1.04 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.

1.05 INFORMATIONAL SUBMITTALS

A. Qualification Data: For testing agency.

B. Panelboard Schedules: For installation in panelboards. Submit final versions after load balancing.

1.06 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.

1.07 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.

1.08 QUALITY ASSURANCE

A. Manufacturer Qualifications: ISO 9001 or 9002 certified.

1.09 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.

B. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace SPD that fails in materials or workmanship within specified warranty period.
   1. SPD Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.01 PANELBOARDS AND LOAD CENTERS COMMON 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: Flush and Surface - mounted, dead-front cabinets.
   1. Rated for environmental conditions at installed location.
      a. Indoor Dry and Clean Locations: NEMA 250, Type 1
      b. Outdoor Locations: NEMA 250, Type 3R
      c. Kitchen and Wash-Down Areas: NEMA 250, Type 4X, stainless steel.
      d. Other Wet or Damp Indoor Locations: NEMA 250, Type 4
      e. 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: Where main breaker for panelboards is specified it shall be individually mounted. Branch mounted breakers are not acceptable.

H. Phase, Neutral, and Ground Buses:
   1. Materia; 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 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 same end of 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: Rated for series-connected system with integral or remote upstream overcurrent protective devices and labeled by an NRTL. Include label or manual with size and type of allowable upstream and branch devices listed and labeled by an NRTL for series-connected short-circuit rating.
   1. Panelboards rated 240 V or less shall have short-circuit ratings as shown on Drawings, but not less than 10,000 A rms symmetrical.
   2. Panelboards rated above 240 V and less than 600 V shall have short-circuit ratings as shown on Drawings, but not less than 14,000 A rms symmetrical.

K. 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. Panelboards and overcurrent protective devices rated above 240 V and less than 600 V shall have short-circuit ratings as shown on Drawings, but not less than 14,000 A rms symmetrical.

2.02 PERFORMANCE REQUIREMENTS

A. Surge Suppression: Factory installed as an integral part of indicated panelboards, complying with UL 1449 SPD Type 1.

2.03 POWER 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, distribution type.

C. Doors: Secured with vault-type latch with tumbler lock; keyed alike.
1. For doors more than 36 inches (914 mm) high, provide two latches, keyed alike.

D. Mains: Indicated on panelboard directory.

E. Branch Overcurrent Protective Devices for Circuit-Breaker Frame Sizes 125 A and Smaller: Bolt-on circuit breakers.

F. Branch Overcurrent Protective Devices for Circuit-Breaker Frame Sizes Larger Than 125 A: Bolt-on circuit breakers.

G. Branch Overcurrent Protective Devices: Fused switches.

H. 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.

2.04 LIGHTING AND APPLIANCE 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.

2.05 LOAD CENTERS

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. Load Centers: Comply with UL 67.

C. Mains: Circuit breaker or lugs only indicated on plan.

D. Branch Overcurrent Protective Devices: Plug-in circuit breakers, replaceable without disturbing adjacent units.

E. Doors: Concealed hinges secured with flush latch with tumbler lock; keyed alike.

F. Conductor Connectors: Mechanical type for main, neutral, and ground lugs and buses.

2.06 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.

2.07 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

3.01 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.

3.02 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 accessible location.

3.03 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.

3.04 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.

3.05 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.

3.06 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

1.01 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

1.02 SUMMARY

A. Section Includes:
1. Standard-grade receptacles, 125 V, 20 A.
2. USB receptacles.
3. GFCI receptacles, 125 V, 20 A.
4. SPD receptacles, 125 V, 20 A.
5. Hazardous (classified) location receptacles.
6. Twist-locking receptacles.
7. Pendant cord-connector devices.
8. Cord and plug sets.
9. Toggle switches, 120/277 V, 20 A.
10. Decorator-style devices, 20 A.
11. Occupancy sensors.
12. Digital timer light switches.
13. Residential devices.
14. Wall-box dimmers.
15. Wall plates.
16. Floor service fittings.
17. Poke-through assemblies.
18. Prefabricated multioutlet assemblies.
19. Service poles.

1.03 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.

G. SPD: Surge protective device.

1.04 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.

1.05 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

1.06 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.

1.07 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

2.01 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.

2.02 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. Tamper-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.
3. Configuration: NEMA WD 6, Configuration 5-20R.
4. Standards: Comply with UL 498 and FS W-C-596.

C. 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.

D. 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.

2.03 STANDARD-GRADE RECEPTACLES, 125 V, 15 A

A. Duplex Receptacles, 125 V, 15 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 5-15R.
4. Standards: Comply with UL 498 and FS W-C-596.

B. Tamper-Resistant Duplex Receptacles, 125 V, 15 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.
3. Configuration: NEMA WD 6, Configuration 5-15R.
4. Standards: Comply with UL 498 and FS W-C-596.
5.

C. Weather-Resistant Duplex Receptacle, 125 V, 15 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 5-15R.
4. Standards: Comply with UL 498.

D. Tamper- and Weather-Resistant Duplex Receptacles, 125 V, 15 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 5-15R.
4. Standards: Comply with UL 498.

2.04 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**] [**Non-feed**] through.
5. Standards: Comply with UL 498, UL 943 Class A, and FS W-C-596.

B. Tamper-Resistant 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. Integral shutters that operate only when a plug is inserted in the receptacle.
3. Configuration: NEMA WD 6, Configuration 5-20R.
4. Type: Feed through.

C. Tamper- and Weather-Resistant, GFCI 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: 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.
3. Configuration: NEMA WD 6, Configuration 5-15R.
4. Type: **Feed** through.
5. Standards: Comply with UL 498 and UL 943 Class A.

2.05 TWIST-LOCKING RECEPTACLES

A. Twist-Lock, Single Receptacles, 120 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. Configuration: NEMA WD 6, Configuration L5-20R.
3. Standards: Comply with UL 498.

B. Twist-Lock, Single Receptacles, 250 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. Configuration: NEMA WD 6, Configuration L6-20R.
3. Standards: Comply with UL 498.

C. Twist-Lock, Single Receptacles, 277 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. Configuration: NEMA WD 6, Configuration L7-20R.
3. Standards: Comply with UL 498.

D. Twist-Lock, Isolated-Ground, Single 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. Grounding: Equipment grounding contacts shall be connected only to green grounding screw terminal of the device and with inherent electrical isolation from mounting strap. Isolation shall be integral to receptacle construction and not dependent on removable parts.
3. Configuration: NEMA WD 6, Configuration L5-20R.
4. Standards: Comply with UL 498.

2.06 PENDANT CORD-CONNECTOR DEVICES

A. Description: Matching, locking-type plug and receptacle body connector, heavy-duty grade.
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

B. Configuration: NEMA WD 6, Configurations L5-20P and L5-20R.

C. Body: Nylon, with screw-open, cable-gripping jaws and provision for attaching external cable grip.

D. Standards: Comply with FS W-C-596.

2.07 CORD AND PLUG SETS

A. Match voltage and current ratings and number of conductors to requirements of equipment being connected.

B. Cord: Rubber-insulated, stranded-copper conductors, with Type SOW-A jacket; with green-insulated grounding conductor and ampacity of at least 130 percent of the equipment rating.

C. Plug: Nylon body and integral cable-clamping jaws. Match cord and receptacle type for connection.

2.08 TOGGLE SWITCHES, 120/277 V, 15 A

A. Single-Pole Switches, 120/277 V, 15 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. Standards: Comply with UL 20 and FS W-S-896.

B. Two-Pole Switches, 120/277 V, 15 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. Comply with UL 20 and FS W-S-896.
3. Description: Contact surfaces treated with a coating that kills 99.9 percent of certain common bacteria within two hours when regularly and properly cleaned.
4. Standards: Comply with UL 20 and FS W-S-896.

C. Three-Way Switches, 120/277 V, 15 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. Comply with UL 20 and FS W-S-896.

D. Four-Way Switches, 120/277 V, 15 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. Standards: Comply with UL 20 and FS W-S-896.

E. Pilot-Light, Single-Pole Switches: 120/277 V, 15 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: Illuminated when switch is off.
   3. Standards: Comply with UL 20 and FS W-S-896.

F. Lighted Single-Pole Switches, 120/277 V, 15 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: Handle illuminated when switch is off.
   3. Standards: Comply with NEMA WD 1, UL 20, and FS W-S-896.

G. Key-Operated, Single-Pole Switches, 120/277 V, 15 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: Factory-supplied key in lieu of switch handle.
   3. Standards: Comply with UL 20 and FS W-S-896.

H. Single-Pole, Double-Throw, Momentary-Contact, Center-off Switches, 120/277 V, 15 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: For use with mechanically held lighting contactors.
   3. Standards: Comply with NEMA WD 1, UL 20, and FS W-S-896.

I. Key-Operated, Single-Pole, Double-Throw, Momentary-Contact, Center-off Switches, 120/277 V, 15 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: For use with mechanically held lighting contactors, with factory-supplied key in lieu of switch handle.
3. Standards: Comply with NEMA WD 1, UL 20, and FS W-S-896.

2.09 TOGGLE SWITCHES, 120/277 V, 20 A

A. Single-Pole Switches, 120/277 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. Standards: Comply with UL 20 and FS W-S-896.

B. Antimicrobial, Single-Pole Switches, 120/277 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: Contact surfaces treated with a coating that kills 99.9 percent of certain common bacteria within two hours when regularly and properly cleaned.
3. Standards: Comply with UL 20 and FS W-S-896.

C. Two-Pole Switches, 120/277 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. Comply with UL 20 and FS W-S-896.

D. Antimicrobial, Double-Pole Switches, 120/277 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: Contact surfaces treated with a coating that kills 99.9 percent of certain common bacteria within two hours when regularly and properly cleaned.
3. Standards: Comply with UL 20 and FS W-S-896.

E. Three-Way Switches, 120/277 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. Comply with UL 20 and FS W-S-896.

F. Antimicrobial, Three-Way Switches, 120/277 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: Contact surfaces treated with a coating that kills 99.9 percent of certain common bacteria within two hours when regularly and properly cleaned.
   3. Standards: Comply with UL 20 and FS W-S-896.

G. Four-Way Switches, 120/277 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. Standards: Comply with UL 20 and FS W-S-896.

H. Pilot-Light, Single-Pole Switches: 120/277 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: Illuminated when switch is on.
   3. Standards: Comply with UL 20 and FS W-S-896.

I. Lighted Single-Pole Switches, 120/277 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: Handle illuminated when switch is off.
   3. Standards: Comply with NEMA WD 1, UL 20, and FS W-S-896.

J. Key-Operated, Single-Pole Switches, 120/277 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: Factory-supplied key in lieu of switch handle.
3. Standards: Comply with UL 20 and FS W-S-896.

K. Single-Pole, Double-Throw, Momentary-Contact, Center-off Switches, 120/277 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: For use with mechanically held lighting contactors.
3. Standards: Comply with NEMA WD 1, UL 20, and FS W-S-896.

L. Key-Operated, Single-Pole, Double-Throw, Momentary-Contact, Center-off Switches, 120/277 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: For use with mechanically held lighting contactors, with factory-supplied key in lieu of switch handle.
3. Standards: Comply with NEMA WD 1, UL 20, and FS W-S-896.

2.10 DECORATOR-STYLE DEVICES, 15 A

A. Decorator Duplex Receptacles, 125 V, 15 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. Square face.
3. Configuration: NEMA WD 6, Configuration 5-15R.
4. Standards: Comply with UL 498.

B. Decorator, Tamper-Resistant, Duplex Receptacles, 125 V, 15 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 5-15R.
4. Standards: Comply with UL 498.

C. Decorator, Tamper- and Weather-Resistant, Duplex Receptacles, 125 V, 15 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 5-15R.
4. Standards: Comply with UL 498.

D. Decorator Single-Pole Switches, 120/277 V, 15 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. Comply with UL 20.

E. Decorator Single-Pole Lighted Switches,120/277 V, 15 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: Square face illuminated when circuit is switched off.
3. Standards: Comply with UL 20.

F. Decorator, Antimicrobial, Single-Pole Switches, 120/277 V, 15 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: Contact surfaces treated with a coating that kills 99.9 percent of certain common bacteria within two hours when regularly and properly cleaned.
3. Standards: Comply with UL 20 and FS W-S-896.

2.11 DECORATOR-STYLE DEVICES, 20 A

A. Decorator 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. Square face.
3. Configuration: NEMA WD 6, Configuration 5-20R.
4. Standards: Comply with UL 498.

B. Decorator Tamper-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.

C. Decorator, 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.

D. Decorator Single-Pole Switches, 120/277 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. Comply with UL 20.

E. Decorator Single-Pole Lighted Switches,120/277 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: Square face illuminated when circuit is switched off.

3. Standards: Comply with UL 20.

F. Decorator, Antimicrobial, Single-Pole Switches, 120/277 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: Contact surfaces treated with a coating that kills 99.9 percent of certain common bacteria within two hours when regularly and properly cleaned.
3. Standards: Comply with UL 20 and FS W-S-896.

2.12 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.

2.13 FLOOR SERVICE FITTINGS

A. Flush-Type Floor Service Fittings:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
a. Hubbell Incorporated
b. Arrow Hart
c. Thomas & Betts
d. Wiremold/Legrand
2. Description: Type: Modular, flush-type, dual-service units suitable for wiring method used, with cover flush with finished floor.
3. Compartments: Barrier separates power from voice and data communication cabling.
4. Power Receptacle: NEMA WD 6 Configuration 5-20R, gray finish, unless otherwise indicated.
5. Data Communication Outlet: Blank cover with bushed cable opening, keyed, color-coded, RJ-45 jacks for twisted pair cable.

B. Flap-Type Service Fittings:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Hubbell Incorporated
   b. Arrow Hart
   c. Thomas & Betts
2. Description: Type: Modular, flap-type, dual-service units suitable for wiring method used, with flaps flush with finished floor.
3. Compartments: Barrier separates power from voice and data communication cabling.
4. Flaps: Round, die-cast aluminum with satin finish.
5. Service Plate: Same finish as flaps.
6. Power Receptacle: NEMA WD 6 Configuration 5-20R, gray finish, unless otherwise indicated.
7. Data Communication Outlet: Blank cover with bushed cable opening. RJ-45 jacks for twisted pair cable.

C. Above-Floor Service Fittings:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Hubbell Incorporated
   b. Leviton Manufacturing Co.
   c. Thomas & Betts
   d. Wiremold/Legrand
2. Description: Type: Modular, above-floor, dual-service units suitable for wiring method used.
3. Compartments: Barrier separates power from voice and data communication cabling.
4. Service Plate: Round, die-cast aluminum with satin finish.
5. Power Receptacle: NEMA WD 6 Configuration 5-20R, gray finish, unless otherwise indicated.
6. Data Communication Outlet: Blank cover with bushed cable opening.] [Two modular, keyed, color-coded, RJ-45 jacks for twisted pair cable.

2.14 POKE-THROUGH ASSEMBLIES

A. Description: Factory-fabricated and -wired assembly of below-floor junction box with multichanneled, through-floor raceway/firestop unit and detachable matching floor service-outlet assembly.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Hubbell Incorporated
   b. Thomas & Betts
   c. Wiremold/Legrand
   d. Pass & Seymour

B. Standards: Comply with scrub water exclusion requirements in UL 514.

C. Service-Outlet Assembly: Flush type with two simplex receptacles and space for two RJ-45 jacks.

D. Size: Selected to fit nominal 4-inch (100-mm) cored holes in floor and matched to floor thickness.

E. Fire Rating: Unit is listed and labeled for fire rating of floor-ceiling assembly.

F. Closure Plug: Arranged to close unused 4-inch (100-mm) cored openings and reestablish fire rating of floor.

G. Wiring Raceways and Compartments: For a minimum of four No. 12 AWG conductors and a minimum of two, four-pair cables.

2.15 PREFABRICATED MULTIOUTLET ASSEMBLIES

A. Description: Two-piece surface metal raceway, with factory-wired multioutlet harness.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
a. Hubbell Incorporated
b. Wiremold/Legrand

B. Components shall be products from single manufacturer designed for use as a complete, matching assembly of raceways and receptacles.

C. Raceway Material: Metal, with manufacturer's standard finish.

D. Multioutlet Harness:
1. Receptacles: 15-A, 125-V, NEMA WD 6 Configuration 5-15R receptacles complying with NEMA WD 1, UL 498, and FS W-C-596.
2. Receptacle Spacing: 6 inches (150 mm).
3. Wiring: No. 12 AWG solid, Type THHN copper, two circuit, connecting alternating receptacles.

PART 3 - EXECUTION

3.01 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. Pigtailing 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. Dimmers:
1. Install dimmers within terms of their listing.
2. Verify that dimmers used for fan-speed control are listed for that application.
3. Install unshared neutral conductors online and load side of dimmers according to manufacturers' device, listing conditions in the written instructions.

H. Arrangement of Devices: Unless otherwise indicated, mount flush, with long dimension vertical and with grounding terminal of receptacles on top. Group adjacent switches under single, multigang wall plates.

I. Adjust locations of floor service outlets and service poles to suit arrangement of partitions and furnishings.

3.02 GFCI RECEPTACLES

A. Install non-feed-through GFCI receptacles where protection of downstream receptacles is not required.

3.03 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.

3.04 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 device 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

1.01 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. Motor-control centers.
      c. Panelboards.
      d. Switchboards.
      e. Enclosed controllers.
      f. Enclosed switches.
   2. Spare-fuse cabinets.

1.02 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.
   4. Fuse sizes for elevator feeders and elevator disconnect switches.

1.03 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 electronic format suitable for use in coordination software] [and] [in PDF format].
4. Coordination charts and tables and related data.

1.04 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.

1.05 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

2.01 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.

2.02 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
   3. Type J: 600-V, zero- to 600-A rating, 200 kAIC
   4. Type L: 600-V, 601- to 6000-A rating, 200 kAIC
   5. Type T: 250-V, zero- to 1200-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.

2.03 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

3.01 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.

3.02 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.

3.03 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

3.04 IDENTIFICATION

A. Install labels complying with requirements for identification specified in Section 260553 "Identification for Electrical Systems" and 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

1.01 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

1.02 SUMMARY

A. Section Includes:
1. Fusible switches.
2. Nonfusible switches.
3. Receptacle switches.
4. Shunt trip switches.
5. Molded-case circuit breakers (MCCBs).
6. Molded-case switches.
7. Enclosures.

1.03 DEFINITIONS

A. NC: Normally closed.

B. NO: Normally open.

C. SPDT: Single pole, double throw.

1.04 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.

1.05 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.

1.06 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For enclosed switches and circuit breakers to include in emergency, operation, and maintenance manuals.

1.07 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.

1.08 QUALITY ASSURANCE

A. Testing Qualifications: Accredited by NETA.
1. Testing Contractor’s Field Supervisor: to manufacturer specifications

1.09 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

2.01 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."

2.02 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. Product Selection for Restricted Space: Drawings indicate maximum dimensions for enclosed switches and circuit breakers, including clearances between enclosures, and adjacent surfaces and other items. Comply with indicated maximum dimensions.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by an NRTL, and marked for intended location and application.

D. 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.

2.03 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.

3. Service-Rated Switches: Labeled for use as service equipment.

2.04 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 GD, General Duty, Three Pole, Single Throw, 240-V ac, 600 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, lockable handle with capability to accept two padlocks, and interlocked with cover in closed position.

C. 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

D. Accessories:
1. Hookstick Handle: Allows use of a hookstick to operate the handle.
2. Lugs: Mechanical type, suitable for number, size, and conductor material.
3. Service-Rated Switches: Labeled for use as service equipment.

2.05 RECEPTACLE SWITCHES

a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
2. Eaton
3. General electric Company
4. Siemens Industry, Inc
5. Square D, by Schneider electric

B. Type HD, Heavy-Duty, Three Pole, Single-Throw Fusible Switch: 240-V ac, 30 – 200A; UL 98 and NEMA KS 1; horsepower rated, with clips or bolt pads to accommodate indicated fuses; lockable handle with capability to accept three padlocks; interlocked with cover in closed position.

C. Type HD, Heavy-Duty, Three Pole, Single-Throw Nonfusible Switch: 240-V ac, 30-100A; UL 98 and NEMA KS 1; horsepower rated, lockable handle with capability to accept three padlocks; interlocked with cover in closed position.

D. Interlocking Linkage: Provided between the receptacle and switch mechanism to prevent inserting or removing plug while switch is in the on position, inserting any plug other than specified, and turning switch on if an incorrect plug is inserted or correct plug has not been fully inserted into the receptacle.

E. Receptacle: Polarized, three-phase, four-wire receptacle (fourth wire connected to enclosure ground lug).

F. Accessories:
1. Hookstick Handle: Allows use of a hookstick to operate the handle.

2. Lugs: Mechanical type, suitable for number, size, and conductor material.
3. Service-Rated Switches: Labeled for use as service equipment.

2.06 SHUNT TRIP SWITCHES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Bussman (Eaton)
2. Littlefuse, Inc.
3. Mersen USA

B. General Requirements: Comply with ASME A17.1**,** UL 50, and UL 98, with Class J fuse block and 200-kA interrupting and short-circuit current rating.

C. Type HD, Heavy-Duty, Three Pole, Single-Throw Fusible Switch: 240-V ac, 30-200A; UL 98 and NEMA KS 1; integral shunt trip mechanism; horsepower rated, with clips or bolt pads to accommodate specified and indicated fuses; lockable handle with capability to accept three padlocks; interlocked with cover in closed position.

D. Type HD, Heavy-Duty, Three Pole, Single-Throw Nonfusible Switch: 240V ac, 30-200 A; UL 98 and NEMA KS 1; integral shunt trip mechanism; horsepower rated, lockable handle with capability to accept three padlocks; interlocked with cover in closed position.

E. Control Circuit: 120-V ac; obtained from integral control power transformer with a control power source of enough capacity to operate shunt trip, pilot, indicating and control devices.

F. Accessories:
1. Hookstick Handle: Allows use of a hookstick to operate the handle.
2. Lugs: Mechanical type, suitable for number, size, and conductor material.
3. Service-Rated Switches: Labeled for use as service equipment.

2.07 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 shall be constructed using glass-reinforced insulating material. Current carrying components shall be completely isolated from the handle and the accessory mounting area.

C. 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.

D. MCCBs shall be equipped with a device for locking in the isolated position.

E. 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.

F. Standard: Comply with UL 489 with interrupting capacity to comply with available fault currents.

G. Thermal-Magnetic Circuit Breakers: Inverse time-current thermal element for low-level overloads and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.

H. Adjustable, Instantaneous-Trip Circuit Breakers: Magnetic trip element with front-mounted, field-adjustable trip setting.

I. 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.

J. Current-Limiting Circuit Breakers: Frame sizes 400 A and smaller, and let-through ratings less than NEMA FU 1, RK-5.

K. 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.

L. Ground-Fault Circuit-Interrupter (GFCI) Circuit Breakers: Single- and two-pole configurations with Class A ground-fault protection (6-mA trip).

M. Ground-Fault Equipment-Protection (GFEP) Circuit Breakers: With Class B ground-fault protection (30-mA trip).

N. Features and Accessories:
   1. Standard frame sizes, trip ratings, and number of poles.
   2. Lugs: Mechanical type, suitable for number, size, trip ratings, and conductor material.
   3. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HID for feeding fluorescent and high-intensity discharge lighting circuits.
   4. Ground-Fault Protection: Comply with UL 1053; integrally mounted, self-powere] 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

2.08 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.
   10. V ac.

2.09 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

3.01 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.

3.02 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.

3.03 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. Kitchen Areas: NEMA 250, stainless steel
4. Other Wet or Damp, Indoor Locations: NEMA 250, Type 4
5. Indoor Locations Subject to Dust, Falling Dirt, and Dripping Noncorrosive Liquids:

3.04 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.

3.05 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.

3.06 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.

3.07 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 - WITH VOICE COMMUNICATIONS

PART 1 - GENERAL

1.01 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.

1.02 DESCRIPTION OF WORK

A. This specification intends to describe a Protected Premises integrated "Class E" Fire Detection and Evacuation system. It shall provide evacuation alarm tone signaling using sounding devices to sound the alarm evacuation and/or alert signals, and strobe lights as visual notification devices, with two-way firefighters communications capabilities and firemen's HVAC override control panel. The system shall be intelligent device addressable, 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.

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 Manual Dual Action Fire Alarm Pull Stations.
7. Addressable Analog Smoke Sensors.
8. Addressable Analog Duct Smoke Sensors.
9. Addressable Area Heat Sensors.
10. Addressable Interface Modules.
11. Linear Beam Smoke Detection. (If required)
12. Two-way Fire Warden Phones.
13. Audible and Visual Notification Devices.

14. Hand On-Off-Auto Control Switches for HVAC and/or Purge Systems.
15. Interface Monitoring and/or Control of Fixed Fire Suppression Systems.

B. Non-addressable alarm initiating, supervisory and status monitored devices shall be integrated into the fire alarm system, as applicable, via the addressable interface module:
1. Sprinkler water flow alarm (alarm initiating)
2. Sprinkler standpipe water flow (alarm initiating)
3. Sprinkler valve tamper switch (supervisory)
4. Dry pipe sprinkler system (alarm initiating)
5. Dry pipe sprinkler system low air - high air pressure alarm (supervisory - two monitoring points)
6. Pre-Action sprinkler system (alarm initiating)
7. Pre-Action sprinkler system supervisory air - valve tamper alarm (Supervisory - two monitoring points)
8. Fire pump status contacts (supervisory) (electric or diesel), (minimum of three monitoring points)
9. Emergency generator status contacts (supervisory), (minimum of three monitoring points)
10. HVAC systems On-Auto-Off status (status monitoring), (provide positive feedback confirmation)
11. HVAC systems Purge On-Auto-Off (status monitoring), and fire/smoke dampers closure (status monitoring), (provide positive feedback confirmation)
12. Kitchen-cooking suppression systems, (alarm initiating)
13. Kitchen-cooking suppression systems, (trouble monitoring)
14. Roof, elevator and/or stairwell roof hatches. (minimum one monitoring point each for “open”)
15. Security interface (If required)

C. Audible / visual signaling devices and communicating devices to be controlled by the FCS and/or RSP transponder panels:
1. Speakers
2. Strobe Lights
3. Combination Speaker-Strobe
4. Warden Telephones

D. 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 manual station alarm, sprinkler alarm, smoke alarm, interfaced suppression system alarm, supervisory and system trouble conditions.
2. Magnetic door holders release control. (If required)
3. Air handling fan systems alarm shutdown operations.
4. Special air handling system return fans or exhaust fans used for smoke purge. (If required)
5. Fire/smoke dampers operations. (If required)
6. Stairwell smoke hatches/vents. (If required)
7. Elevator controls for elevator recall. (If required)
8. Elevator shaft smoke hatch/vent release control. (If required)
9. Selected fans pressurizing stairwells and/or elevator shafts. (If required)

1.03 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. EXISTING TO NEW SYSTEMS INTERFACE: (When both old and new systems must act as "one" system). Equipment furnished under this contract shall be made capable of interfacing with the existing system(s). This shall not require two-way data exchange, but shall require alarm, trouble and supervisory monitoring and any alarm input/output function connections required to act as a single system during the project life cycle.
   a. System Software: Should this project require phased installations, the installing fire protection Contractor shall make available any software information that may be required by the Owner's engineering representative.
5. 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.
6. Other (e.g. Project Meetings, Installation Progress Reports to Engineer)

D. MODIFICATIONS TO EXISTING SYSTEM
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. 228 - Door Holders for Fire Protective Signaling Systems.
   b. U.L. 268 and 268A - Smoke Detectors for Fire Protective Signaling Systems. - Detectors Duct Application.
   c. U.L. 346 - Waterflow Indicators for Fire Protective Signaling Systems.
   d. U.L. 464 - Audible Signaling Appliances.
   e. U.L. 864 - Control Units for Fire Protective Signaling Systems.
   f. U.L. 1480 - Speakers for Fire Protective Signaling Systems.
   g. U.L. 1481 - Power Supplies for Fire Protective Signaling Systems.
   h. U.L. 1971 - Signaling Devices for the Hearing Impaired.
3. National Fire Protection Association Standards.
   a. NFPA No. 13 - 1993 Edition - Sprinkler Alarm and Supervision.
   b. NFPA No. 20 - 1993 Edition - Fire Pump Supervision.
   c. NFPA No. 70 - 1993 Edition - National Electrical Code.
   d. NFPA No. 72 - 1993 Edition - National Fire Alarm Code.
   e. NFPA No. 72, 4-5 Remote Supervising Station Fire Alarm Systems (If Required)
   f. NFPA No. 72, 4-7 Auxiliary Fire Alarm Systems. (If Required)
   g. NFPA No. 72, 3-12 Emergency Voice/Alarm Communications.
   h. NFPA No. 90A - 1993 Edition - Installation of Air Conditioning & Ventilating Systems.
   i. NFPA No. 101 - 1994 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 1992.
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.

1.04 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.

1.05 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.

1.06 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.

1.07 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. Power Calculations

a. Battery capacity calculations. Battery size shall be a minimum of 125% of the calculated requirement.
b. Supervisory power requirements for all equipment.
c. Alarm power requirements for all equipment.
d. Power supply rating justification showing power requirements for each of the system power supplies. Power supplies shall be sized to furnish the total connected load in a worst case condition plus 25% spare capacity.
e. Voltage drop calculations for wiring runs demonstrating a worst case condition.

2. Complete manufacturer's catalog data including supervisory power usage, alarm power usage, physical dimensions, finish and mounting requirements.
3. 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.
4. 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.
5. Provide the address, telephone number, and contact person(s) of the manufacturer's local service facility for normal and off hour warranty issues.
6. 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.
7. 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) 1996).
8. For each system control panel and/or transponder panel, provide panel ampere loading during both normal and alarm mode's, with time calculations to substantiate compliance with battery backup power requirements (battery Ampere-Hour capacity), described elsewhere in these Specifications.
9. For each system control panel and/or transponder panel, provide written schedule of active and spare addresses provided on each addressable circuit to substantiate compliance with circuit usage/spare requirements, described elsewhere in these specifications.
10. For each system control panel and system transponder notification appliance circuit provide a written schedule of spare capability in amperes and/or wattage available for future possible use.
11. Provide manufacture'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.

12. 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.
13. Provide shop drawings as follows:
    a. Drawing or catalog page showing actual dimensions of the main FCS.
    b. Drawing(s) or catalog page(s) showing actual dimensions of any additional system control panels, amplifier cabinets and/or battery cabinets.
    c. Drawing or catalog page showing actual dimensions of the remote annunciator(s).
    d. Single line riser diagram showing, all equipment, all connections and number and size of all conductors and conduits.
    e. Provide samples of various items when so requested by the Architect/Engineer.
14. The fire alarm Contractor shall provide copies of certification for service technicians formal training by the system manufacture. As a minimum, certification documents shall indicate training dates, systems qualified, name of individual certified and current status.

1.08 SYSTEM OPERATION

A. Description

INITIATION	OPERATION
1. Operation of manual fire alarm stations	Sound evacuation tone signal through loudspeaker stations, and flash visual fire warning signals, on alarm floor and floor above and floor below. Sound an "alert" tone signal on all other loudspeakers Recorded announcements shall follow tone signals. Sound audible signal and display "manual station" and zone identification at fire command station and outlying annunciators. Operate relay at fire command station to accommodate transmission of a "manual" signal through telephone company wires to central station location**.**

INITIATION		OPERATION
2.	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 as noted for manual stations. (Omit alarm verification sequence for heat detectors.) Sound audible signal and display "duct smoke" "area smoke" "elevator lobby 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.
3.	Triggering of waterflow switch in sprinkler system	Sound audible signal and display "waterflow" and zone identification at fire command station and outlying annunciators. Sound evacuation and alert tone signals, followed by recorded announcement, through loudspeakers, and flash visual fire warning signals, as noted above for manual stations. . Operate relay at fire command station to accommodate transmission of a "waterflow" signal through telephone company wires to a central station location. Operate outlying addressable modules to accommodate transmission of signals to elevators, fans, dampers and other equipment, as scheduled elsewhere or as described hereinafter. Display status of affected equipment at Fire Command Station and outlying annunciators.
4.	Operation of tamper switch on manual valve of sprinkler or fire standpipe system	Sound audible signal and display "manual valve tamper" and location identification at fire command station and outlying annunciators. Operate relay at fire command station to accommodate transmission of a "supervisory" signal through telephone company wires to a central station location municipal fire alarm wires to Fire Department.
5.	Operation of "master alarm" switch at Fire Command Station	Sound evacuation tone on all speakers in building and flash all strobes.
6.	Operation of warden’s station calling button	Sound audible signal and display "floor warden station" and location identification at fire command station and outlying annunciators.

INITIATION		OPERATION
7.	Operation of individual motorized equipment "override start or stop" control switch at the fire command station.	Initiate start or stop operation and display status of selected motor and report status at the fire command station.
8.	Operation of individual smoke exhaust damper system "purge" switch.	Initiate operation and display status of selected damper system to permit smoke purge of selected area.
9.	Operation of individual smoke exhaust damper system "override" purge switch.	Reinitiate operation and display status of selected damper system after damper heat sensor has operated.
10.	Operation of alarm contact on standalone system furnished separate from the work of this section.	Same as for waterflow except display "subsystem" type and zone (location).
11.	Operation of a supervisory contact on a standalone system furnished separate from the work of this section.	Same as tamper switch, except contact on a standalone system display "supervisory" and zone furnished separate from the (sub-system).
12.	Operation of "outside assistance" key switch at the fire command station	Operate relay at fire command station to accommodate transmission of signal to central station location.
13.	Operation of "fire drill" key switch at the fire command station	Void operation of "central station" relays.

B. Reset of all alarm initiating device circuits, alarm notification circuits, and equipment control relays shall be accomplished from the fire command station. Manual fire alarm stations shall require local reset before central reset from the fire command station is possible. 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 such as to provide 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. Kitchen hood exhaust fans, laboratory fume hoods and other fan designated on drawing as such shall continue to run if in operation. 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 manual station, smoke or heat detector, sprinkler/standpipe alarm or supervisory actuating device, and sub-system alarm or supervisory initiating device 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. The system shall provide for intercom and fire evacuation public address features as follows:-
    a. The system shall be of a dual channel type, capable of automatically broadcasting evacuation tones followed by recorded "evacuation" announcements repetitively to the alarm floor and other contiguous floor(s) as noted hereinbefore, and simultaneously broadcasting alert tones followed by recorded "alert" announcements repetitively to all other floors. No tone signals shall be broadcast in stairwells.
    b. Manual "on-off" control from the fire command station of evacuation tone signals, recorded announcements and flashing of strobes through loudspeaker stations on any or all floors.
    c. Initiation of voice announcements from the fire command station through loudspeaker stations on any or all floors, and separately through loudspeaker stations in stairwells.
    d. Intercom between fire command station and any floor warden station, such intercom being controlled from the fire command station. Call initiation from warden stations to fire command station shall be possible.
    e. Intercom use shall not interfere with simultaneous broadcasting of evacuation signals, alert tones or voice announcements over system loudspeakers.
    f. Patching in of voice announcements from any floor warden station to the loudspeaker stations on any or all floors, such patching in being controlled from the fire command station.
3. The fire evacuation public address equipment in the system shall include the following features and functions:
    a. Amplifiers shall be sized to accommodate a quantity of speakers equal to that shown on the drawings, plus an additional bulk quantity of 15 speakers intended for installation at locations as directed throughout the building. Sizing shall be based on an average requirement of 2.0 watts per speaker.
    b. Amplifiers shall have a frequency response range of ±1.5 dB from 30 to 10,000 hertz and at rated output, less than 2% distortion over the frequency range of 60 to 15,000 hertz.
    c. Failure of a power amplifier shall shut down the amplifier and indicate a trouble condition as described in Reference Standard RS17-3A. Amplifiers shall be

arranged in such manner, either by pairing or automatic switchover, to provide redundancy.

d. Tone oscillators, microphone circuits and ancillary equipment shall be paired in a similar fashion to the amplifiers and be provided with either automatic or manual switchover to the redundant system.

e. Where the audio path consists of twisted pair "riser cables," it shall include double the number of required pairs (as determined by the total number of speakers called for). Connections at the amplifiers shall be arranged to readily allow their "transfer" to future amplifiers as necessary.

4. In lieu of the central amplification system described above, distributed amplification may be provided, however, such equipment shall conform to the redundancy requirements described hereinbefore, and the outlying equipment must derive its power from the central equipment.

5. Reporting of all required alarms and supervisory signals to the Fire Command Station (FCS) from initiating devices of the non-addressable type, including (but not limited to) sprinkler and standpipe waterflow and supervisory devices, manual fire alarm stations, sub-system (e.g., halon, pre-action sprinkler, etc.) alarm and supervisory contacts, and the like shall be accomplished in conjunction with addressable monitoring modules of the initiating device type (i.e., AMM/ID). AMM/ID's shall be of a type intended for connection of NFPA 72, Style 6 "branch" signalling line circuits (SLC) as described hereinbefore and shall be connected to the appropriate SLC on the floor on which they are located. Except where incorporated as part of manual fire alarm stations (or in the outlet boxes on which they are mounted), AMM/ID's shall be mounted adjacent to the associated initiating devices in outlying addressable monitor module boxes and shall be complete with engraved red nameplate. Each AMM/ID shall be interconnected to its associated initiating device by means of an initiating device circuit (IDC) as described hereinbefore. Provide an end-of-line resistor at each initiating device so as to permit supervision of the interconnecting circuitry. Terminals shall be incorporated in each addressable module box for the accommodation of all entering conductors.

6. 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.

7. 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 box including two ACM's ("purge", "override purge") and two AMM/S's ("open"/"closed") for each smoke purge damper system. Refer to HVAC floor plans and risers for quantity of smoke purge damper systems (i.e., one system for each penetration of any multi-floor duct which will be used for smoke purge, and for each fan system which includes direct outside exhaust provisions).
   c. 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.
   d. 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").
   e. 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").
   f. One addressable box, including one ACM for the fire stair door unlocking system.
   g. One addressable module box, including one ACM, for the fire/smoke door release system.
   h. One addressable module box, including one ACM for each fire stair or elevator machine room smoke vent.
   i. One addressable module box, including one ACM for each escalator controller.
   j. Additional addressable module boxes as necessary to comply with the scheduled control of equipment in response to system alarm actuating devices.

8. 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.

9. Smoke detectors indicated in mechanical equipment rooms shall be of the combination photocell plus fixed temperature/rate-of-rise type.
10. Smoke detection devices shall have integrally mounted pilot lamps giving a "triggered" indication.
11. Smoke detection devices which are mounted in ducts, above hung ceilings or under raised floors 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. The pilots for detectors under raised floors or in ceiling plenums shall be remotely mounted in a graphic annunciator panel at a location within the computer space as directed.
12. Smoke detectors mounted in hospital nursing home patient rooms shall each be equipped with a remote "triggered" indication light wired in parallel (with the pilot light integral with the detector. These remote pilot lights shall each be flush mounted in the corridor over or adjacent to the door to the room as directed by the Architect.
13. 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.
14. Heat detectors located in sprinklered elevator machine rooms or elevator shafts shall be of the 135°F "fixed temperature only" type.
15. 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 Supervisory Functions

1. Activation of any supervisory circuit, (i.e.; supervised fire sprinkler valve closure, fire suppression system air pressure abnormal, low temperature, fire pump trouble, emergency fuel tank level alarm), shall cause the following actions and indications:
   a. Activate "Supervisory Alarm" notification to the FCS computer terminal display indicating device address, device type, device location, time and date.
   b. Activate "Supervisory Alarm" notification to the appropriate receiving agency and/or on site location as shown on the drawings.
   c. Annunciate alarm notification on system remote alphanumeric annunciators.
   d. Audible signals shall be silenceable from the control panel by an acknowledge switch.
   e. Record within system history, the occurrence of the event, the time of occurrence and the device initiating the event.
   f. Record all events at the system alarm printer.

G. 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 silenceable 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 disconnect.
   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

2.01 BASIC SYSTEM EQUIPMENT, CIRCUITING, ADDRESSING AND OPERATING CAPABILITIES

A. The Fire Command Station and remote control transponder panels shall communicate via a RS-485, peer to peer, Multiple Access Protocol: Carrier Sense, Multiple Access, Collision Detect, also known as CSMA/CD an ETHERNET type protocol. These system devices shall be connected as network "nodes". The network connections in each of these system devices or nodes shall be made using a network interface module (NIM). Status changes in any network node shall be sent to all other node's for processing and local operations as required for this project. Network data communication wiring shall be NFPA Standard 72 style 7, two conduit system, wherein a single open, single ground or wire-to-wire short shall not degrade the network operation.

B. The FCS shall provide NFPA Standard 72, Style 4 operation with loop isolator analog signaling circuitry required to communicate with, and receive alarms from 120 points, consisting of a maximum of sixty intelligent analog alarm initiating and sixty intelligent controllable output devices. Analog loops shall be configured with loop isolators and wired in a manner that prevents a catastrophic wiring event on a floor from effecting the performance of other floors.

C. Systems allowing more than sixty devices per addressable loop shall be wired in a Style 7 configuration with raceway design configured to allow a maximum of one section of the loop within a single raceway. Loop isolation between floors shall be maintained.

D. System power supplies, including necessary transformers rectifiers, regulators, filters and surge protection required for system operation, with the capacity to power the system in a worst case condition with all devices in alarm and all local indicating appliances active without exceeding the listed ratings. All system devices shall display normal and alarm conditions consistently whether operating from normal power or reserve (standby) power.
   1. Systems not displaying an alarm indication at each detector when in a standby power mode shall include an addressable remote LED indicator to perform this required function.
   2. System primary power: Primary power for the FCS and the secondary power battery chargers shall be obtained from a dedicated emergency power circuits. Circuit breakers shall be fitted with a suitable guard, requiring removal of a screw to open, and used only for fire alarm. Each circuit used for fire alarm purposes shall be permanently labeled for function.

3. Secondary power supply: Provide sealed gelled electrolyte batteries as the secondary power supply for all fire alarm functions. The battery supply shall be calculated to operate loads in a supervisory mode for twenty four (24) hours for proprietary and central station systems, sixty (60) hours for municipal or remote supervisory systems, with no primary power applied, and after that time, operate in alarm mode for fifteen (15) minutes. Batteries shall be sized at 125% of the calculated size to compensate for deterioration and aging during the battery life cycle. Battery calculations shall be submitted to justify the battery size.
4. Provide battery charging circuitry for each standby battery bank in the system. The charger shall be automatic in design, adjusting the charge rate to the condition of the batteries. All system battery charge rates and terminal voltages shall be read using the fire alarm control panel LCD display in the service mode, indicating directly in volts and amps. Meters reading in percentage are not acceptable.
5. System 16 bit core processor, with internal operating system to process incoming alarm signals and issue output commands required as a result of the alarm reception, by system programming or by manual commands. Total system response time shall not exceed 2.5 seconds on a system configured to maximum capacity. All system processors shall be supervised by individual watchdog circuitry furnishing automatic restart after loss of activity. Systems with single watchdog circuits for all processors shall not be acceptable unless supplied with a "hot" standby CPU. Digital communication capabilities required for the control panel to communicate with remote annunciators, input/output drivers and displays shall be provided.
6. System remote annunciators shall be located, as a minimum, within the main building lobby, building supervisor's office and mechanical equipment room, unless indicated elsewhere on project drawings.
7. Manual addressable fire pull stations shall be dual action and listed by Underwriters' Laboratories, Inc. The intelligent manual fire station shall operate on any addressable detection circuit. It shall be red in color with a diagonal white stripe one inch wide from the upper left hand corner to the lower right hand corner shall be painted or applied. The stripe shall not render any lettering illegible or cover any station number. Manual fire stations shall be individually annunciated on the control panel. Manual fire station address shall be set by electronic means only. Mounting height shall be 48" inches to the manual station actuation handle from the finished floor.
8. The intelligent/analog photoelectric smoke sensor shall be Underwriters' Laboratories, Inc. listed. The smoke sensor shall contain a long life light emitting diode (LED) as its light source, and photo diode as a light receiver. An automatic gain control circuit shall be compensating for detector aging and dirt accumulation. The smoke sensor shall be a plug-in twist/lock unit which allows for easy connection to its mounting base. Each smoke sensor, when activated, shall have a flashing LED indicator which shall be by the control panel. Application Specific Detection environmental settings shall be programmed as directed by the Engineer.
9. It shall be possible to adjust and/or electronically measure the sensitivity of each individual intelligent analog smoke sensor from the control panel. Relative sensitivity or manual test methods which check the smoke sensor at the maximum allowable obscuration will not be considered as being equivalent.
10. 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.

11. Heat detectors shall be a 135° F. rate compensation/fixed temperature element heat detector. Unit shall be U.L. for a maximum coverage area of 2,500 sq. ft.. Rate-of-rise alarm threshold rate shall be 15° F. per minute. Activation of the this rate-of-rise heat detector shall be self restoring. All detectors shall be addressable and have a white finish. The thermal detectors shall be individually annunciated on the control panel. Thermal detectors shall contain an integral alarm lamp. The detector’s address shall be set by electronic means only, no mechanical means such as programming pins, dipswitches or rotary dials shall be used.
12. Heat detectors high temperature shall be a 200° F. conventional rate compensation/fixed temperature element heat detector (non-addressable detector.) The detector shall be U.L. listed for a maximum coverage area of 2,500 sq. ft.. Rate-of-rise alarm threshold rate shall be 15° F. per minute. Upon activation of the this rate-of-rise heat detector the detector shall lock into alarm until reset at the main fire control panel and shall be self restoring. The detector shall be individually annunciated at the control panel by means of interfacing with an addressable conventional zone module (CZM). The detector’s interface module address shall be set by electronic means only, no mechanical means such as programming pins, dipswitches or rotary dials shall be used.
13. 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.
14. 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”.
15. 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.
16. Sounding Devices:
    a. Sounding devices shall be of sufficient number so that an alarm shall be clearly audible to all occupants of the building and/or fire area, as required by these Specifications. Mounting height shall be 96" inches to the centerline of the sounding device above the finished floor except that in locations where ceilings prevent the installation at 96" inches centerline, the centerline of the device shall be 6" inches

below the ceiling. If combination sound/strobe devices are used mounting heights shell be 80 inches to the centerline of the device above the finished floor.

b. Audible alarm signals shall produce a sound level at least 15 dBA above the average ambient sound level or 5 dBA above the maximum sound level having a duration of a least 60 seconds (whichever is greater) measured 5 feet above the floor in each occupiable area. The average ambient sound level is the root mean square, A-weighed sound pressure measured over a 24-hour period.

c. Bells: The bells shall be vibrating Motor Bells UL Listed for Fire Protective Service. Shells shall be 10 " aluminum, except as indicated. Bells shall have a permanent magnet motor and suppression to minimize RFI. Sound output at 10 feet shall be 92 dBA. Bells are weatherproof where indicated. Bells shall be Wheelock Model MB-G10-24-R.

d. Chimes: The chimes shall be UL 464 Listed for audible appliances and UL 1971 Listed for visual appliances. They shall be vibrating, with a dBA of 83 at 10 feet. Frequency range to be 800 to 1200 Hz. All inputs shall employ terminals that accept #12 to #18 AWG wire sizes. The chimes shall be Wheelock Model CH70-24-R. For chime strobes use Wheelock Model CH70-24MCW-FR.

e. Horns: The horns shall be UL 464 Listed. They shall be electronic, operating on a regulated voltage range of 16 to 33 VDC. They shall be of low current design, with zero inrush. They shall be for indoor use and meet the requirements of FCC Part 15,Class B. The horn shall have a minimum of 2 field selectable settings for dBA levels and have a choice of continuous or temporal code 3 audible outputs. Use Wheelock Model NH-12/24-R.

f. Horns: Electric-vibrating-polarized type, operating on 24-V dc, with provision for housing the operating mechanism behind a grille. Horns produce a sound-pressure level of 90 dB, measured 10 feet (3 m) from the source.

17. Audible notification appliances shall be powered by dedicated notification circuits. Visual notification appliances shall be powered by dedicated notification circuits. Audible appliances and visual appliances shall not be powered by the same notification circuit. Combination audible/visual devices may be used, but shall be wired as per this Specification.

18. Visual signals shall be installed as shown on the drawings in accordance with the requirements of the U.L.1971 standard and NFPA 72. Where multiple visual signals are visible from any location, circuitry shall be incorporated for the synchronization of flash rate.

    a. UL 1971 Listed for Emergency Devices for the Hearing Impaired in all public mode installations.

    b. Strobes shall meet UL 1971 and produce a flash rate of one (1) flash per second minimum over the Listed input voltage (20VDC - 31VDC) range.

    c. All visual signals shall incorporate a Xenon flashtube enclosed in a rugged Lexan lens or equivalent with solid state circuitry.

    d. The strobe intensity shall have a minimum of 4 field selectable strobe settings for 15,30,75 or 110 candela (wall mount). The switch for setting the candela shall be mounted in the rear of the unit, to prevent tampering. Use Wheelock Model RSS-24 MCW-FR.

    e. The strobes shall be available for semi-flush or surface mounting and in combination with audible signals at locations shown on drawings.

19. Speakers and Speaker strobes.

a. The speaker shall be UL Listed under Standard 1480 for Fire Protective Service: speaker appliances equipped with strobes shall additionally be listed under UL Standard 1971, Signaling Devices for the Hearing Impaired.
b. All speakers shall be designed for a field selectable input of either 25 or 70 VRMS, with selectable power taps of from ⅛ watt to 2 watts. All models shall have a listed sound output of 88.8 dB at 10 feet and a listed frequency response of 400 to 4000 Hz. The speaker shall incorporate sealed back construction. All input terminals shall accept #12 to #18 AWG wire size and be supervised.
c. All UL 1971 Listed strobes shall be certified to meet FCC Part 15,Class B and shall incorporate low temperature compensation to insure the lowest possible current consumption. If synchronized, the strobes shall not have any drift. The speakers and speaker strobes shall be designed for indoor surface mounting. They shall mount to standard electrical back boxes requiring no additional trimplate.
d. The strobe portion of the appliance shall produce a flash rate of one (1) flash per second over the voltage range of 16 to 33VDC for 24 VDC models. They shall incorporate a Xenon flashtube in a rugged Lexan lens. The strobe shall draw low current with zero inrush. The strobe intensity shall have a minimum of four (4) field selectable settings: 15,30,75 or 110 candela. The switch for selecting the intensity shall be mounted in the rear, to prevent tampering by unauthorized persons.
e. Speakers and speaker strobes shall be installed to meet NFPA 72 (1999) and ADA requirements.
f. The speakers and speaker strobes shall be Wheelock Series E70 Multi Candela.

20. The system shall provide status indicators and control switches for all of the following functions:
    a. HVAC supply and exhaust fans.
    b. Audible and visual evacuation alarm circuit zone control.
    c. Status indicators for sprinkling system water flow and valve supervisory devices.
    d. Any additional status or control functions as indicated on the drawings, including but not limited to, emergency generator functions, fire pump functions, door unlocking and security with bypass capabilities.
    e. Purge fan units by floor and/or fire area.
    f. Fire and/or smoke dampers.
    g. Warden telephones.
21. 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.)
22. 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.
23. HVAC supply-exhaust units, purge units, 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.

24. Flame detector shall be ultraviolet type wit plug-in base and solid-state amplifier-switching circuit set for 10 seconds delay, unless otherwise noted.
25. Linear Beam Smoke Detection shall be installed as shown on the project drawings. The detector shall be of the combination type with both the transmitter and receiver enclosed within the same detector housing. The transmitter shall emit an invisible infrared pulsating beam across the protected area to a fixed reflector or prism. This reflecting device shall be mounted rigidly and securely and directly opposite the detector. This reflective device shall cause the emitted beam to return to the detectors receiver, thus completing the detection linear beam circuit. The detector receiver lens directs the reflected IR pulse to a silicon photodiode. The resulting electrical signal is evaluated by the detector electronics. The attenuation of the IR pulse by smoke particles via scattering and absorption, results in an alarm condition.
26. 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.
27. Remote Control Panels (RCP) shall consist of an enclosure, power supply, digital communications circuitry, mother boards, batteries and hardware, modules and circuitry described for inclusion in the fire alarm control panel as required to function as specified. System control panels shall function in stand alone fail safe mode upon loss of the FCS processing, communications and/or communications wiring.
28. 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.
29. 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."

E. One-way Tone/Voice Communication
1. The evacuation alarm and alert signals shall be capable of being initiated automatically from the FCS and transmitted to any speaker circuit, selected speaker circuits or all speaker circuits.
2. The alarm signal, alert signal and live voice announcements shall be capable of manual transmission from the FCS to any speaker circuit, selected speaker circuits or all speaker circuits by manual selection of the associated speaker circuit control switches.
3. Live voice announcements, via the hand-held microphone or patched in warden phone, by use of speaker control switches, shall take priority over all previously activated alarm inputs. In addition to NFPA 72 requirements, the system shall be capable of priority live voice announcements over subsequent alarm conditions. In no case shall subsequent alarms disrupt emergency live voice announcements.
4. Alarm speaker amplification equipment shall be sized, as a minimum, to provide the following wattage levels for each location type of alarm speaker:
    a. Each floor alarm speaker: Provide one (1) watt of input power.

b. Each toilet alarm speaker: Provide one-half (½) watt of input power.
c. Each mechanical room alarm speaker: Provide two (2) watts of input power.
d. Each stairwell alarm speaker: Provide one-half (½) watt of input power.
e. Each elevator cab alarm speaker: Provide one-quarter (¼) watt of input power.

5. As a minimum, alarm speaker amplification equipment shall be sized to provide the above indicated wattage of input power to each location type of alarm speaker shown on the Drawings, plus twenty-five percent (25%) spare capacity to permit the addition of future alarm speakers.
6. Alarm speaker amplifiers shall be paired to provide 100% redundancy. One (1) backup alarm speaker amplifier shall be provided for each primary alarm speaker amplifier. If any primary alarm speaker amplifier fails, its function shall be taken over by its backup amplifier.
7. Alarm tone and alert tone oscillators and pre-amplifiers shall be paired to provide 100% redundancy.
8. As a minimum, each stairwell shall be provided with a dedicated notification appliance circuit.
9. As a minimum, the system shall be configured as a two (2) channel voice system.

F. Two-Way Warden Telephone Communication

1. Picking up a Warden telephone handset shall automatically:
   a. Sound an audible signal at the Fire Command Station (FCS).
   b. Flash the individual telephone "calling-in/connected" LED for the calling-in circuit at the FCS.
2. Connecting the call, by operating the appropriate telephone line "connect" switch, at the FCS shall automatically:
   a. Silence the audible call-in signal.
   b. Continuously light the individual telephone "calling-in/connected" LED indicator for the calling-in circuit at the FCS.
   c. Connect the appropriate Warden telephone circuit to the FCS master telephone for talking.
   d. Light the LED indicator at the connected Warden telephone.
3. Operating additional Warden telephone line "connect" switches, at the FCS shall automatically:
   a. Permit Warden telephones to talk to other Warden telephone locations via a patch in the telephone network, controlled at the FCS. Up to five (5) Warden telephones may be operated simultaneously.
4. Warden telephones shall be capable of making announcements over alarm speaker circuits via a "patch" circuit and speaker circuit control switches, controlled at the FCS.
5. The telephone handset shall be red, equipped with armor covering over wiring at hand set to its housing.
6. REMOTE DEVICE LOCATION-INDICATING LIGHTS AND IDENTIFICATION PLATES
   a. Description: An LED-indicating light in the vicinity of each sprinkler waterflow switch and valve tamper switch denotes the associated device is in an abnormal or trouble mode. Lamp is flush mounted in a single gang wall plate. A red, laminated, phenolic-resin identification plate at the indicating light identifies, in engraved white letters, the room where the valve is located or the protected spaces downstream from the waterflow switch.
7. 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.

PART 3 - OPTION #2 0 GRAPHIC DISPLAY/CONTROL

3.01 PROPRIETARY CENTRAL RECEIVING STATION MONITORING CONSOLE

A. Furnish and install at all locations as shown on the drawings, U.L. Listed, proprietary monitoring system control consoles meeting all equipment operational requirements of NFPA 72, 4-4.4. 1 through 4-4.4. 1 0.
1. The proprietary monitoring system control consoles are intended to allow operators to view and acknowledge global system off-normal events, view graphic displays, view global system lists and data, silence/unsilence local network alarm evacuation appliances, reset local networked systems, view system lists, change detector sensitivities, control local network system outputs using the keyboard and monitor touch display.
a. The proprietary monitoring system control consoles shall operate as real time, prioritized, preemptive operating systems to ensure efficient and timely processing of network events.
b. The system shall have the capability of supporting multiple proprietary monitoring system control consoles in order to insure system continuity of operation under

emergency trouble conditions and to allow technical service without disruption of event monitoring activity.

B. Each proprietary monitoring system control console shall include the following capacities, features and capabilities:
   1. Color graphics terminal/display system which shall consist of a UL listed rack mounted, IBM OS/2TM operating system based computer; desk mounted keyboard and supervised parallel printer; and rack mounted 19 inch (touch screen - optional) color monitor. The central monitoring system storage capacity, as installed, shall be the total of the sum of the capacities of the local systems.
      a. Minimum computer configuration shall include:
         1) 486DX 66MHZ processor
         2) 8 Megabytes of RAM (MINIMUM, 16 RECOMMENDED)
         3) Gigabyte storage capacity disk drive
         4) Megabyte storage capacity disk drive
         5) SVGA or XGA Monitor display, 1024 X 768 resolution, 256 color palette
         6) Serial communications port
         7) Parallel printer port
         8) Mouse
      b. Uninterruptible power supply capable of supporting the computer, monitor and printer for a period of 24 hours under maximum normal load and subsequently processing full system alarm information for a period of five minutes.
         1) The UPS system shall include a positive means of disconnecting the input and output of the UPS system while maintaining continuity of power supply to the load.
   2. The system shall be software based and configurable as any one of the following:
      a. NFPA 72 Local Campus, utilized in a display only configuration
      b. NFPA 72 Local Highrise utilized as the system primary display and control point. Individual network panels shall not be capable of acknowledge, silence or manual keyboard control when configured in this style except in the event of communications loss with the network command console.
      c. NFPA 72 Proprietary utilized as the primary control point for a collection of local control panels and capable of top event acknowledge, query and control of all local systems.
   3. The operator graphical user interface screen shall consist of individual areas as follows:
      a. Status line displaying the status of the global system and the network control center; individual counts for alarm, supervisory, security, trouble and acknowledgments; system message; current operator level; and current time and date.
      b. Graphics window displaying a graphic or map associated with the current selected alarm including an appropriate flashing icon showing the exact location and type of the alarm. On screen control "buttons" shall be associated with the graphics and furnished as follows:
         1) ZOOM button shall allow the operator to select the next screen on file to increase the definition of the displayed area. If a greater definition screen is not programmed for the area of alarm, the network command shall beep to indicate the command cannot be implemented.
         2) NORMAL button shall return the graphic to the original zoom level.
         3) NEXT button shall cause the next graphic event in the queue to be displayed.
         4) PREV button shall cause the previous graphic in the queue to be displayed.
      c. Graphical user interface, on screen "button" array used to control the system via mouse or touch screen. All system functions available through the keyboard shall

be accessible through this array of control buttons allowing system operation with a minimum of operator training. Buttons shall be supplied in addition to the graphic controls specified as follows:

1) LOG ON - LOG OFF with changing caption dependent upon whether the operator is logged on or off. When the button is pushed, a dialog box containing a keypad shall appear to allow operator entry of passcodes and an (OK) button shall signify completion of the logging procedure.
2) SHOW shall allow the operator to display lists of information regarding the current system state. Pressing the button shall cause the appearance of a menu allowing the selection of the list to be displayed.
3) DEVICE TYPE shall cause the appearance of a dialog box requesting a module address. Entry of a valid address shall display a list of device types connected to the module. A (PRINT) button shall initiate printing of the displayed list.
4) SUPERVISORY shall provide a listing of the current global supervisory events. A "PRINT" button shall initiate printing of the displayed list.
5) MESSAGES shall cause the appearance of a dialog box requesting a module address. Entry of a valid address shall display a list of messages associated with that module. A PRINT button shall initiate printing of the displayed list.
6) ALARMS shall provide a listing of the current global alarm events. A PRINT button shall initiate printing of the displayed list.
7) MODULE TYPE shall provide a list of all module types connected. A PRINT button shall initiate printing of the displayed list.
8) STATUS shall provide a listing of the current status of the system. A PRINT button shall initiate printing of the displayed list.
9) SENSITIVITY shall cause the appearance of a dialog box for device address and display the sensitivity when entered. A PRINT button shall initiate printing of the data.
10) TROUBLE shall display a list of current troubles. A PRINT button shall initiate printing of the data.
11) ANALOG shall cause the appearance of a dialog box for device address selection and shall display the device analog sensitivity upon user request. A PRINT button shall initiate printing of the data.
12) SECURITY shall display a listing of the current security events. A PRINT button shall initiate printing of the data.
13) THRESHOLD shall cause the appearance of a dialog box for device address and display the device threshold voltage when entered.. A "PRINT" button shall initiate printing of the data.
14) CANCEL shall cancel the show mode dialog box and return to the main display.
15) USER shall cause the appearance of eight user defined push buttons and descriptive text to the right of each. The CANCEL button shall clear the user push button display.
16) OPTIONS button shall be supplied to display a dialog box containing buttons less frequently used including:
    a) CHANGE; main editing main editing available to level "C" operators only
    b) DE/ENERG; turn devices on or off
    c) DEVICE; set or change sensitivity
    d) DIS/ENABLE; control device or node

e) HISTORY; generate
f) FEATURE; edit system features
g) HELP; scrolling window for the display of information regarding core commands
h) LOG; operator comments to printer and history
i) PASSWORD; entry of four to ten case sensitive characters comprising a password
j) TIME; set time and date

d. Event window displaying a listing all system trouble and alarm activity in chronological order.
e. System node status bar displaying changes in local control panel status via changes in color and message. Clicking on the indicator displaying a trouble or alarm shall cause the appearance of a dialog box with information about the current problem. In systems larger than ten nodes, multiple nodes shall be capable of being grouped under a single indicator.
f. Command and query window shall be a general purpose area on the screen used for command entry, editing and information display.
g. Command status line at the screen bottom shall be used for the prompts, error and warning messages.

4. The keyboard function keys shall furnish shortcut commands to implement a minimum of 29 common system commands. In addition, a minimum of IO user programmable shortcut commands shall be furnished to allow custom implementation of common commands that may be unique to the system.
5. Software for generation of graphic screens shall accept user input using any available CAD or PIC format for drawings, photographs or sketches and capture the image. The screen may then be modified to include the icons necessary to indicate system events.
   a. Systems requiring individually drawn screens shall be supplied with a minimum of five levels of zoom for each system alarm and trouble point, generated by the supplying contractor.
6. The monitoring system graphic control console shall be capable of downloading all device custom messages from all connected network residents, eliminating the requirement for reentry of this information at the control center unless additional or different descriptions are required at the graphical user interface.
7. The system shall automatically display a device customaction message of 70 characters minimum for each actuating device connected to the fire alarm network fire control panels.
8. The system shall have the and capacity to sequence up to 190 simultaneous alarms and 190 troubles.
9. System configuration shall be menu driven and capable of being operated by a person with no previous computer programming experience.
10. The system shall have the ability to assume terminal control of any network connected local control system, reading sensitivity, displaying system information and initiating commands when accessed by approved passwords.

C. EQUIPMENT

1. Furnish an IBM compatible PC with a 80486 processor with at a minimum processing speed of 66 MHZ. The power supply shall be rated at a minimum of 200 watts continuous load. The computer shall have at least one 5 ¼" high density floppy diskette drive and be equipped with at least 8 megabyte of 70 nanosecond dynamic random access memory.
2. The computer shall have one serial RS232 input/output port configured as COMI for communications with the optional touch screen. Communications to the fire alarm control panel shall be via an interface card fitted into one of the expansion slots of the computer.

This card, supplied by the fire alarm control panel manufacturer, shall contain the circuitry to interface the computer RS232 fortnat configured as COM2 with conversion to 20 NM current loop or other long distance transmission for communication to the fire alarm control panel.

3. The hard disk drive shall sized to suit the installation; storing an average of four graphic screens per alarm point, with 25% spare space, and with a minimum of .5 gigabyte. The hard disk controller shall be 1: I interleave and provide a minimum of 450 kilobytes per second data throughput when operating with the hard disk drive.
4. The monitor shall be high resolution with a resolution of 640 vertical and 350 horizontal lines and a dot pitch of .31 mm as a minimum. Screen size shall be a minimum of 14" diagonal measurement, unless detailed otherwise on the drawings. Optional screen size of 19" shall be available and furnished where indicated.
5. The graphic monitor shall also be fitted with a "touch screen" operator interface. The touch screen shall inherent to the monitor installation and be useable with any approved unmodified compatible monitor, allowing any point on the screen to be assigned as a "touch point" . Touch screen must be capable of being operated by a gloved hand.
   a. Manufacturers supplying monitors unable to meet this requirement for touch operation from an unmodified monitor shall supply a spare modified monitor in each required location to avoid delays inherent in procuring specially equipped monitors in the event of failure.
6. A logging printer shall be installed adjacent to the graphics terminal as shown on drawings. This printer shall be an "IBM/EPSON" compatible with a parallel data connection to the graphics computer parallel port designated as LPT1.

D. SOFTWARE

1. The software shall control the operations, functions and display of the graphics system and provide for automatic boot up and run from the hard disk drive of the computer.
2. All project specific actuating device programming shall be capable of being carried out on site via password access.
3. In the normal mode the monitor shall display a series of screens that automatically change at approximately IO seconds intervals to the next screen in the queue. The minimum screens in the queue shall be eight (8) with the number displayed selectable via a password access. This password shall be separate to the programming password.
4. The system shall monitor all alarms and troubles detected by the fire alarm control panels connected to the network and provide two (2) separate disk based log files, one for alarms, and one for troubles. These logs may be enabled, disabled, or cleared with password access. These log files are to be continually appended until manually cleared so as to provide complete historical information of all alarms and troubles. This log information shall not be lost upon power failure or fire alarm control panel reset. A utility file shall be provided to sort the logged data by system, date or by device and display this information either on the screen or the system printer.
5. When an alarm or trouble is registered at any fire alarm control panel the graphics system shall display the first screen image for the first actuated device. The system shall be capable of zooming in for information up to ten (10) times if required. At all times when in the alarm or trouble mode the fire control panel status, i.e., number of current alarms and or troubles is to be displayed on the graphics screen.
6. A terminate and stay resident (TSR) utility program shall be part of the system software and be capable of operating with proprietary third party CAD, scanning and drawing programs. This TSR program shall be capable of capturing screen images for use as displays by the fire alarm graphics system program. Once captured these screen images are to be capable of being reproduced by the graphics software without the use of CAD

scanning or drawing programs that produced them. A screen file viewing utility program shall also be provided to allow display of the captured screens for checking purposes.

a. Systems not supporting owner based screen creation in this manner shall include the cost of an average of five screens per system point, to be generated by the installing contractor. Additional screens required by system revisions and reprogram shall be furnished to the owner at no charge for a period of two years in compliance with this paragraph.

7. The main menu shall consist of the following as a minimum requirements:
   a. Monitor (Return to normal mode)
   b. Devices (Provide access to device configuration sub-menu)
   c. Logging (Provide access to disk log sub-menu)
   d. User Options (Provide access to operating options)
   e. Utilities (Provide access to consistency reports, icon editor, custom messages, data base and touch screen test)
   f. Quit to operating system (Exit graphic system and return to computer disk operating system)
8. The Color Graphics System shall consist of the hardware and software as detailed above, interface card, and operation manual.

3.02 MAGNETIC DOOR HOLDERS

A. Description: Units are equipped for wall or floor mounting as indicated and are complete with matching door plate. Electromagnet operates from a 120-V ac source and requires no more than 3 W to develop 25-lbf (111-N) holding force.

B. Material and Finish: Match door hardware.

3.03 CENTRAL FIRE ALARM CONTROL PANEL (FACP)

A. General: Comply with UL 8614.

B. Cabinet: Lockable steel enclosure. Arrange panel so all operations required for testing or for normal care and maintenance of the system are performed from the front of the enclosure. If more than a single unit is required to form a complete control panel, provide exactly matching modular unit enclosures. Accommodate all components and allow ample gutter space for interconnection of panels and field wiring. Identify each enclosure by an engraved, red, laminated, phenolic-resin nameplate. Lettering on the enclosure's nameplate shall not be less than 1 inch (25 mm) high. Identify individual components and modules within the cabinets with permanent labels.

C. Systems: Alarm and supervisory systems are separate and independent in the FACP. The alarm-initiating zone boards in the FACP consist of plug-in cards. Construction requiring removal of field wiring for module replacement is unacceptable.

D. Control Modules: Types and capacities required to perform all functions of the fire alarm systems. Local, visible, and audible signals announce alarm, supervisory, and trouble conditions. Each type of audible alarm has a different sound.

E. Alphanumeric Display and System Controls: Arrange to provide the basic interface between human operator at the FACP and addressable system components, including annunciation and supervision. A display with a minimum of 32 characters shows alarm, supervisory, and

component status messages. Arrange keypad for use in entering and executing control commands.

F. Voice Alarm: An emergency communication system, integral with the FACP, includes central voice alarm system components complete with microphones, preamplifiers, amplifiers, and tone generators. Features include the following:
1. Amplifiers comply with UL 1711.
2. Two Alarm channels permit simultaneous transmission of different announcements to different zones or floors automatically or by using the central control microphone. All announcements are made over dedicated, supervised communication lines.
3. Status annunciator indicates the status of the various voice alarm speaker zones and the status of firefighter telephone 2-way communication zones.

3.04 GRAPHIC ANNUNCIATOR

A. Indicating lights include individual LED indicators for each type of alarm and supervisory device and an LED to indicate trouble. The actuation of any alarm or supervisory signal causes the illumination of a zone light, floor light, and device light. System trouble causes the illumination of all of these lights and also the trouble light. Additional LEDs indicate normal and emergency power modes for the system. A toggle or pushbutton switch tests the LEDs mounted on the panel. The test switch does not require key operation.

B. Faceplate: Satin-finished stainless steel or brushed aluminum. Floor plan and zone boundary lines are engraved in the faceplate and filled with colored paint. Floor plan lines are ¼-inch- (6-mm-) wide black, and zone boundaries are ⅛-inch- (3-mm-) wide red. Engraved legends for the LEDs and switches are ¼-inch- (6-mm-) high minimum, in letters filled with red paint.

C. General: Printer is dot-matrix type, listed and labeled as an integral part of the fire alarm system.

3.05 EMERGENCY POWER SUPPLY

A. General: Components include valve-regulated, recombinant lead acid battery, charger, and an automatic transfer switch. Battery nominal life expectancy is 10 years, minimum.

B. General: Components include nickel-cadmium-type battery, charger, and an automatic transfer switch. Battery nominal life expectancy is 20 years, minimum.

C. Battery capacity is adequate to operate the complete alarm system in normal or supervisory (nonalarm) mode for a period of 24 hours. At the end of this period, the battery has sufficient capacity to operate the system, including alarm indicating devices in either alarm or supervisory mode, for a period of 15 minutes.

D. Battery Charger: Solid-state, fully automatic, variable charging-rate type. Provide capacity for 150 percent of the connected system load while maintaining the batteries at full charge. In the event batteries are fully discharged, the charger recharges them completely within 4 hours. Charger output is supervised as part of system power supply supervision.

E. Integral Automatic Transfer Switch: Transfers the load to the battery without loss of signals or status indications when normal power fails.

3.06 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 4 - EXECUTION

4.01 INSTALLATION, GENERAL

A. Install system according to NFPA standards referenced in Parts 1 and 2 of this Section.

B. Fire Alarm Power Supply Disconnect: Paint red and label "FIRE ALARM." Provide with lockable handle or cover.

4.02 EQUIPMENT INSTALLATION

A. Manual Pull Stations: Mount semi-flush in recessed back boxes with operating handles 48 inches (1220 mm) above the finished floor or lower as indicated.

B. Waterflow Detectors and Valve Supervisory Switches: Connect for each sprinkler valve station required to be supervised.

C. Smoke Detectors: Install ceiling-mounted detectors not less than 4 inches (100 mm) from a side wall to the near edge. Install detectors located on the wall at least 4 inches (100 mm), but not more than 12 inches (300 mm), below the ceiling. For exposed solid-joist construction, mount detectors on the bottom of the joists. On smooth ceilings, install detectors not over 30 feet (9 m) apart in any direction. Install detectors no closer than 60 inches (1520 mm) from air registers.

D. Audible Alarm-Indicating Devices: Install not less than 90 inches (2280 mm) above the finished floor nor less than 6 inches (150 mm) below the ceiling. Install bells and horns on flush-mounted back boxes with the device-operating mechanism concealed behind a grille or as indicated. Combine audible and visual alarms at the same location into a single unit.

E. Visual Alarm-Indicating Devices: Install adjacent to each alarm bell or alarm horn and not more than 80 inches (2030 mm) above the finished floor and at least 6 inches (150 mm) below the ceiling.

F. Device Location-Indicating Lights: Locate in public space near the device they monitor.

G. FACP: Surface mount with tOP3 of cabinets not more than 72 inches (1830 mm) above the finished floor.

H. Graphic Annunciator: Arrange as indicated, with the top of the panel no more than 72 inches (1830 mm) above the finished floor.

4.03 WIRING INSTALLATION

A. Wiring Method: Install wiring in metal raceway according to Division 26 Section "Raceways 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 3unction, 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. Wiring to Central-Station Transmitter: 1-inch (27) GRC between the FACP and the central-station transmitter connection as indicated. Install number of conductors and electrical supervision for connecting wiring as needed to suit central-station monitoring function. Final connections to terminals in central-station transmitter are made under another contract.

F. Minimum temperature rating of the cables shall be 150 Deg. Celsius.

4.04 IDENTIFICATION

A. Identify system components, wiring, cabling, and terminals according to Division 26 Section "Identification for Electrical Systems"

4.05 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 26 05 26 "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.

4.06 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.

B. Pretesting: After installation, align, adjust, and balance the system and perform complete pretesting. Determine, through pretesting, the conformance of the system to the requirements of the Drawings and Specifications. Correct deficiencies observed in pretesting. Replace malfunctioning or damaged items with new ones and retest until satisfactory performance and conditions are achieved. Prepare forms for systematic recording of acceptance test results.

C. Report of Pretesting: After pretesting is complete, provide a letter certifying the installation is complete and fully operable, including the names and titles of the witnesses to the preliminary tests.

D. Final Test Notice: Provide a 10-day minimum notice in writing when the system is ready for final acceptance testing.

E. Minimum System Tests: Test the system according to the procedures outlined in NFPA 72. Minimum required tests are as follows:
   1. Verify the absence of unwanted voltages between circuit conductors and ground.
   2. Test all conductors for short circuits using an insulation-testing device.
   3. With each circuit pair, short circuit at the far end of the circuit and measure the circuit resistance with an ohmmeter. Record the circuit resistance of each circuit on the record drawings.
   4. Verify that the control unit is in the normal condition as detailed in the manufacturer's operation and maintenance manual.
   5. Test initiating and indicating circuits for proper signal transmission under open circuit conditions. one connection each should be opened at not less than 10 percent of the initiating and indicating devices. Observe proper signal transmission according to class of wiring used.
   6. Test each initiating and indicating device for alarm operation and proper response at the control unit. Test smoke detectors with actual products of combustion.
   7. Test the system for all specified functions according to the approved operation and maintenance manual. Systematically initiate specified functional performance items at each station, including making all possible alarm and monitoring initiations and using all communications options. For each item, observe related performance at all devices required to be affected by the item under all system sequences. Observe indicating lights, displays, signal tones, and annunciator indications. Observe all voice audio for routing, clarity, quality, freedom from noise and distortion, and proper volume level.
   8. Test Both Primary and Secondary Power: Verify by test that the secondary power system is capable of operating the system for the period and in the manner specified.

F. Retesting: Correct deficiencies indicated by tests and completely retest work affected by such deficiencies. Verify by the system test that the total system meets the Specifications and complies with applicable standards.

G. Report of Tests and Inspections: Provide a written record of inspections, tests, and detailed test results in the form of a test log. Submit log upon the satisfactory completion of tests.

H. Tag all equipment, stations, and other components at which tests have been satisfactorily completed.

4.07 CLEANING AND ADJUSTING

A. Cleaning: Remove paint splatters and other spots, dirt, and debris. Touch up scratches and marred finish to match original finish. Clean unit internally using methods and materials recommended by manufacturer.

4.08 DEMONSTRATION

A. Startup Services: Engage a factory-authorized service representative to provide startup service and to demonstrate and train owner's maintenance personnel as specified below.
1. Train Owner's maintenance personnel on procedures and schedules related to startup and shutdown, troubleshooting, servicing, adjusting, and preventive maintenance. Provide a minimum of 8 hours' training.
2. Training Aid: Use the approved final version of the operation and maintenance manual as a training aid.
3. Schedule training with Owner with at least 7 days' advance notice.

4.09 ON-SITE ASSISTANCE

A. Occupancy Adjustments: When requested within one year of date of Substantial Completion, provide on-site assistance in adjusting sound levels, controls, and sensitivities to suit actual occupied conditions. Provide up to 3 requested adjustment visits to the site for this purpose.

PART 5 - EXECUTION

5.01 INSTALLATION, GENERAL

A. Install system according to NFPA standards referenced in Parts 1 and 2 of this Section.

B. Fire Alarm Power Supply Disconnect: Paint red and label "FIRE ALARM." Provide with lockable handle or cover.

5.02 EQUIPMENT INSTALLATION

A. Manual Pull Stations: Mount semiflush in recessed back boxes with operating handles 48 inches (1220 mm) above the finished floor or lower as indicated.

B. Water-Flow Detectors and Valve Supervisory Switches: Connect for each sprinkler valve station required to be supervised.

C. Smoke detectors in hotel guestrooms, dormitory rooms, apartments shall be "system type" analogue addressable devices of the photoelectric cell type, each complete with an integral audible device (having a 90 dB, sound power rating at 10 feet) powered from the system conductors, and activated only by the smoke detector(s) within the unit (i.e., room, suite apartment).

D. Smoke or heat detection devices indicated in kitchens and boiler rooms shall be of the 190F "fixed temperature only" type.

E. Smoke detection devices in laboratories and maintenance shops and garage areas shall be of the photoelectric cell type.

F. Smoke detectors indicated in mechanical equipment rooms shall be of the combination photocell plus fixed temperature/rate-of-rise type.

G. Smoke detection devices shall have integrally mounted pilot lamps giving a "triggered" indication.

H. Smoke detection devices which are mounted in ducts, above hung ceilings or under raised floors 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. The pilots for detectors under raised floors or in ceiling plenums shall be remotely mounted in a graphic annunciator panel at a location within the computer space as directed. 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.

I. Smoke detectors mounted in hospital nursing home patient rooms shall each be equipped with a remote "triggered" indication light wired in parallel (with the pilot light integral with the detector. These remote pilot lights shall each be flush mounted in the corridor over or adjacent to the door to the room as directed by the Architect.

J. 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.

K. Heat detectors located in sprinklered elevator machine rooms or elevator shafts shall be of the 135°F "fixed temperature only" type.

L. Smoke detectors for spaces where ambient temperature may fall below 32°F shall be projected beam type which may be suitable for -22°F.

M. Smoke Detectors: Install ceiling-mounted detectors not less than 4 inches (100 mm) from a side wall to the near edge. Install detectors located on the wall at least 4 inches (100 mm), but not more than 12 inches (300 mm), below the ceiling. For exposed solid-joist construction, mount detectors on the bottom of the joists. On smooth ceilings, install detectors not over 30 feet (9 m) apart in any direction. Install detectors no closer than 60 inches (1520 mm) from air registers.

N. Audible Alarm-Indicating Devices: Install not less than 90 inches (2280 mm) above the finished floor nor less than 6 inches (150 mm) below the ceiling. Install bells and horns on flush-mounted back boxes with the device-operating mechanism concealed behind a grille or as indicated. Combine audible and visual alarms at the same location into a single unit.

O. Visual Alarm-Indicating Devices: Install adjacent to each alarm bell or alarm horn and not more than 80 inches (2030 mm) above the finished floor and at least 6 inches (150 mm) below the ceiling.

P. Device Location-Indicating Lights: Locate in public space near the device they monitor.

Q. FACP: Surface mount with tops of cabinets not more than 72 inches (1830 mm) above the finished floor.

R. Graphic Annunciator: Arrange as indicated, with the top of the panel no more than 72 inches (1830 mm) above the finished floor.

5.03 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. Wiring to Central-Station Transmitter: 1-inch (27) GRC between the FACP and the central-station transmitter connection as indicated. Install number of conductors and electrical supervision for connecting wiring as needed to suit central-station monitoring function. Final connections to terminals in central-station transmitter are made under another contract.

F. Minimum temperature rating of the cables shall be 150 Deg. Celsius.

5.04 IDENTIFICATION

A. Identify system components, wiring, cabling, and terminals according to Division 26 Section "Identification for Electrical Systems

5.05 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.

5.06 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.

5.07 FIELD TESTING

A. Each addressable analog smoke detector shall be individually field tested prior to installing the device at it's 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 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.

5.08 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 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 effected 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.

5.09 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.

5.10 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.

5.11 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.

5.12 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.

Affected Office Area	Manual Fire Pull Station	Area Smoke Detector	Duct Smoke Detector	Sprinkler Water Flow	Dry or Wet Chemical	Tamper Switch	Fire System Trouble
Send Alarm Message/Signal to FCS	√	√	√	√	√	N/A	N/A
Activate Audible/Visuals	√	√	√	√	√	N/A	N/A
Shutdown HVAC	√	√	√	√	√	N/A	N/A
Close Magnetic Door	√	√	√	√	√	N/A	N/A
Send Alarm Message/ Signal Lobby Annunciator	√	√	√	√	√	N/A	N/A
Send Alarm Message/Signal Remote Agency	√	√	√	√	N/A	N/A	N/A
Shutdown Bridge Link Unit Heater	NO	N/A	NO	NO	NO	N/A	N/A
Send Trouble Signal/Message to FCS	N/A	N/A	N/A	N/A	N/A	N/A	√
Send Trouble Signal/Message to Lobby Annunciator	N/A	N/A	N/A	N/A	N/A	N/A	√
Send Trouble Signal/Message to Remote Agency	N/A	N/A	N/A	N/A	N/A	N/A	√
Activate System Audible Trouble Bell	N/A	N/A	N/A	N/A	N/A	N/A	√
Send Supervisory Signal/Message to FCS	N/A	N/A	N/A	N/A	N/A	√	N/A
Send Supervisory Signal/Message to Lobby Annunciator	N/A	N/A	N/A	N/A	N/A	√	N/A
Send Supervisory Signal/Message to Remote Agency	N/A	N/A	N/A	N/A	N/A	√	N/A
Send Alarm Message/Signal to FCS						N/A	N/A
Activate Audible/Visuals						N/A	N/A
Shutdown HVAC						N/A	N/A

Affected Office Area	Manual Fire Pull Station	Area Smoke Detector	Duct Smoke Detector	Sprinkler Water Flow	Dry or Wet Chemical	Tamper Switch	Fire System Trouble
Close Magnetic Door						N/A	N/A
Send Alarm Message/Signal Lobby Annunciator						N/A	N/A
Send Alarm Message/Signal Remote Agency						N/A	N/A
Shutdown Bridge Link Unit Heater	NO		NO	NO	NO	N/A	N/A
Send Trouble Signal/Message to Lobby Annunciator	N/A	N/A	N/A	N/A	N/A	N/A	
Send Trouble Signal/Message to Remote Agency	N/A	N/A	N/A	N/A	N/A	N/A	
Activate System Audible Trouble Bell	N/A	N/A	N/A	N/A	N/A	N/A	
Send Supervisory Signal/Message to FCS	N/A	N/A	N/A	N/A	N/A		N/A
Send Supervisory Signal/Message to Lobby Annunciator	N/A	N/A	N/A	N/A	N/A		N/A
Send Supervisory Signal/Message to Remote Agency	N/A	N/A	N/A	N/A	N/A		N/A
Activate Supervisory Bell	N/A	N/A	N/A	N/A	N/A		N/A

END OF SECTION 28 31 13

EXHIBIT D: DRAWINGS

FASHION INSTITUTE of TECHNOLOGY
State University of New York

227 WEST 27TH STREET NEW YORK, NY 10001

REPLACEMENT OF WEST COURTYARD AND POMERANTZ CENTER AC UNITS

K&L Group
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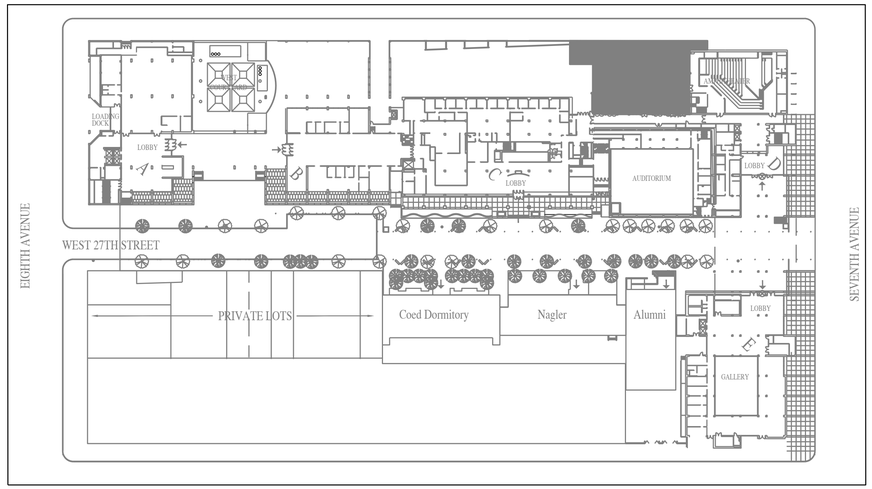
116 West 32nd Street, 12th Floor, New York, N.Y. 10001
P 212.643.9055 *www.mgedpc.net*

PROJECT DATA LOCATION:
340 8TH 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	COVER SHEET
EN-001	ENERGY COMPLIANCE
MECHANICAL	
M-001	SYMBOLS, ABBREVIATIONS, NOTES
M-101	CELLAR MECHANICAL PLAN
M-102	1ST FLOOR MECHANICAL PLAN
M-103	ROOF MECHANICAL PLAN
M-104	4TH FLOOR MECHANICAL PLANS
M-201	4TH FLOOR MECHANICAL PIPING PLAN
M-501	MECHANICAL DETAILS 1
M-502	MECHANICAL DETAILS 2
M-503	MECHANICAL DETAILS 3
M-601	HVAC AIR FLOW DIAGRAM
M-701	MECHANICAL SCHEDULES 1
M-702	MECHANICAL SCHEDULES 2
M-801	AC-1W UNIT TEMPERATURE CONTROL DIAGRAM 1
M-802	AC-2W UNIT TEMPERATURE CONTROL DIAGRAM 2
M-803	AC-3W UNIT TEMPERATURE CONTROL DIAGRAM 3
M-804	CHILLED WATER BOOSTER SYSTEMS CONTROLS DIAGRAM
M-805	AC-5D UNIT TEMPERATURE CONTROL DIAGRAM 5
M-901	ROOF MECHANICAL DEMOLITION PLAN
M-902	4TH FLOOR MECHANICAL DEMOLITION PLAN
ELECTRICAL	
E-001	ELECTRICAL LEGEND, ABBREVIATIONS, AND GENERAL NOTES
E-100	SUBCELLAR & CELLAR MER ELECTRICAL PLAN
E-101	4TH FLOOR DEMOLITION AND NEW WORK PART PLANS
E-102	ELECTRICAL 1ST FLOOR AND ROOF POWER PART PLANS
PLUMBING	
P-001	PLUMBING SYMBOL LIST, ABBREVIATIONS, AND NOTES
P-101	1ST FLOOR PLUMBING PLAN
P-102	ROOF PLUMBING PLAN
P-501	PLUMBING SPECIFICATIONS AND DETAILS
FIRE ALARM	
FA-001	FIRE ALARM SYMBOL LIST, ABBREVIATIONS, RISER DIAGRAM & MATRIX
FA-002	FIRE ALARM SYMBOL LIST, ABBREVIATIONS, RISER DIAGRAM & MATRIX
FA-100	FIRE ALARM FIRST AND FOURTH FOURTH FLOOR PART PLANS
FA-101	FIRE ALARM ROOF PART PLAN

BID SET 06/08/2022

NEW YORK CITY BUILDING DEPARTMENT NOTE
THIS PLAN IS FOR ECC SCOPE AND APPROVAL ONLY.
(NOTE IS APPLICABLE ONLY TO NYC DOB REVIEW PROCESS. CONTRACTOR MUST PROVIDE ALL WORK SHOWN ON PLAN)

NEW YORK CITY BUILDING DEPARTMENT APPROVAL NOTE
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.

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.

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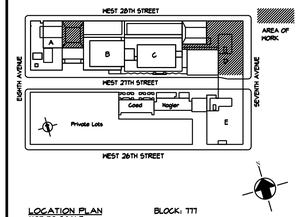
rev. no.	date	revisions
	06/08/2022	ISSUED TO BID



LOCATION PLAN
NOT TO SCALE

BLOCK: 777
LOT: 1

Fashion Institute of Technology

340 8th Avenue
New York, NY 10001

MEP Consultants
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PROJECT:
WEST COURTYARD
340 8TH AVENUE
AC UNITS REPLACEMENT

DRAWING TITLE:
COVER SHEET

DOB NOW JOB#

SEAL & SIGNATURE:

DATE:	05/31/2022
PROJECT No:	8969.29
DRAWING BY:	MY
CHK BY:	DNE
DWG No:	T-001.00
SCALE: NTS	1 OF 1

2020 NYCECC NEW YORK STATE BUILDING MECHANICAL SYSTEMS

BUILDING MECHANICAL SYSTEMS

	PROVISIONS	ITEM DESCRIPTION	PROPOSED DESIGN VALUE	CODE PRESCRIPTIVE VALUE	SUPPORTING DOCUMENTATION
C403.1	GENERAL	MECHANICAL SYSTEMS AND EQUIPMENT SERVING THE BUILDING.		SYSTEMS SHALL COMPLY WITH SECTIONS C403.2 AND SHALL COMPLY WITH SECTIONS C403.3, AND C403.4.	
C403.2	PROVISIONS APPLICABLE TO ALL MECHANICAL SYSTEMS (MANDATORY)				
C403.2.12	AIR SYSTEM DESIGN AND CONTROL	EACH HVAC SYSTEM WITH FAN SYSTEM MOTOR EXCEEDING 5 HP.	BMS PROVIDED	SHALL MEET SECTION C403.2.12.1 THROUGH C403.2.12.3.	SEE MECHANICAL DRAWINGS AND SPECIFICATIONS.
C403.4	HVAC SYSTEM CONTROLS	EACH HEATING AND COOLING SYSTEM SHALL BE PROVIDED WITH THERMOSTATIC CONTROLS.	BMS PROVIDED	SYSTEMS SHALL HAVE THERMOSTATIC CONTROLS AS SPECIFIED IN SECTIONS: C403.2.4.1, C403.2.4.1.3, C403.2.4.2, C403.2.4.3, C403.3.1, C403.4, C403.4.1 OR C403.4.4	SEE MECHANICAL DRAWINGS.
C403.4.2	OFF-HOUR CONTROLS	ZONE THERMOSTATIC CONTROL.	BMS PROVIDED	SHALL BE PROVIDED WITH AUTOMATIC TIME CLOCK OR PROGRAMMABLE CONTROL. SEE EXEPTIONS.	SEE CONTROL DRAWINGS.
C403.4.2.1	THERMOSTATIC SETBACK CAPABILITIES	THERMOSTATIC CONTROLS	BMS PROVIDED	SHALL HAVE THE CAPABILITY TO SET BACK TO 55°F OR UP TO 85°F.	SEE CONTROL DRAWINGS.
C403.4.2.2	AUTOMATIC SETBACK AND SHUTDOWN CAPABILITIES	AUTOMATIC TIME CLOCK OR PROGRAMMABLE CONTROLS	BMS PROVIDED	SHALL BE CAPABLE TO FOLLOW THE 7 DIFFERENT PROGRAMMABLE DAILY SCHEDULES AND MANUAL OVERRIDES.	SEE CONTROL DRAWINGS.
C403.4.2.3	AUTOMATIC START CAPABILITIES	HVAC SYSTEM	BMS PROVIDED	SHALL BE PROVIDED WITH CONTROLS CAPABLE AUTOMATICALLY ADJUSTING DAILY START TIME OF THE HVAC SYSTEM	SEE CONTROL DRAWINGS.
C403.5	ECONOMIZERS (PRESCRIPTIVE)	EACH COOLING SYSTEM	BMS PROVIDED	SHALL INCLUDE EITHER AN AIR OR WATER ECONOMIZER MEETING REQUIREMENTS OF SECTION C403.5.1 THROUGH C403.5.5. SEE EXCEPTIONS.	SEE MECHANICAL AND CONTROL DRAWINGS.
C403.5.1	INTEGRATED ECONOMIZER CONTROL	ECONOMIZER SYSTEM	BMS PROVIDED	SHALL BE INTEGRATED WITH COOLING SYSTEM AND BE CAPABLE OF PROVIDING PARTIAL COOLING.	SEE MECHANICAL AND CONTROL DRAWINGS.
C403.5.3	AIR ECONOMIZERS	AIR ECONOMIZERS	BMS PROVIDED	SHALL COMPLY WITH SECTIONS C403.5.3.1 TROUGH C403.5.3.5	SEE MECHANICAL AND CONTROL DRAWINGS.
C403.5.3.1	DESIGN CAPACITY	AIR ECONOMIZERS	BMS PROVIDED	SHALL COMPLY WITH SECTIONS C403.5.3.1 TROUGH C403.5.3.5	SEE MECHANICAL AND CONTROL DRAWINGS.
C403.5.3.2	CONTROL SIGNAL	ECONOMIZER DAMPERS	BMS PROVIDED	SHALL BE CAPABLE OF BEING SEQUENCED WITH THE MECHANICAL COOLING EQUIPMENT. SEE EXEPTION.	SEE MECHANICAL AND CONTROL DRAWINGS.
C403.5.3.3	HIGH-LIMIT SHUTOFF	AIR ECONOMIZERS	BMS PROVIDED	HIGH-LIMIT SHUT OFF CONTROL SHALL COMPLY WITH TABLE C403.5.3.3	SEE MECHANICAL AND CONTROL DRAWINGS.
C403.5.3.4	RELIEF OF EXCESS OUTDOOR AIR	AIR ECONOMIZERS	BMS PROVIDED	SYSTEMS SHALL BE CAPABLE OF RELIEVING EXCESS OUTDOOR AIR.	SEE MECHANICAL AND CONTROL DRAWINGS.
C403.5.3.5	ECONOMIZER DAMPERS.	ECONOMIZER DAMPERS	BMS PROVIDED	SHALL COMPLY WITH SECTION C403.7.7	SEE MECHANICAL AND CONTROL DRAWINGS.
C403.7.7	SHUTOFF DAMPER CONTROLS	OUTDOOR AIR SUPPLY AND EXHAUST DUCTS	BMS PROVIDED	SHALL BE EQUIPPED WITH MOTORIZED DAMPERS. SEE EXCEPTIONS.	SEE MECHANICAL AND CONTROL DRAWINGS.
C403.8.1	ALLOWABLE FAN MOTOR HORSEPOWER	EACH HVAC SYSTEM		SHALL NOT EXCEED THE ALLOWABLE FAN SYSTEM MOTOR NAMEPLATE HP OR FAN SYSTEM BHP. AS SHOWN IN TABLE C403.8.1(1). SEE EXCEPTIONS.	SEE MECHANICAL DRAWINGS.
C403.8.2	MOTOR NAMEPLATE HORSEPOWER	FOR EACH FAN, MOTOR SIZE		THE MOTOR SHALL NOT BE LARGER THAN THE FIRST AVAILABLE MOTOR SIZE. SEE EXCEPTIONS.	SEE MECHANICAL DRAWINGS.
C403.8.3	FAN EFFICIENCY	FAN EFFICIENCY GRADE (FEG)		FANS SHALL HAVE FEG OF NOT LESS THAN 67 IN ACCORDANCE WITH AMCA 205. SEE EXCEPTIONS.	SEE MECHANICAL DRAWINGS.
C403.11.1	DUCT AND PLENUM INSULATION AND SEALING	SUPPLY AND RETURN DUCTS		SHALL BE INSULATED WITH MINIMUM R-6 IN UNCONDITIONED SPACES INSIDE AND A MINIMUM R-8 INSULATION WHERE LOCATED OUTSIDE. SEE EXCEPTIONS.	SEE MECHANICAL DRAWINGS AND SPECIFICATIONS.
C403.11.2	DUCT CONSTRUCTION	DUCTWORK		SHALL BE CONSTRUCTED IN ACCORDDANCE WITH NEW YORK CITY MECHANICAL CODE	SEE MECHANICAL DRAWINGS AND SPECIFICATIONS.
C403.11.2.1	LOW PRESSURE DUCT SYSTEMS	ALL DUCTS AND PLENUM OPERATING AT A STATIC PRESSURE LESS THAN 2 INCHES OF WATER.		SHALL BE SECURELY FASTENED AND SEALED. SEE EXCEPTIONS.	SEE MECHANICAL DRAWINGS AND SPECIFICATIONS.
C403.11.3	PIPING INSULATION	PIPES SERVING THE HEATING OR COOLING SYSTEMS		SHALL BE THERMALLY INSULATED IN ACCORDANCE TO TABLE C403.11.3. SEE EXCEPTIONS.	SEE MECHANICAL DRAWINGS AND SPECIFICATIONS.
C403.11.3.1	PROTECTION OF PIPING INSULATION	PIPING INSULATION EXPOSED TO WEATHER		SHALL BE PROTECTED FROM DAMAGE.	SEE MECHANICAL DRAWINGS AND SPECIFICATIONS.

COMPLIANCE WITH 2020 NEW YORK CITY ENERGY CODE.
TO THE BEST OF OUR KNOWLEDGE, BELIEF AND PROFESSIONAL JUDGMENT
THIS APPLICATION IS IN COMPLIANCE WITH THE 2020 NYCECC.

PROGRESS INSPECTIONS FOR ENERGY CODE COMPLIANCE COMMERCIAL BUILDINGS

	INSPECTION/TEST	PERIODIC (MINIMUM)	REFERENCE STANDARD (SEE ECC CHAPTER 6) OR OTHER CRITERIA	2020 NYC ECC
IIA ENVELOPE INSPECTIONS				
IIB MECHANICAL AND SERVICE WATER HEATING INSPECTIONS				
IIB2	SHUTOFF DAMPERS: DAMPERS FOR STAIR AND ELEVATOR SHAFT VENTS AND OTHER OUTDOOR AIR INTAKES AND EXHAUST OPENINGS INTEGRAL TO THE BUILDING ENVELOPE SHALL BE VISUALLY INSPECTED TO VERIFY THAT SUCH DAMPERS, EXCEPT WHERE PERMITTED TO BE GRAVITY DAMPERS, COMPLY WITH APPROVED CONSTRUCTION DRAWINGS. MANUFACTURER'S LITERATURE SHALL BE REVIEWED TO VERIFY THAT THE PRODUCT HAS BEEN TESTED AND FOUND TO MEET THE STANDARD.	AS REQUIRED DURING INSTALLATION.	APPROVED CONSTRUCTION DOCUMENTS: AMCA 500D	C402.5.5, C403.7.7
IIB3	HVAC AND SERVICE WATER HEATING EQUIPMENT: EQUIPMENT SIZING, EFFICIENCIES AND OTHER PERFORMANCE FACTORS OF ALL MAJOR EQUIPMENT UNITS, AS DETERMINED BY THE APPLICANT OF RECORD , AND NO LESS THAN 15% OF MINOR EQUIPMENT UNITS, SHALL BE VERIFIED BY VISUAL INSPECTION AND, WHERE NECESSARY, REVIEW OF MANUFACTURER'S DATA.	PRIOR TO FINAL PLUMBING AND CONSTRUCTION INSPECTION.	APPROVED CONSTRUCTION DOCUMENTS.	C403.1, C403.2, C403.3, C403.75, C404.2, C404.5, C404.9, C405.10, C406
IIB4	HVAC AND SERVICE WATER HEATING SYSTEM CONTROLS: NO LESS THAN 20% OF EACH TYPE OF REQUIRED CONTROLS AND ECONOMIZERS SHALL BE VERIFIED BY VISUAL INSPECTION AND TESTED FOR FUNCTIONALITY AND PROPER OPERATION. SUCH CONTROLS SHALL INCLUDE, BUT ARE NOT LIMITED TO: - THERMOSTATIC - SET POINT OVERLAP RESTRICTION - OFF-HOUR - SHUTOFF DAMPER - SNOW-MELT SYSTEM - ZONES - ECONOMIZERS - AIR SYSTEMS - VARIABLE AIR VOLUME FAN - SINGLE ZONE COOLING SYSTEMS - HYDRONIC SYSTEM - HEAT REJECTION EQUIPMENT FAN SPEED - COMPLEX MECHANICAL SYSTEMS SERVING MULTIPLE ZONES - VENTILATION - ENERGY RECOVERY SYSTEM - TEMPERATURE - SERVICE WATER HEATING - HOT WATER SYSTEM CONTROLS WITH SEASONALLY DEPENDENT FUNCTIONALITY: CONTROLS WHOSE COMPLETE OPERATION CANNOT BE DEMONSTRATED DUE TO PREVAILING WEATHER CONDITIONS TYPICAL OF THE SEASON DURING WHICH PROGRESS INSPECTIONS WILL BE PERFORMED SHALL BE PERMITTED TO BE SIGNED OFF FOR THE PURPOSE OF A TEMPORARY CERTIFICATE OF OCCUPANCY WITH ONLY A VISUAL INSPECTION, PROVIDED, HOWEVER, THAT THE PROGRESS INSPECTOR SHALL PERFORM A SUPPLEMENTAL INSPECTION WHERE THE CONTROLS ARE VISUALLY INSPECTED AND TESTED FOR FUNCTIONALITY AND PROPER OPERATION DURING THE NEXT IMMEDIATE SEASON THEREAFTER. THE OWNER SHALL PROVIDE FULL ACCESS TO THE PROGRESS INSPECTOR WITHIN TWO WEEKS OF THE PROGRESS INSPECTOR'S REQUEST FOR SUCH ACCESS TO PERFORM THE PROGRESS INSPECTION. FOR SUCH SUPPLEMENTAL INSPECTIONS, THE DEPARTMENT SHALL BE NOTIFIED BY THE APPROVED PROGRESS INSPECTION APPROVED AGENCY OF ANY UNRESOLVED DEFICIENCIES IN THE INSTALLED WORK WITHIN 180 DAYS OF SUCH SUPPLEMENTAL INSPECTION.	AFTER INSTALLATION AND PRIOR TO FINAL ELECTRICAL AND CONSTRUCTION INSPECTION, EXCEPT THAT FOR CONTROLS WITH SEASONALLY DEPENDENT FUNCTIONALITY, SUCH TESTING SHALL BE PERFORMED BEFORE SIGN_OFF FOR ISSUANCE OF A FINAL CERTIFICATE OF OCCUPANCY.	APPROVED CONSTRUCTION DOCUMENTS INCLUDING CONTROL SYSTEM NARRATIVES; ASHRAE GUIDELINE 1: THE HVAC COMMISSIONING PROCESS WHERE APPLICABLE	C403., C404, C406
IIB5	HVAC INSULATION AND SEALING: INSTALLED DUCT AND PIPING INSULATION SHALL BE VISUALLY INSPECTED TO VERIFY PROPER INSULATION PLACEMENT AND VALUES. JOINTS, LONGITUDINAL AND TRANSVERSE SEAMS AND CONNECTIONS IN DUCTWORK SHALL BE VISUALLY INSPECTED FOR PROPER SEALING.	AFTER INSTALLATION AND PRIOR TO CLOSING SHAFTS, CEILINGS AND WALLS.	APPROVED CONSTRUCTION DOCUMENTS; SMACNA DUCT CONSTRUCTION STANDARDS, METAL AND FLEXIBLE.	C403.11, C404.4, C404.5, MC 603.9
IIC ELECTRICAL POWER AND LIGHTING SYSTEMS				
IIC7	ELECTRIC MOTORS (INCLUDING BUT NOT LIMITED TO FAN MOTORS): WHERE REQUIRED BY THE CONSTRUCTION DOCUMENTS FOR ENERGY CODE COMPLIANCE, MOTOR LISTING OR LABELS SHALL BE VISUALLY INSPECTED TO VERIFY THAT THEY COMPLY WITH THE RESPECTIVE ENERGY REQUIREMENTS IN THE CONSTRUCTION DOCUMENTS.	PRIOR TO FINAL ELECTRICAL AND CONSTRUCTION INSPECTION.	APPROVED CONSTRUCTION DOCUMENTS.	C403.8, C405.6, C405.7, C405.9
IID OTHER				
IID1	MAINTENANCE INFORMATION: MAINTENANCE MANUALS FOR MECHANICAL, SERVICE HOT WATER AND ELECTRICAL EQUIPMENT AND SYSTEMS REQUIRING PREVENTIVE MAINTENANCE SHALL BE REVIEWED FOR APPLICABILITY TO INSTALLED EQUIPMENT AND SYSTEMS BEFORE SUCH MANUALS ARE PROVIDED TO THE OWNER. LABELS REQUIRED FOR SUCH EQUIPMENT OR SYSTEMS SHALL BE INSPECTED FOR ACCURACY AND COMPLETENESS.	PRIOR TO SIGN-OFF OR ISSUANCE OF FINAL CERTIFICATE OF OCCUPANCY.	APPROVED CONSTRUCTION DOCUMENTS, INCLUDING ELECTRICAL DRAWINGS WHERE APPLICABLE, ASHRAE GUIDELINE 4; PREPARATION OF OPERATING AND MAINTENANCE DOCUMENTATION FOR BUILDING SYSTEMS.	C403.2.10

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NEW YORK CITY BUILDING DEPARTMENT NOTE

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(NOTE IS APPLICABLE ONLY TO NYC DOB REVIEW PROCESS. CONTRACTOR MUST PROVIDE ALL WORK SHOWN ON PLAN)

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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.

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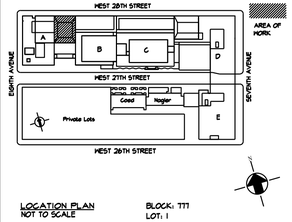
rev. no. date revisions

- 06/08/2022 ISSUED TO BID



LOCATION PLAN
NOT TO SCALE

BLOCK: 777
LOT: 1

Fashion Institute of Technology

340 8th Avenue
New York, NY 10001

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PROJECT:
WEST COURTYARD
340 8TH AVENUE
AC UNITS REPLACEMENT

DRAWING TITLE:
ENERGY COMPLIANCE

DOB NOW JOB •

SEAL & SIGNATURE:

DATE:	05/31/2022
PROJECT No:	8969.29
DRAWING BY:	ST
CHK BY:	DNE
DWG No:	EN-001.00
SCALE: NTS	1 OF 1

SYMBOL LIST AND ABBREVIATIONS

ABBREV.	SYMBOL	DESCRIPTION
(E)		EXISTING WORK TO REMAIN
		NEW WORK
		EXISTING WORK TO BE REMOVED
		DIRECTION OF FLOW
		RETURN OR EXHAUST DUCT DOWN
		RETURN OR EXHAUST DUCT UP
		SUPPLY DUCT DOWN
		SUPPLY DUCT UP
MD	MD MD	MOTORIZED DAMPER
FSD/AD, FD/AD, SD/AD		FIRE & SMOKE DAMPERS W/ACCESS DOOR IN DUCT AT WALL
FC	FC	FLEXIBLE CONNECTION
	SD	DUCT MOUNTED SMOKE DETECTOR W/AD
	T	THERMOSTAT WITH DISPLAY
	H	HUMIDISTAT WITH DISPLAY
		CONNECT NEW TO EXISTING WORK
		POINT OF DISCONNECTION. CAP IF NOT TO BE RECONNECTED
TS	TS	TEMPERATURE SENSOR
		THERMOMETER
		WATER PRESSURE GAUGE
		STEAM PRESSURE GAUGE WITH SYPHON
AAV		AUTOMATIC AIR VENT
CV		TWO WAY CONTROL VALVE
		THREE WAY CONTROL VALVE
		BUTTERFLY VALVE
		BUTTERFLY CONTROL VALVE
PSV		SAFETY RELIEF VALVE
		GATE VALVE / SHUT-OFF VALVE
		GLOBE VALVE
		CHECK VALVE
		~~BALL VALVE~~
		~~PLUG VALVE~~
		COMBINATION FLOW MEASURING AND BALANCING VALVE
		NEEDLE VALVE
		NEEDLE VALVE WITH BLOCK AND BLEED
		STRAINER WITH CAPPED BLOW-DOWN VALVE
TDV		TRIPLE DUTY VALVE
		ECCENTRIC REDUCER
		UNION
	CHWR	CHILLED WATER RETURN
	CHWS	CHILLED WATER SUPPLY
	LPC	LOW PRESSURE CONDENSATE RETURN
	LPS	LOW PRESSURE STEAM
	CW	COLD (CITY) WATER
		PIPE DOWN
		PIPE UP
		END CAP
		PUMP

ABBREVIATIONS

ABBREV.	DESCRIPTION
ABV	ABOVE
AFF	ABOVE FINISHED FLOOR
AFM	AIR FLOW MEASURING STATION
AHU	AIR HANDLING UNIT
APD	AIR PRESSURE DROP
ATC	AUTOMATIC TEMPERATURE CONTROL
BMS	BUILDING MANAGEMENT SYSTEM
BOD	BOTTOM OF DUCT
BOP	BOTTOM OF PIPE
BTU	BRITISH THERMAL UNITS
CFM	CUBIC FEET PER MINUTE
CH-1	CHILLER #1
CO	CARBON MONOXIDE
CT-1	COOLING TOWER #1
DDC	DIRECT DIGITAL CONTROL
DP	DIFFERENTIAL PRESSURE
DN	DOWN
DWG	DRAWING
(E)	EXISTING
EAT	ENTERING AIR TEMPERATURE
ELEV	ELEVATION
EWT	ENTERING WATER TEMPERATURE
FPM	FEET PER MINUTE
FT	FEET
GAL	GALLON
GPM	GALLON PER MINUTE
HP	HORSE POWER
KW	KILOWATT
LAT	LEAVING AIR TEMPERATURE
LBs	POUNDS
LBS/HR	POUNDS PER HOUR
LRA	LOCKED ROTOR AMPS
LWT	LEAVING WATER TEMPERATURE
MAX	MAXIMUM
MBH	THOUSANDS BTU PER HOUR
MECH	MECHANICAL
MER	MECHANICAL EQUIPMENT ROOM
MIN	MINIMUM
NC	NORMALLY CLOSED
NIC	NOT IN CONTRACT
NO	NORMALLY OPEN
NTS	NOT TO SCALE
P-1	PUMP #1
PD	PRESSURE DROP
PRV	PRESSURE REDUCING VALVE
PSI(G)	POUNDS PER SQUARE INCH (GAUGE)
RPM	REVOLUTIONS PER MINUTE
TYP	TYPICAL
VFD	VARIABLE FREQUENCY DRIVE
WB	WET BULB
WPD	WATER PRESSURE DROP
WT	WEIGHT

NOTE:

SYMBOLS AND ABBREVIATIONS LISTED IN THE TABLES ABOVE ARE TYPICAL FOR HVAC AIR AND WATER DISTRIBUTION SYSTEMS. NOT ALL OF LISTED SYMBOLS OR ABBREVIATIONS WERE USED IN THIS PROJECT.

BUILDING DEPARTMENT NOTES

1. THE OWNER SHALL ENGAGE THE SERVICES OF AN AGENCY APPROVED BY THE NYC DEPARTMENT OF BUILDINGS TO PERFORM ALL REQUIRED SPECIAL INSPECTIONS (BC 1704) AND PROGRESS INSPECTIONS (BC 110). SPECIAL AND PROGRESS INSPECTIONS SHALL BE PAID FOR BY THE OWNER. THE FOLLOWING ITEMS REQUIRE SPECIAL INSPECTION (CODE REFERENCES ARE TO THE DECEMBER 31, 2014 CODE):

SPRAYED FIRE-RESISTANT MATERIALS	BC 1704.11
MECHANICAL SYSTEMS	BC 1704.16
FIRESTOP, DRAFTSTOP AND FIREBLOCK SYSTEMS	BC 1704.27
ENERGY CODE COMPLIANCE INSPECTIONS	BC 110.3.5
FINAL 28-116.2.4.2 AND BC 110.5 AND DIRECTIVE 14 OF 1975	

   THE FOLLOWING ITEMS REQUIRE PROGRESS INSPECTIONS:

ENERGY CODE COMPLIANCE	BC 110.3.5
FIRE RESISTANT RATED CONSTRUCTION	BC 110.3.4
FINAL INSPECTION	28-116.2.4.2 AND BC 110.5 28-116.2.4

2. UPON COMPLETION OF THE WORK, A TEST SHALL BE CONDUCTED IN THE PRESENCE AND UNDER DIRECTION OF A LICENSED PROFESSIONAL ENGINEER OR REGISTERED ARCHITECT, RETAINED BY THE CONTRACTOR QUALIFIED TO CONDUCT SUCH TESTS. THE TEST SHALL SHOW COMPLIANCE WITH THE CODE REQUIREMENTS FOR VENTILATION AND THE PROPER FUNCTIONING OF ALL OPERATING DEVICES, BEFORE THE SYSTEM IS APPROVED (BC 1704).
3. ALL INSPECTIONS AND TESTS WILL BE MADE IN COMPLIANCE WITH BC 1704.
4. VENTILATION FOR ALL AREAS COMPLIES WITH THE MINIMUM CODE REQUIREMENTS OF MC 401, MC 402,AND MC 403.
5. CERTIFICATES OF COMPLIANCE (BC 110.6 AND 28-116.4) SHALL BE OBTAINED AND PAID FOR BY THE CONTRACTOR.
6. ALL HVAC SYSTEMS AND EQUIPMENT COMPLY WITH THE REQUIREMENTS OF THE ENERGY CONSERVATION CONSTRUCTION CODE OF THE STATE OF NEW YORK (MC 301.2).
7. THE FOLLOWING WORK ITEMS, COMPONENTS, MATERIALS, CAPACITIES, ETC. SHALL COMPLY WITH THE FOLLOWING CODE REFERENCES:

   WORK ITEM/MATERIALS CODE SECTION

A. DUCT CONSTRUCTION	MC 603
B. ELECTRIC WIRING & EQUIPMENT	MC 301.7
C. CONTROLS	MC 405
D. NOISE CRITERIA LEVELS	BC 1207
E. PIPING INSULATION	MC 1204
F. INTAKE, EXHAUST, RELIEFS	MC 401

8. REFER TO ARCHITECTURAL DRAWINGS FOR THE RATED WALLS AND PARTITIONS.
9. MINIMUM TEMPERATURE TO BE MAINTAINED DURING HEATING SEASON: BC 1204- WHEN 13 DEG F OUTSIDE.
10. A STATEMENT WILL BE FILED BY THE OWNER OR TENANT IN POSSESSION THAT THE VENTILATING SYSTEM WILL BE KEPT IN CONTINUOUS OPERATION DURING NORMAL OCCUPANCY OF THE PREMISES.
11. EQUIPMENT SHALL BE LISTED AND APPROVED AS REQUIRED MC 107, MC 102.
12. ALL BUILDING DEPARTMENT FORMS REQUIRED, INCLUDING THOSE REQUIRED FOR SPECIAL INSPECTIONS, PROGRESS INSPECTIONS, CERTIFICATE OF COMPLIANCE, SERVICE EQUIPMENT PERMIT OR OTHER REASONS WITH REGARD TO THIS PROJECT SHALL BE COMPLETED AND FILED WITH THE NYC BUILDING DEPARTMENT BY THE OWNER. THE OWNER SHALL ENGAGE THE SERVICES OF A NYS LICENSED PROFESSIONAL ENGINEER AND AGENCIES APPROVED FOR SPECIAL INSPECTIONS TO SIGN AND SEAL ALL REQUIRED BUILDING DEPARTMENT FORMS AND DRAWINGS.
13. CONTRACTOR SHALL OBTAIN AND PROVIDE SERVICE EQUIPMENT PERMITS IN ACCORDANCE WITH SECTION 28-105.2 OF THE BUILDING CODE. SERVICE EQUIPMENT PERMITS SHALL BE REQUIRED FOR THE USE AND OPERATION OF THE CHILLER.
14. DRAWING FILED INCLUDE WORK PERFORMED UNDER A SEPARATE CONTRACT (SEE SPEC FOR DESCRIPTION OF WORK PERFORMED). CONTRACTOR DOB PERMIT SHALL COVER THIS WORK AS WELL AND CONTRACTOR SHALL BE RESPONSIBLE FOR SIGN OFF AND CLOSE OUT OF ALL WORK ON THE FILED DRAWINGS.

GENERAL DEMOLITION NOTES:

1. DEMOLITION OF HVAC ITEMS SHALL BE PERFORMED UNDER THE HVAC CONTRACT.
2. LOCATION OF THE EXISTING DUCTWORK & PIPING AS SHOWN ON DRAWINGS IS APPROXIMATE.
3. PROVIDE TEMPORARY SUPPORTS WHERE REQUIRED.
4. DURING DEMOLITION, PROPERLY CAP AND PROTECT ALL DUCTWORK, EQUIPMENT, AND PIPING THAT WILL REMAIN IN OPERATION.
5. WHERE EXISTING INSULATION TO REMAIN IS DAMAGED BY THE REQUIREMENTS OF THE WORK, REPLACE ANY DAMAGED INSULATION TO MATCH EXISTING.
6. DEMOLISH ALL EQUIPMENT AS INDICATED, FIXTURES AND/OR MISCELLANEOUS ARTICLES IN THEIR ENTIRETY INCLUDING AUXILIARY EQUIPMENT, PIPING, WIRING, CONDUIT AND DUCTWORK. DEMOLITION WORK SHALL BE PERFORMED BY WORKMEN EXPERIENCED IN THIS TYPE OF WORK AND SHALL BE CARRIED THROUGH TO COMPLETION WITH DUE REGARDS TO THE SAFETY OF ALL BUILDING OCCUPANTS AND THE EMPLOYEES OF THE CONTRACTOR WITH AS LITTLE DISTURBANCE AS POSSIBLE.
7. MATERIALS RESULTING FROM THE DEMOLITION OPERATIONS SHALL NOT BE ALLOWED TO ACCUMULATE ON THE FLOORS AND ROOF SURFACES, EXTERIOR GRADE SURFACES OR OTHER PARTS OF THE PREMISES, AND SHALL BE PROMPTLY REMOVED AND DISPOSED OF AWAY FROM THE PREMISES.
8. INCLUDE ALL DEMOLITION OF SYSTEMS AND COMPONENTS WHERE SYSTEMS SHALL BE REPLACED BY NEW WORK. REFER TO THE DRAWINGS AND SPECIFICATIONS FOR THE SCOPE OF NEW AND RECONNECTED WORK. THE INTENT OF THIS REQUIREMENT IS TO HAVE THE CONTRACTOR DISCONNECT, DEMOLISH AND REMOVE ALL EXPOSED AND CONCEALED WORK WHERE BEING REPLACED OR CONNECTED TO THE NEW LAYOUTS.
9. COORDINATE ELECTRICAL POWER DISCONNECTION PRIOR TO DEMOLITION WITH ELECTRICAL CONTRACTOR.
10. PROTECT ALL HVAC WORK AND WORK OF OTHER TRADES WHICH IS TO REMAIN, FROM DAMAGE DURING DEMOLITION.
11. ALL PIPING AND DUCTWORK TO REMAIN SHALL HAVE ENDS TERMINATED IN A NEAT MANNER READY FOR CONNECTION OF NEW WORK. ALL EXPOSED ENDS OF PIPING AND DUCTWORK SHALL BE CAPPED. SCREWED PIPING SHALL END ON A SCREWED JOINT. FLANGED PIPE SHALL END WITH A FLANGED JOINT. WELDED PIPING SHALL BE MECHANICALLY CUT, CLEANED OF BURRS AND A CAP WELDED TO THE PIPE. DUCTWORK SHALL BE CAPPED WITH SHEET METAL CONNECTED TO THE DUCT TO REMAIN.
12. REMOVAL OF EQUIPMENT, PIPING AND DUCTWORK SHALL INCLUDE ALL HANGERS & SUPPORT ASSOCIATED WITH THE EQUIPMENT, PIPING AND DUCTWORK TO BE REMOVED.

SCOPE OF WORK INCLUDING BUT NOT LIMITED TO:

1. THE SCOPE OF WORK FOR THE WEST COURTYARD CONSISTS OF REMOVING THREE (3) AC UNITS WITH DX AND AIR COOLED CONDENSERS AND INSTALLING NEW AC UNITS WITH CHILLED WATER LOCATED ON THE ROOF OF THE WEST COURT YARD.
2. THE SCOPE OF WORK FOR THE POMERANTZ 4TH FLOOR CONSISTS OF REMOVING 20 TON AC UNIT WITH DX AND AIR COOLED CONDENSER AND INSTALL A NEW AC UNIT WITH CHILLED WATER.
3. INSTALL NEW CONTROLS AND CONNECT TO THE EXISTING BUILDING AUTOMATION SYSTEM.
4. THE HVAC CONTRACTOR SHALL COORDINATE ALL THE ROOF REPAIR WORK AND THE TEMPORARY PROTECTION OF THE ROOF OPENING DURING THE AHUS REPLACEMENT WITH MASPETH ROOFING (CONTACT INFO IAN PAUL EMAIL ian@maspethroofing.com) THE ROOFING CONTRACTOR TO MAINTAIN THE ROOF WARRANTY.
5. THE CONTRACTOR SHALL PROVIDE AN ALTERNATE #1 FOR REPLACING THE EXISTING CEILING WITH NEW AS NOTED ON M-201.

GENERAL NOTES:

1. 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. CONTRACTOR WILL NOT BE RESPONSIBLE FOR DELAYS CAUSED BY THE MITIGATION ACTIVITIES OR ANY ASSOCIATED COSTS.
2. ALL PIPING AND DUCTWORK SHALL BE SUSPENDED FROM BUILDING STRUCTURE ONLY, EXCEPT AS SPECIFICALLY ALLOWED IN THE SPECIFICATIONS. HVAC CONTRACTOR SHALL PROVIDE SUPPLEMENTARY STEEL AS NECESSARY TO SUPPORT PIPES AND DUCTS FROM BUILDING STRUCTURE. THE ARCHITECT AND STRUCTURAL ENGINEER SHALL BE THE SOLE DETERMINANT AS TO PERMISSIBILITY OF HANGING NEW WORK FROM BUILDING STRUCTURE AND SLABS.
3. PIPING AND DUCTWORK PROVIDED UNDER THIS CONTRACT SHALL BE COORDINATED UNDER THIS CONTRACT WITH WORK BEING PROVIDED BY OTHER TRADES.
4. 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 CEILING HEIGHTS, TO MEET STRUCTURAL AND FIELD CONDITIONS. CONTRACTOR SHALL PROVIDE REDRAWING OF SHOP DRAWINGS AS NECESSARY TO ACCOMMODATE THE ARCHITECT'S REQUIREMENTS, AT NO ADDITIONAL COST TO THE OWNER. REFER TO ARCHITECTURAL REFLECTED CEILING PLANS FOR REQUIRED CEILING HEIGHTS.
5. INSTALL ALL DUCTWORK IN STRICT ADHERENCE TO THE CEILING HEIGHTS INDICATED ON THE ARCHITECT'S DRAWINGS. CONSULT WITH OTHER CONTRACTORS AND IN CONJUNCTION WITH THE OTHER CONTRACTORS, ESTABLISH THE NECESSARY SPACE REQUIREMENTS FOR EACH TRADE.
6. 6. THE SHEET METAL DUCTWORK SHALL, WHETHER INDICATED OR NOT, RISE AND/OR DROP AND/OR CHANGE IN SHAPE TO CLEAR ANY AND ALL OTHER DUCTWORK, CONDUITS, LIGHTING FIXTURES, PLUMBING AND HEATING/COOLING MAINS TO MAINTAIN THE DESIRED CEILING HEIGHTS AND TO PROVIDE ADEQUATE MAINTENANCE ROOM AND HEADROOM IN MECHANICAL EQUIPMENT ROOMS. THE DRAWINGS, IN GENERAL, DO NOT SHOW ALL RISES, DROPS AND DUCT TRANSITIONS REQUIRED. THE DRAWINGS SHOW GENERAL ROUTING REQUIREMENTS ONLY.
7. ALL RECTANGULAR DUCTWORK, UNLESS OTHERWISE NOTED, SHALL BE BUILT FROM GALVANIZED SHEET STEEL AND THOROUGHLY BRACED AND STIFFENED.
8. PROVIDE 12" x 12" ACCESS DOORS EVERY 50'-0" RUN OF SUPPLY AND RETURN AIR DUCT FOR CLEANING PURPOSES, EXCEPT IN DUCT ABOVE SOUND CONTROL CEILING. PROVIDE 18" x 18" ACCESS DOORS UPSTREAM AND DOWNSTREAM OF EACH REHEAT COIL, AT EACH FIRE AND FIRE/SMOKE DAMPER, AT EACH MOTORIZED DAMPER, AT EACH CV AND VAV TERMINAL BOX AND WHEREVER ELSE INDICATED IN THE SPECIFICATION. IF THE DUCT IS TOO SMALL TO PROVIDE AN 18" x 18" ACCESS DOOR, A 12" x 12" ACCESS DOOR SHALL BE PROVIDED. SEE SPECIFICATIONS FOR ADDITIONAL ACCESS DOOR REQUIREMENTS.
9. SEE SPECIFICATION FOR DUCTS REQUIRED TO BE ACOUSTICALLY LINED. DIMENSIONS GIVEN ON PLANS ARE INSIDE CLEAR DIMENSIONS. INCREASE SIZE OF SHEET METAL DUCT TO PROVIDE THE SPECIFIED INSIDE CLEAR DIMENSION WITH ACOUSTICAL LINING ADDED.
10. 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.
11. SYMBOLS AND ABBREVIATIONS SHOWN ON THE DRAWINGS ARE FOR MECHANICAL DRAWINGS ONLY. SEE OTHER TRADES DRAWINGS FOR THEIR RESPECTIVE SYMBOLS AND ABBREVIATIONS.
12. PRIOR TO PERFORMING ANY CORE DRILLING OR CUTTING OF EXISTING FLOOR OR ROOF SLAB, CONTRACTOR SHALL PERFORM A SCAN OF THE SLAB USING GROUND PENETRATING RADAR (GPR) TO CONFIRM THAT THERE ARE NO EXISTING CONDUITS OR PIPES IN THE AREA OF CORE DRILL OR CUTTING OF THE SLAB.

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NEW YORK CITY ENERGY CONSERVATION CODE

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BID SET 06/08/2022

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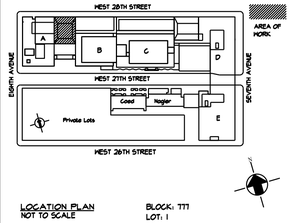
rev. no.	date	revisions
-	06/08/2022	ISSUED TO BID



LOCATION PLAN
NOT TO SCALE

BLOCK: 777
LOT: 1

Fashion Institute of Technology

340 8th Avenue
New York, NY 10001

MEP Consultants

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116 West 32nd Street, 12th Floor, New York, N.Y. 10001
P 212.643.9055 www.mgedpc.net

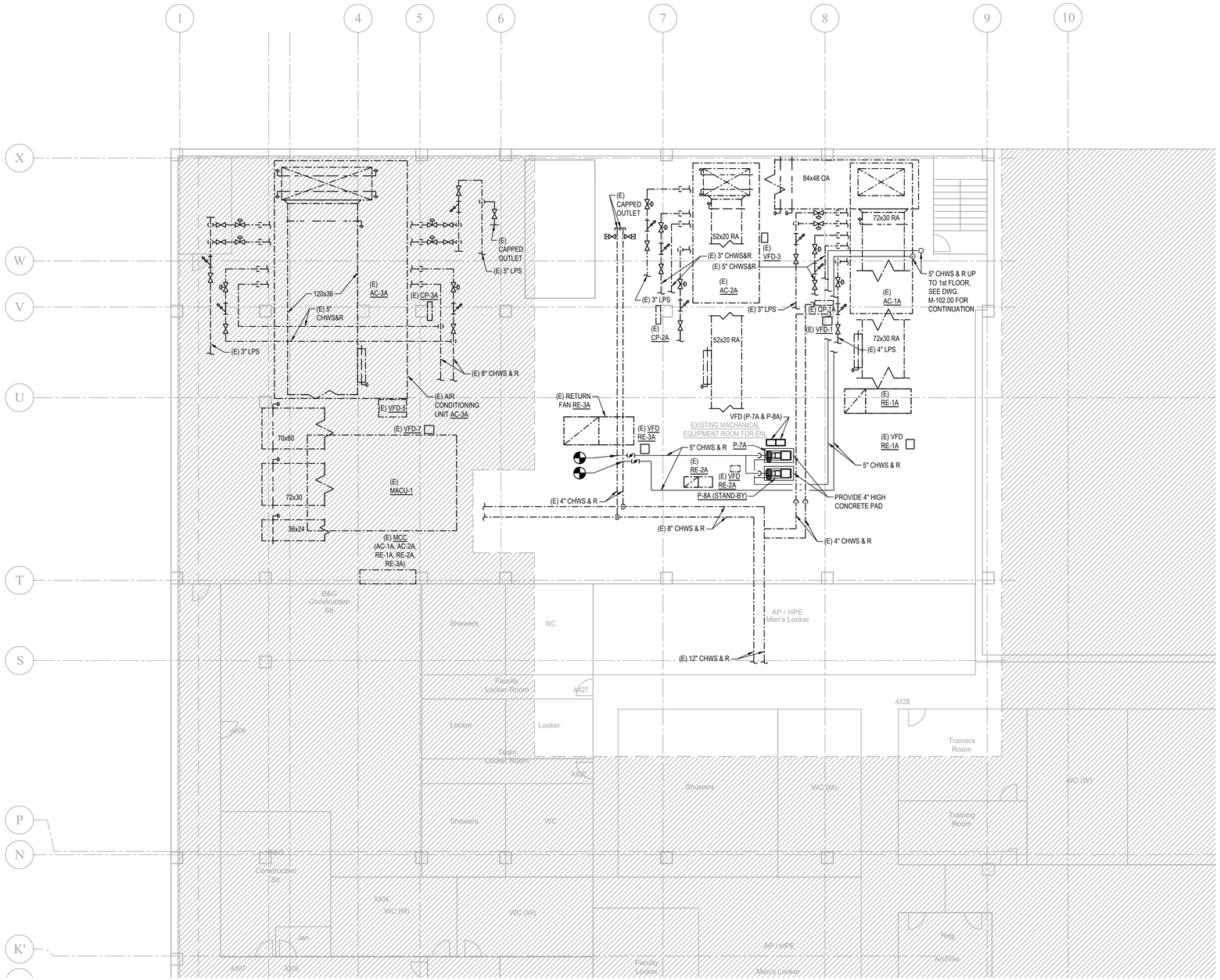
PROJECT:
WEST COURTYARD
340 8TH AVENUE
AC UNITS REPLACEMENT

DRAWING TITLE:
SYMBOLS, ABBREVIATIONS, NOTES

DOB NOW JOB •

SEAL & SIGNATURE:

DATE:	05/31/2022
PROJECT No:	896929
DRAWING BY:	MY
CHK BY:	DNE
DWG No:	M-001.00
SCALE: NTS	1 OF 19



NOTES

1. INSTALL THE NEW PUMPS ON CONCRETE PAD AS REQUIRED ON THE SPECIFICATIONS. PROVIDE INERTIA PADS AND VIBRATION ISOLATORS AS PER SPECIFICATIONS.
2. PROVIDE ALL THE ACCESSORIES AND THE METALLIC FLEXIBLE CONNECTIONS AS SHOWN ON DETAIL DRAWINGS AND REQUIRED ON THE SPECIFICATIONS.
3. COORDINATE WITH THE FIT THE INSTALLATION OF THE NEW ISOLATION VALVES TO CONNECT TO THE EXISTING CHILLED WATER SYSTEM. CONTRACTOR SHALL NOTIFY FIT AT LEAST TWO WEEKS IN ADVANCE THE WORK TO CONNECT TO THE EXISTING CHILLED WATER SYSTEM.
4. CONTRACTOR SHALL SUBMIT TO THE ENGINEER PADS LAYOUT AND PIPING LAYOUT FOR APPROVAL PRIOR TO START INSTALLATION
5. CONTRACTOR TO OPEN PIPE SHAFT AS NEEDED TO INSTALL THE CHILLED WATER PIPES AND TO REPAIR THE SHAFT AT THE COMPLETION OF THE PIPES INSTALLATION.
6. CONTRACTOR TO VERIFY AND COORDINATE THE EXACT LOCATION AND DIMENSIONS OF ALL DUCT, PIPING AND ELECTRICAL CONDUITS.

BID SET 06/08/2022

① CELLAR MECHANICAL PLAN
1/8" = 1'-0"

0 4' 8' 16'
SCALE: 1/8" = 1'-0"

NEW YORK CITY BUILDING DEPARTMENT NOTE
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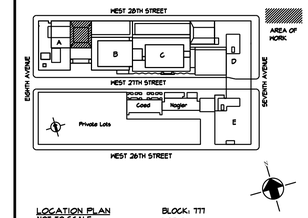
rev. no.	date	revisions
	06/08/2022	ISSUED TO BID



LOCATION PLAN NOT TO SCALE

BLOCK: 777
LOT: 1

Fashion Institute of Technology

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New York, NY 10001

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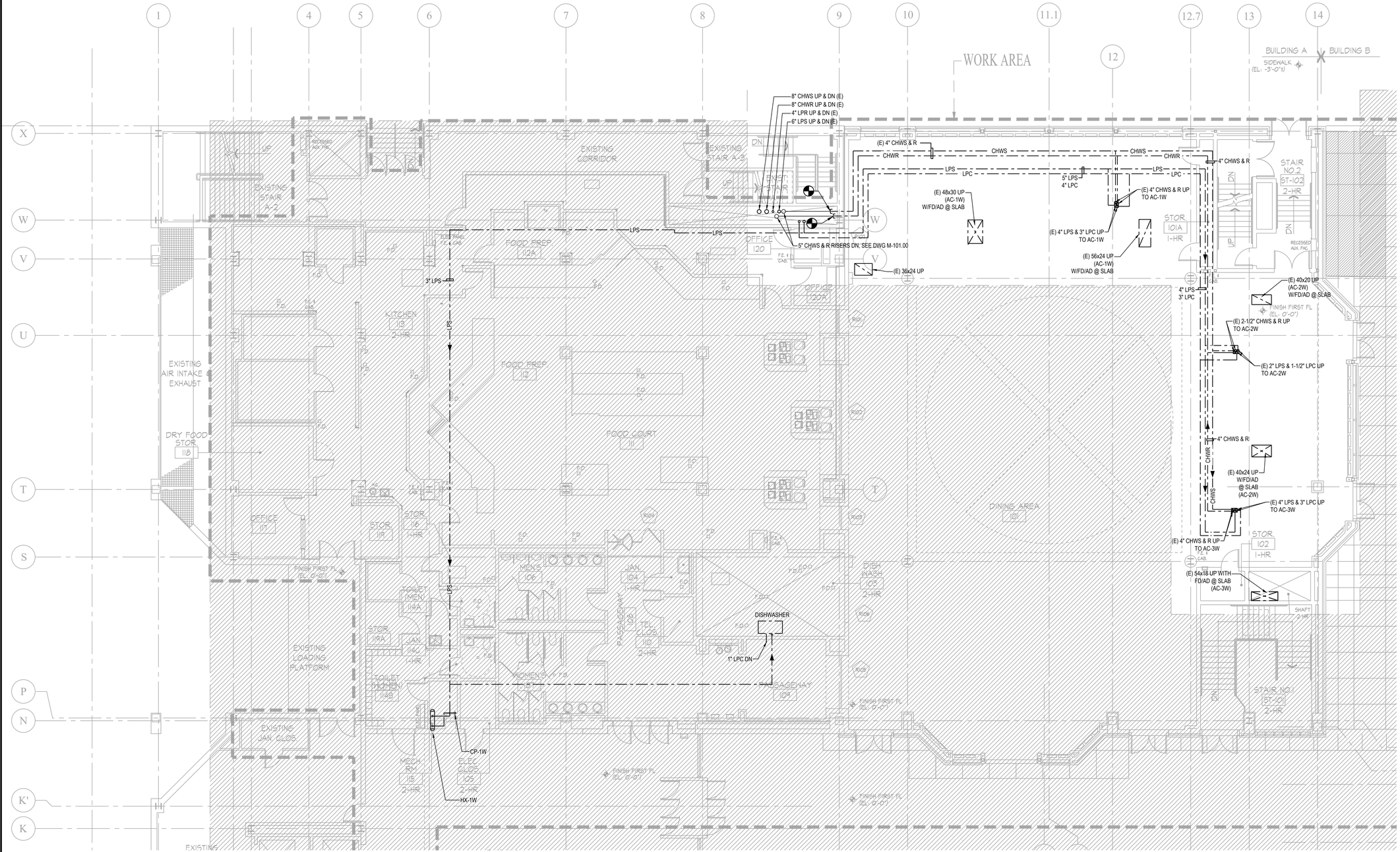
PROJECT:
WEST COURTYARD
340 8TH AVENUE
AC UNITS REPLACEMENT

DRAWING TITLE:
CELLAR
MECHANICAL
PLAN

DOB NOW JOB •

SEAL & SIGNATURE:

DATE:	05/31/2022
PROJECT No:	8969.29
DRAWING BY:	MY
CHK BY:	DNE
DWG No:	M-101.00
SCALE:	1/8"=1'
	2 OF 19



NOTES

1. PRIOR TO START ANY NEW PIPING WORK, CONTRACTOR SHALL SUBMIT PIPE CLEANING PLAN FOR REVIEW AND APPROVAL.
2. CONTRACTOR SHALL PROCEED WITH CLEANING OF THE EXISTING CHILLED WATER, LOW PRESSURE STEAM AND LOW PRESSURE CONDENSATE RETURN PIPES.
3. AFTER THE CLEANING IS COMPLETE AND THE CLEANING REPORT IS SUBMITTED, THE CONTRACTOR SHALL PERFORM A 24 HOUR PRESSURE TEST OF THE EXISTING PIPES. THE PRESSURE TEST SHALL BE AS REQUIRED IN THE SPECIFICATIONS. A PRESSURE TEST REPORT SHALL BE SUBMITTED FOR REVIEW AND APPROVAL.
4. ONLY AFTER THE CLEANING AND PRESSURE TEST ARE COMPLETE AND APPROVED, THE CONTRACTOR CAN PROCEED WITH NEW PIPING WORK.
5. CONTRACTOR TO OPEN SHAFT AS NEEDED TO INSTALL THE CHILLED WATER PIPES AND TO REPAIR THE SHAFT AT THE COMPLETION OF THE PIPES INSTALLATION.
6. CONTRACTOR TO VERIFY AND COORDINATE THE EXACT LOCATION AND DIMENSIONS OF ALL DUCT, PIPING AND ELECTRICAL CONDUITS.

BID SET 06/08/2022

② 1ST FLOOR MECHANICAL PLAN

1/8" = 1'-0"

0 4' 8' 16'

SCALE: 1/8" = 1'-0"

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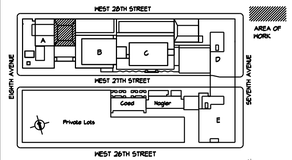

LOCATION PLAN
NOT TO SCALE

BLOCK: 777
LOT: 1

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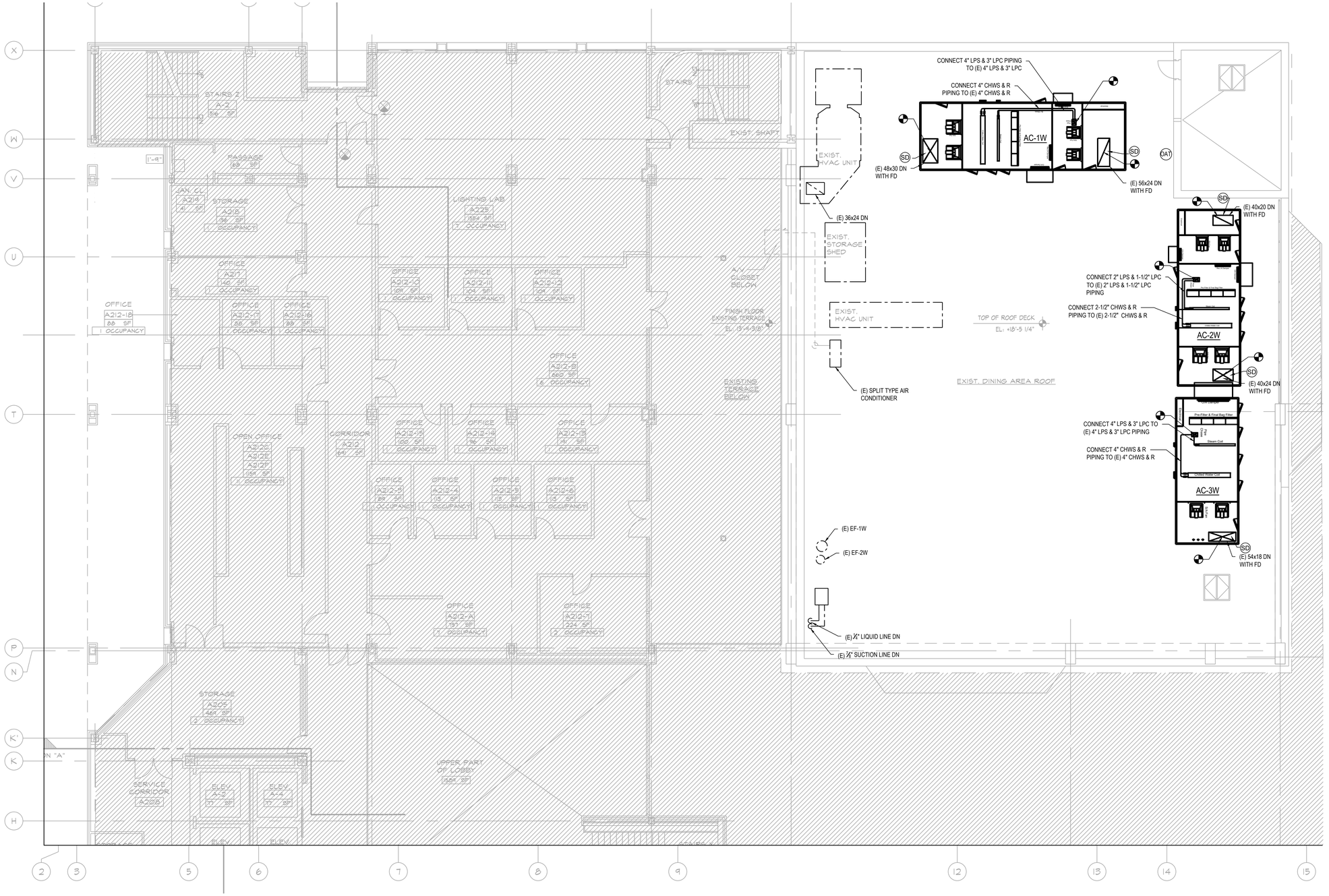
PROJECT:
WEST COURTYARD
340 8TH AVENUE
AC UNITS REPLACEMENT

DRAWING TITLE:
1ST FLOOR
MECHANICAL PLAN

DOB NOW JOB •

SEAL & SIGNATURE:

DATE:	05/31/2022
PROJECT No:	8969.29
DRAWING BY:	MY
CHK BY:	DNE
DWG No:	M-102.00
SCALE: 1/8"=1'	3 OF 19



NOTES

1. INSTALL NEW UNITS ON NEW 24" HEIGHT WITH 1" INSULATED CURBS. COORDINATE WITH ROOF CONTRACTOR FOR THE CURB INSTALLATION AND WATER PROOFING OF THE CURB.
2. THE ROOF REPAIR AND THE TEMPORARY PROTECTION OF THE ROOF OPENINGS DURING THE AHUS DEMOLITION AND INSTALLATION IS PROVIDED BY MASPETH ROOFING UNDER A SEPARATE CONTRACT WITH FIT IN ORDER TO MAINTAIN THE ROOF WARRANTY.
3. THE HVAC CONTRACTOR IS RESPONSIBLE UNDER THIS CONTRACT FOR: COMPLETE DEMOLITION OF THE AHUS INCLUDING THE CURBS, INSTALLATION OF THE NEW CURBS AND INSTALLATION OF THE AHUS WITH ALL THE CONNECTIONS AND ACCESSORIES.
4. THE CONTRACTOR SHALL PROTECT THE ENTIRE ROOF FROM DAMAGES AS THE ROOF IS NEW.
5. CONTRACTOR SHALL PROVIDE WATERPROOFING FOR THE PIPE PENETRATIONS, DUCT PENETRATIONS, DUCT SUPPORTS, AND FOR THE ELECTRICAL CONDUIT PENETRATIONS.
6. THE CONTRACTOR TO COORDINATE THE SIZE OF THE UNITS WITH THE EXISTING CONDITIONS. THE NEW UNITS SHALL HAVE THE SAME FOOTPRINT AS THE EXISTING AND THE DUCT, PIPES AND ELECTRICAL CONDUITS SHALL REMAIN AT THE SAME LOCATION.
7. THE NEW AC UNITS SHALL PROVIDE MINIMUM 24 INCHES BETWEEN THE COOLING COIL AND THE STEAM COIL.
8. INSTALL OAT (OUTDOOR AIR TEMPERATURE) SENSOR ON THE WALL INSIDE AN ENCLOSURE TO PROTECT FROM DIRECT SUN RADIATION.
9. CONTRACTOR TO VERIFY AND COORDINATE THE EXACT LOCATION AND DIMENSIONS OF ALL DUCT, PIPING AND ELECTRICAL CONDUITS.

BID SET 06/08/2022

③ ROOF MECHANICAL PLAN

1/8" = 1'-0"

0 4' 8' 16'

SCALE: 1/8" = 1'-0"

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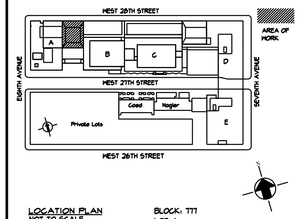
rev. no.	date	revisions
	06/08/2022	ISSUED TO BID



LOCATION PLAN NOT TO SCALE

BLOCK: 777
LOT: 1

Fashion Institute of Technology

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New York, NY 10001

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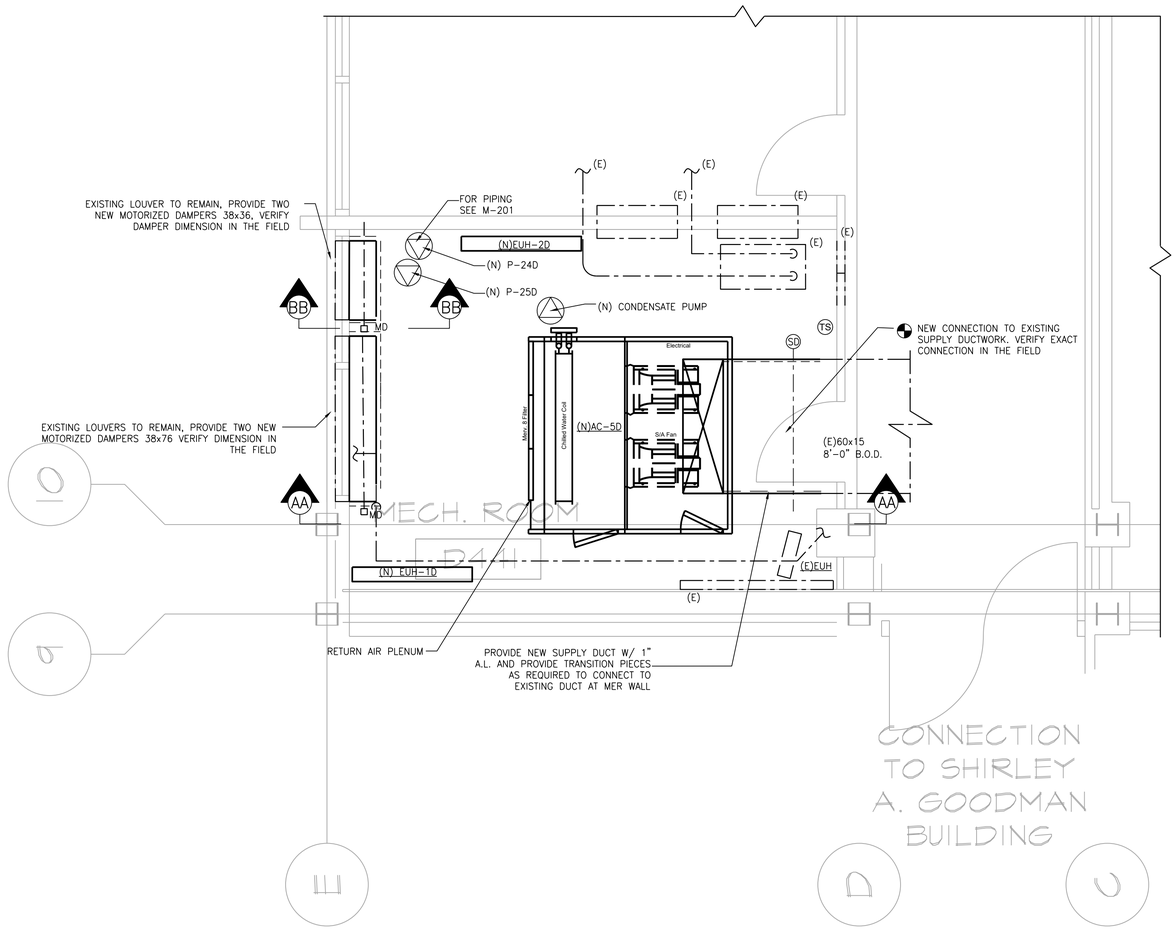
PROJECT:
WEST COURTYARD
340 8TH AVENUE
AC UNITS REPLACEMENT

DRAWING TITLE:
ROOF
MECHANICAL
PLAN

DOB NOW JOB •

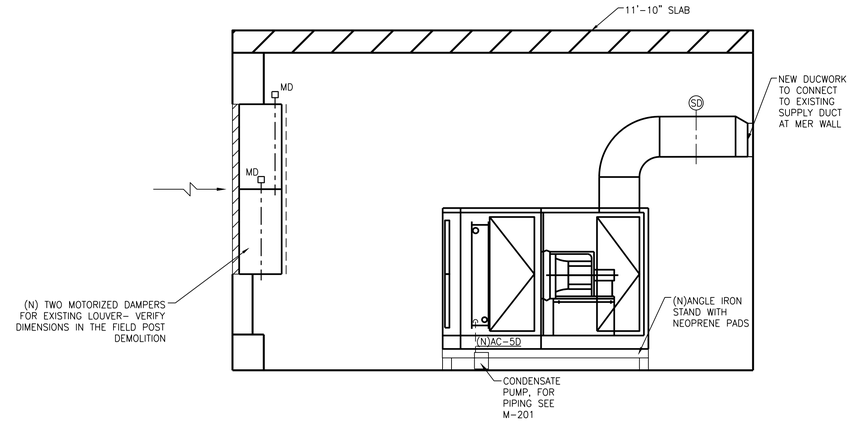
SEAL & SIGNATURE:

DATE:	05/31/2022
PROJECT No:	8969.29
DRAWING BY:	MY
CHK BY:	DNE
DWG No:	M-103.00
SCALE: 1/8"=1'	4 OF 19



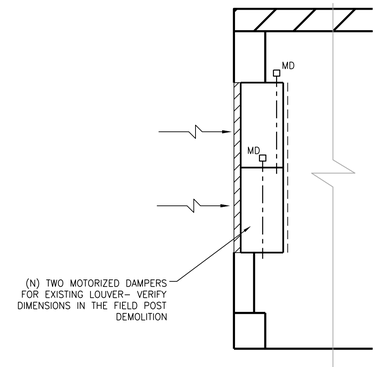
④ PARTIAL 4TH FLOOR MECHANICAL PLAN
3/8" = 1'-0"

0 2' 4' 6'
SCALE: 3/8" = 1'-0"



⑤ SECTION A–A: AIRSIDE ECONOMIZER LOUVER & DUCTWORK
3/8" = 1'-0"

0 2' 4' 6'
SCALE: 3/8" = 1'-0"



⑥ SECTION B–B: AIRSIDE ECONOMIZER & OUTSIDE AIR LOUVER & DUCTWORK
3/8" = 1'-0"

0 2' 4' 6'
SCALE: 3/8" = 1'-0"

NOTES

1. INSTALL THE NEW INLINE PUMPS AS PER MANUFACTURER INSTRUCTIONS AND AS SHOWN ON THE THE DETAILS.
2. PROVIDE ALL THE ACCESSORIES AND THE METALLIC FLEXIBLE CONNECTIONS AS SHOWN ON DETAIL DRAWINGS AND REQUIRED ON THE SPECIFICATIONS.
3. COORDINATE WITH FIT THE INSTALLATION OF THE NEW ISOLATION VALVES TO CONNECT TO THE CHILLED WATER SYSTEM. CONTRACTOR SHALL NOTIFY FIT AT LEAST TWO WEEKS IN ADVANCE THE WORK TO CONNECT TO THE CHILLED WATER SYSTEM.
4. PRIOR TO INSTALL THE NEW STAND AND NEW AHU, THE CONTRACTOR SHALL PAINT THE FLOOR WITH AN EPOXY BASED PAINT. THE COLOR SHALL BE GRAY AND SHALL BE COORDINATED WITH FIT.
5. INSTALL NEW UNIT ON A METALLIC STAND WITH VIBRATION ISOLATORS AS PER SPECIFICATION.
6. AC-5D SHALL BE DELIVERED IN SECTION NO LARGER THAN 34 INCHES WIDE TO ALLOW RIGGING THROUGH STANDARD DOOR OPENING.
7. INSTALL NEW FIRE SMOKE DAMPERS ON THE OUTDOOR WALL.
8. INSTALL AUTOMATIC HIGH CAPACITY AIR VENT ON THE EXISTING RADIATION PIPING. COORDINATE WITH FIT STAFF TO DRAIN THE SYSTEM AND FOR THE LOCATION OF THE AIR VENT.
6. CONTRACTOR TO VERIFY AND COORDINATE THE EXACT LOCATION AND DIMENSIONS OF ALL DUCT, PIPING AND ELECTRICAL CONDUITS.

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rev. no.	date	revisions
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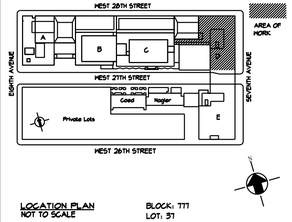

LOCATION PLAN NOT TO SCALE

BLOCK: 777
LOT: 37

Fashion Institute of Technology

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PROJECT:
POMERANTZ CENTER
300 7TH AVENUE
AC UNIT REPLACEMENT

DRAWING TITLE:
4TH FLOOR
MECHANICAL
PLANS

SEAL & SIGNATURE:

DATE:	05/31/2022
PROJECT No:	8969.29
DRAWING BY:	MY
CHK BY:	DNE
DWG No:	M-104.00
SCALE: 3/8"=1'	5 OF 19

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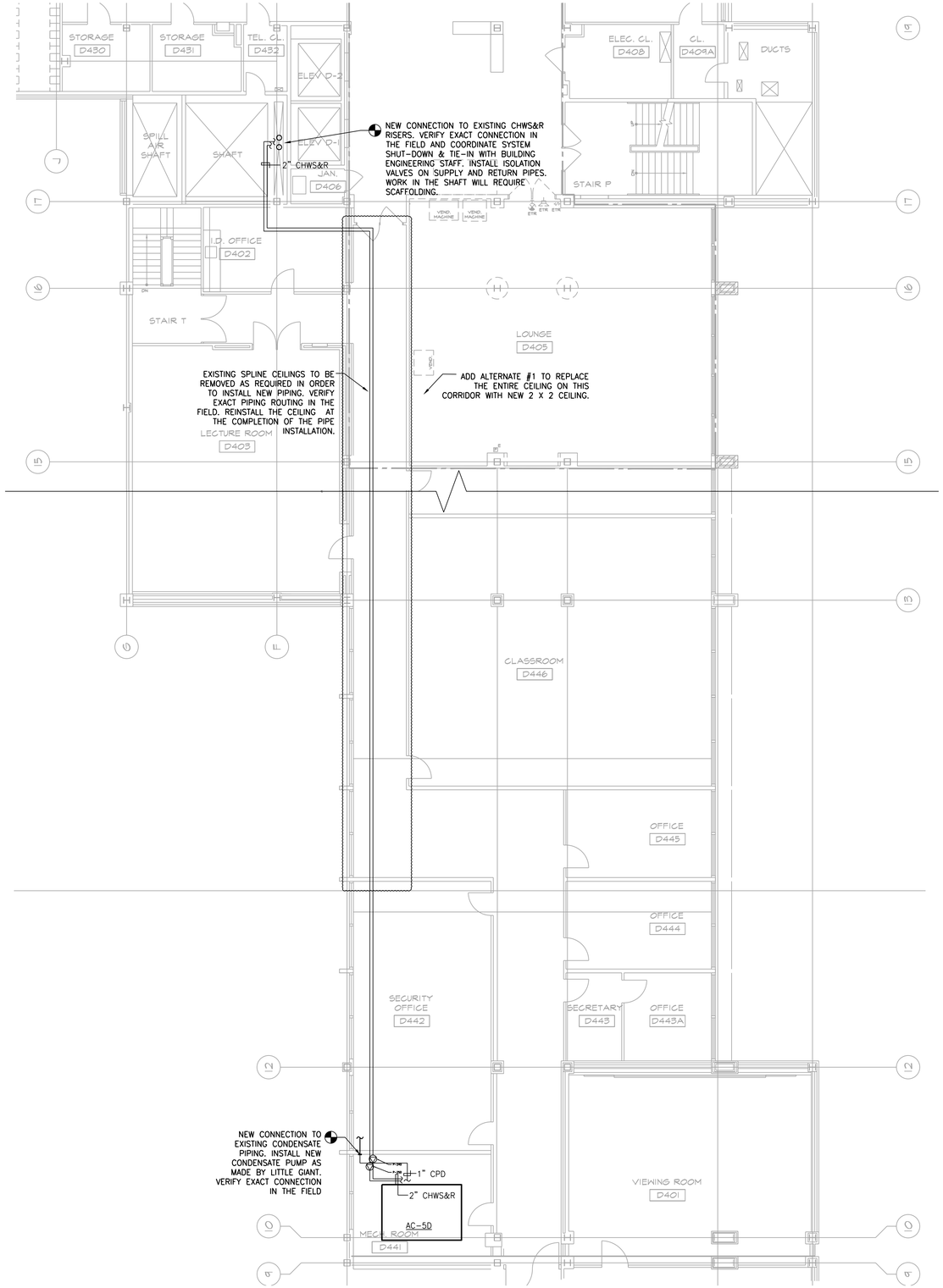

⑦ 4TH FLOOR MECHANICAL PIPING PLAN

1/8" = 1'-0"

0 4' 8' 16'

SCALE: 1/8" = 1'-0"

BID SET 06/08/2022

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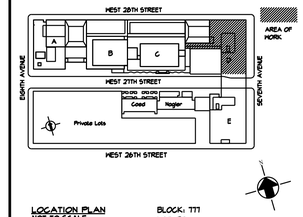

LOCATION PLAN
NOT TO SCALE

BLOCK: 777
LOT: 37

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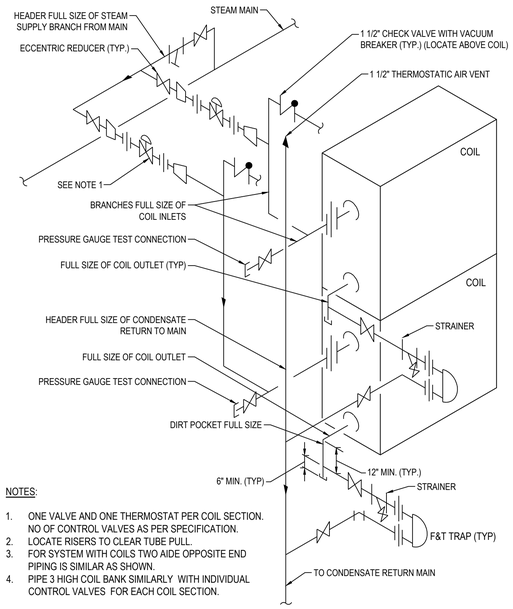
PROJECT:
POMERANTZ CENTER
300 7TH AVENUE
AC UNIT REPLACEMENT

DRAWING TITLE:
4TH FLOOR
MECHANICAL PIPING
PLAN

SEAL & SIGNATURE:

DATE:	05/31/2022
PROJECT No:	8969.29
DRAWING BY:	MY
CHK BY:	DNE
DWG No:	M-201.00
SCALE: 1/8"=1'	6 OF 19

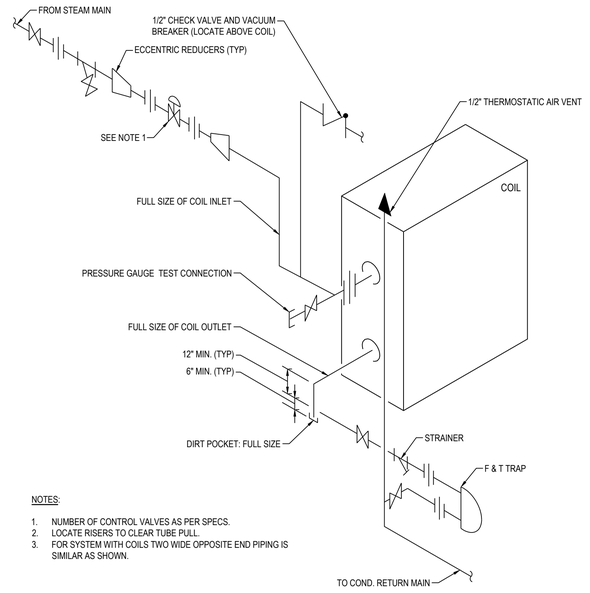


NOTES:

1. ONE VALVE AND ONE THERMOSTAT PER COIL SECTION. NO OF CONTROL VALVES AS PER SPECIFICATION.
2. LOCATE RISERS TO CLEAR TUBE PULL.
3. FOR SYSTEM WITH COILS TWO AIDE OPPOSITE END PIPING IS SIMILAR AS SHOWN.
4. PIPE 3 HIGH COIL BANK SIMILARLY WITH INDIVIDUAL CONTROL VALVES FOR EACH COIL SECTION.

MULTIPLE VERTICAL COIL PIPING FOR STEAM PREHEAT COILS

N.T.S.

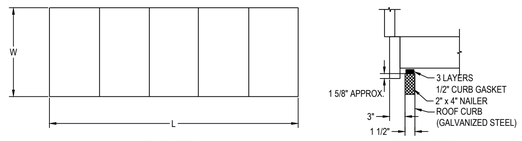


NOTES:

1. NUMBER OF CONTROL VALVES AS PER SPECS.
2. LOCATE RISERS TO CLEAR TUBE PULL.
3. FOR SYSTEM WITH COILS TWO WIDE OPPOSITE END PIPING IS SIMILAR AS SHOWN.

ONE HIGH VERTICAL STEAM COIL PIPING FOR PREHEAT COILS

N.T.S.



	AC-1W	AC-2W	AC-3W
L	404"	346"	286"
W	130"	120"	120"
UNIT WGT (LBS)	5,500	3,500	3,000

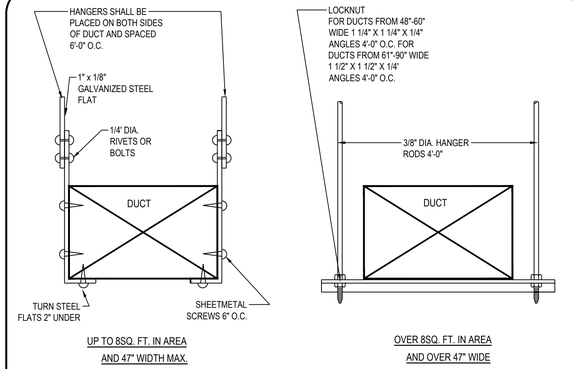
NOTE: CURB, NAILER, AND GASKET FURNISHED BY MANUFACTURER, ALL PARTS NOT SHOWN ARE FURNISHED AND INSTALLED IN FIELD "BY OTHERS."

NOTE:

1. ALL DIMENSIONS ARE SHOWN IN INCHES,AND ARE SHOWN FROM THE UPPER FRAME.
2. WORK MUST BE COORDINATED WITH ROOF CONTRACTOR.

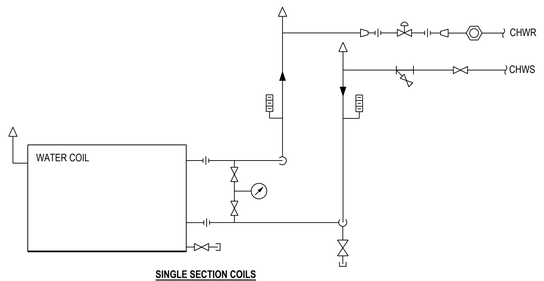
ROOF CURB DETAIL

N.T.S.

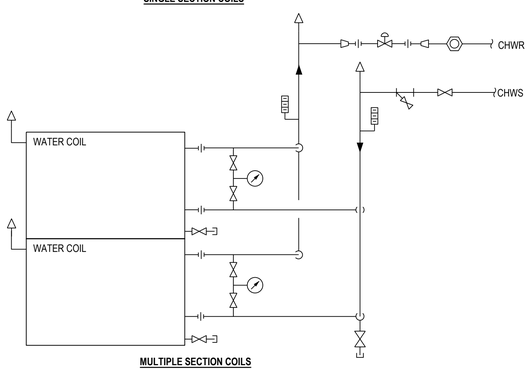


METHOD OF SUPPORTING DUCTS

N.T.S.



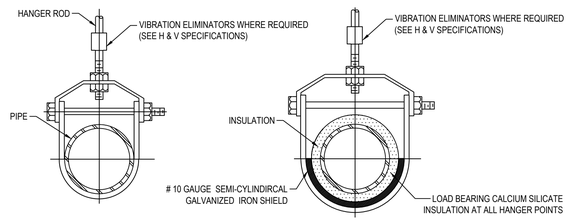
SINGLE SECTION COILS



MULTIPLE SECTION COILS

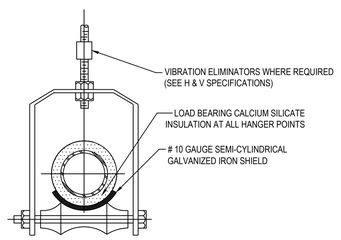
TYPICAL CONNECTIONS TO CHILLED WATER COILS

N.T.S.



CLEVIS HANGER

N.T.S.



CLEVIS ROLLER HANGER

N.T.S.

BID SET 06/08/2022

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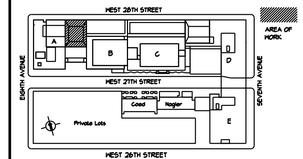
rev. no.	date	revisions
-	06/08/2022	ISSUED TO BID



LOCATION PLAN
NOT TO SCALE

BLOCK: 777
LOT: 1

Fashion Institute of Technology

340 8th Avenue
New York, NY 10001

MEP Consultants

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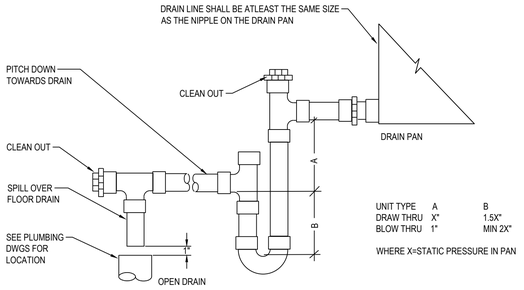
PROJECT:
WEST COURTYARD
340 8TH AVENUE
AC UNITS REPLACEMENT

DRAWING TITLE:
MECHANICAL DETAILS 1

DOB NOW JOB •

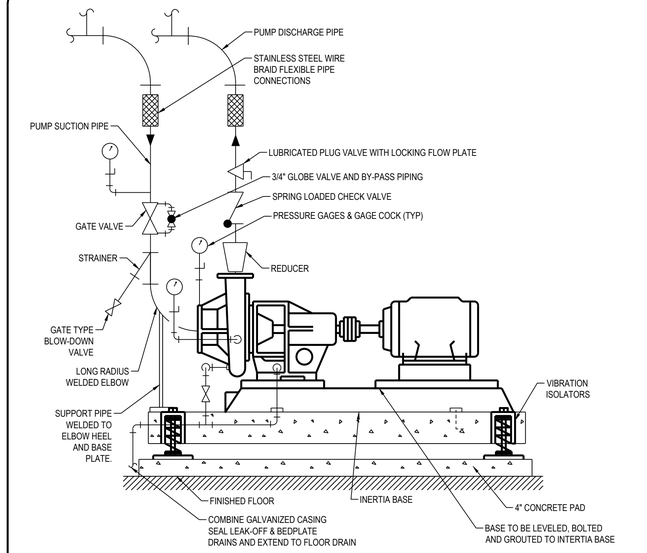
SEAL & SIGNATURE:

DATE:	05/31/2022
PROJECT No:	8969.29
DRAWING BY:	MY
CHK BY:	DNE
DWG No:	M-501.00
SCALE: NTS	7 OF 19



AIR HANDLING UNIT DRAIN TRAP DETAIL

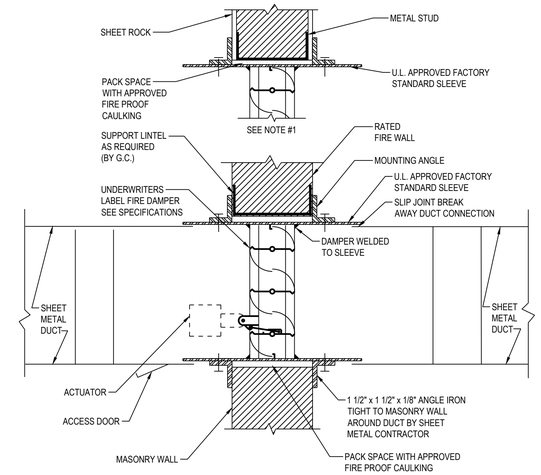
N.T.S.



NOTES:
1. INERTIA BASE HEIGHTS SHALL BE AS FOLLOWS: UP TO 15HP=6", 20-50HP=8", 60-100HP=10", OVER 100HP=12".

PIPING CONNECTION DETAIL - END SUCTION PUMP

N.T.S.

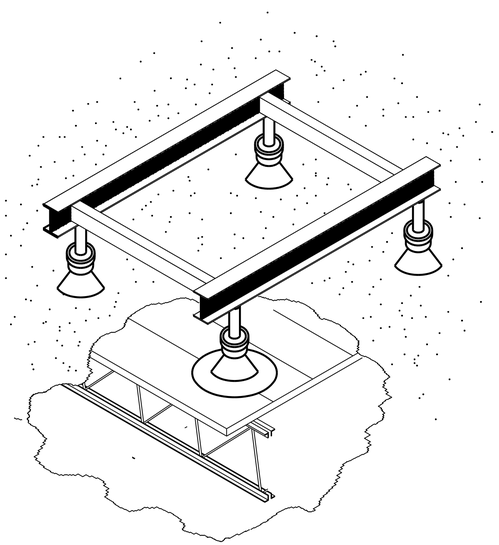


NOTES:
1. IN RATED SHEETROCK WALLS, METAL STUD FRAME PROVIDED BY GENERAL CONTRACTOR.
2. TYPICAL FOR DUCTS 12" OR LESS IN DEPTH.
3. DAMPER SHALL CLOSE WHEN SYSTEM FAN IS OFF. DAMPER TO RE-OPEN UPON FAN START IN NON-ALARM CONDITIONS.

RUSKIN MODEL NO. FSD60
BSA# 176-82-SM

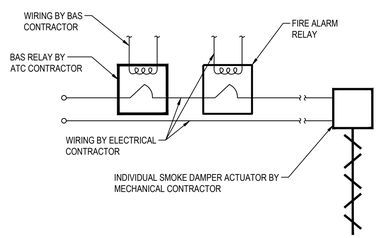
SMOKE DAMPER AND COMBINATION FIRE/SMOKE DAMPER DETAIL

N.T.S.



SUPPORT FOR FLOOR MOUNTED EQUIPMENT AC-5D

N.T.S.



SMOKE DAMPER AND FIRE/SMOKE DAMPER WIRING DETAIL

NTS

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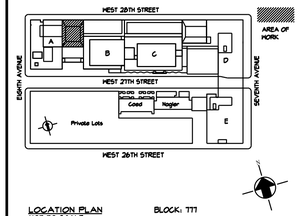

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BLOCK: 777
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PROJECT:
WEST COURTYARD
340 8TH AVENUE
AC UNITS REPLACEMENT

DRAWING TITLE:
MECHANICAL DETAILS 2

DOB NOW JOB •

SEAL & SIGNATURE:

DATE:	05/31/2022
PROJECT No:	8969.29
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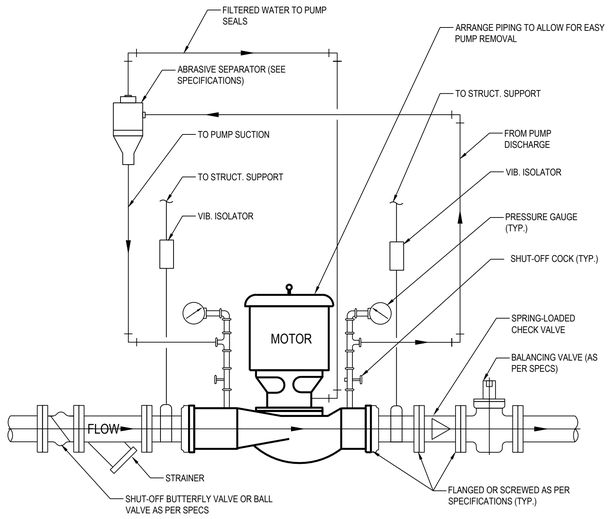
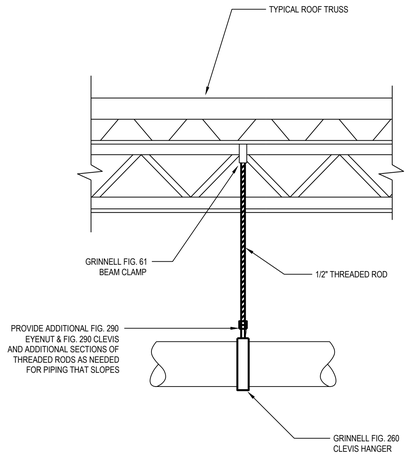
CHK BY:	DNE
DWG No:	M-502.00
SCALE: NTS	8 OF 19



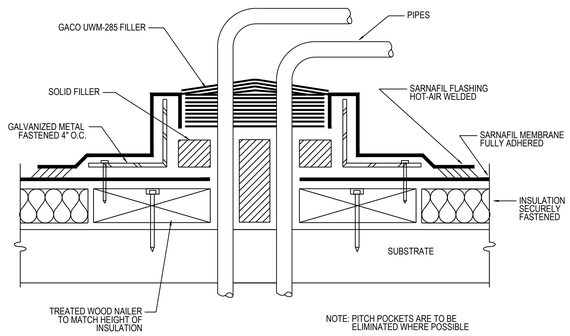
NOTES:

1. IF MOTOR IS IN HORIZONTAL POSITION PROVIDE SEPARATE HANGER FOR MOTOR.
2. FOR MOTORS LESS THAN 3 HP DELETE ABRASIVE SEPARATOR & RELATED PIPING.

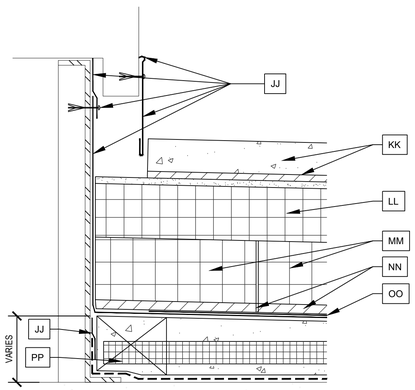
IN LINE PUMP DETAIL
NTS.



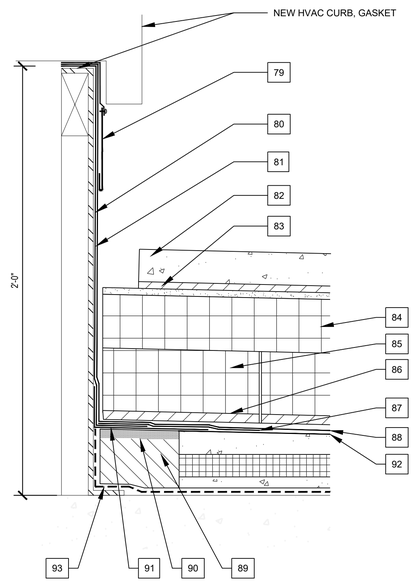
PIPE HANGER SCHEMATIC
N.T.S.



PITCH POCKET
NOT TO SCALE



2023 - EXIST. BASE AT HVAC CURB FOR REFERENCE ONLY
3" = 1'-0"



2023 INSTALL - BASE AT NEW HVAC CURB FOR REFERENCE ONLY
3" = 1'-0"

NOTES:
- THE CURB INSTALLATION IS PART OF THIS CONTRACT AND SHALL BE PERFORMED BY THE MECHANICAL CONTRACTOR.
- THE ROOFING AROUND THE CURB IS PART OF A SEPARATE CONTRACT AND SHALL BE PERFORMED BY MASPETH ROOFING (CONTACT INFO IAN PAUL SEE M-001).
- THE TEMPORARY PROTECTION OF THE ROOF DURING THE DEMOLITION AND TO COMPLETE INSTALLATION OF THE AHU IS PART OF A SEPARATE CONTRACT AND SHALL BE COORDINATED WITH MASPETH ROOFING.
- ALL WORK MUST BE COORDINATED WITH THE ROOF CONTRACTOR MASPETH ROOFING.

EXISTING

JJ. II. STRAP - 1/8" X 2" @ 16" - REMAINS/REMOVE
KK. SET ASIDE PAVERS AND DRAINAGE MAT - RELOCATE PAVERS SO AS NOT TO OVERLOAD THE STRUCTURE
LL. SET ASIDE CEMENTITIOUS BOARD INSULATION TO EXPOSE 16"-WIDE EXTRUDED POLYSTYRENE INSULATION BOARD.
MM. SET ASIDE 16"-WIDE EXTRUDED POLYSTYRENE INSULATION BOARD.
NN. SET ASIDE 16"-WIDE STRIP OF DRAINAGE MAT
OO. REMOVE TAPE - FOLD BACK POLYETHYLENE SHEET AND CONDUCTIVE FABRIC AS NECESSARY.
PP. REMOVE BASE FLASHING, AND ROOFING MEMBRANE, LIGHTWEIGHT INSULATING CONCRETE, AND VAPOR RETARDER DIRECTLY BELOW.

REVISED / NEW - 2023 HVAC REPLACEMENT

79. .040" ALUMINUM CAP FLASHING ASSEMBLY - RIVIT RECEIVER AND EXTENSION @ 12"
80. BASE FLASHING 1ST PLY
81. BASE FLASHING 2ND PLY
82. CONCRETE PAVERS - RESTORE TO ORIGINAL POSITIONS - HOLD BACK 2" FROM FLASHING.
83. DRAINAGE MAT UNDER PAVERS - RESTORE
84. CEMENTITIOUS BOARD INSULATION - RESTORE
85. EXTRUDED POLYSTYRENE INSULATION BOARD - RESTORE
86. DRAINAGE MAT - RESTORE
87. ROOFING MEMBRANE 2ND PLY - EXTEND 4" PAST MAKE-UP PLY
88. POLYETHYLENE SHEET AND CONDUCTIVE FABRIC - RESTORE - RETAPE EDGE SHEET
89. POLYISOCYANURATE INSULATION BOARD IN URETHANE ROOFING ADHESIVE - MATCH SLOPE OF ADJOINING LIGHTWEIGHT INSULATING CONCRETE
90. 1/2" THK. GYPSUM-BASED COVER BOARD - SURFACE AT SAME ELEVATION OF EXISTING ROOFING MEMBRANE
91. MAKE-UP PLY USING 1ST PLY OF ROOFING MEMBRANE - EXTEND 4" ONTO EXISTING ROOFING MEMBRANE
92. EXISTING ROOFING MEMBRANE
93. VAPOR RETARDER FROM EDGE OF EXISTING VAPOR RETARDER TO GYPSUM-BASED COVER BOARD TOP SURFACE

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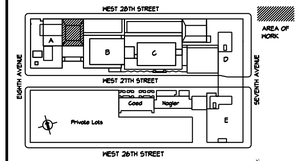

LOCATION PLAN NOT TO SCALE

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LOT: 1

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New York, NY 10001

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PROJECT:
WEST COURTYARD
340 8TH AVENUE
AC UNITS REPLACEMENT

DRAWING TITLE:
MECHANICAL DETAILS 3

DOB NOW JOB #

SEAL & SIGNATURE:

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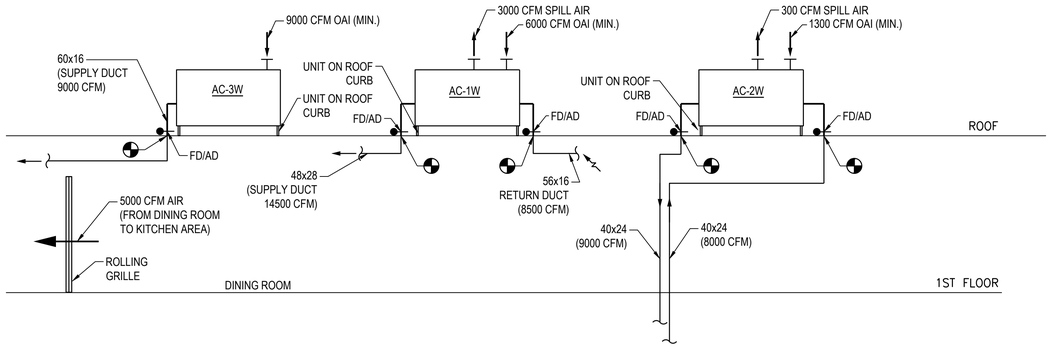
DATE:	05/31/2022
PROJECT No:	8969.29
DRAWING BY:	MY
CHK BY:	DNE
DWG No:	M-503.00
SCALE: NTS	9 OF 19



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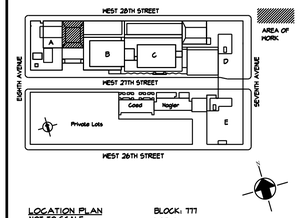

LOCATION PLAN
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BLOCK: 777
LOT: 1

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PROJECT:
WEST COURTYARD
340 8TH AVENUE
AC UNITS REPLACEMENT

DRAWING TITLE:
HVAC AIR FLOW DIAGRAM

DOB NOW JOB •

SEAL & SIGNATURE:

DATE:	05/31/2022
PROJECT No:	8969.29
DRAWING BY:	MY
CHK BY:	DNE
DWG No:	M-601.00
SCALE: NTS	10 OF 19

AC UNITS SCHEDULE — BASED ON COOLBREEZE

GENERAL					SUPPLY FAN DATA												RETURN FAN DATA												
									SINGLE FAN DATA												SINGLE FAN DATA								
TAG No.	SERVICE	LOCATION	TOTAL AIR FLOW CFM	MIN. OUTSIDE AIR FLOW CFM	TOTAL AIR FLOW CFM	TOTAL OPERATING POWER (HP)	SIZE / CLASS / ARRANGEMENT	No. OF FANS	AIR FLOW CFM	TOTAL ESP IN. W.C.	OPERATING POWER (HP)	FAN RPM / MAX FAN RPM	OUTLET VELOCITY FPM	STATIC EFFICIENCY %	MOTOR HP	MOTOR RPM	V/PH/HZ	TOTAL AIR FLOW CFM	TOTAL OPERATING POWER (HP)	SIZE / CLASS / ARRANGEMENT	No. OF FANS	AIR FLOW CFM	TOTAL ESP IN. W.C.	OPERATING POWER (HP)	FAN RPM / MAX FAN RPM	OUTLET VELOCITY FPM	STATIC EFFICIENCY %	MOTOR HP	MOTOR RPM	V/PH/HZ	SEE CONTINUATION
AC-1W	FIRST FLOOR DINING ROOM	WEST COURTYARD ROOF	14,500	6000	14,500	17	20 / 2 / 4	2	7250	5	8.5	2,593 / 2,694	1,427	66	10	1770	208/3/60	9,500	4.4	16 / I / 4	2	4,250	1.6	2.2	2,085 / 2,374	2,043	56	3	1,770	208/3/60	
AC-2W	CELLAR FLOOR BOOK STORE	WEST COURTYARD ROOF	9,000	1,300	9,000	9.2	20 / 2 / 4	2	4,500	4.25	4.6	2,258 / 2,532	1,475	66	5	1770	208/3/60	8,000	3.5	16 / I / 4	2	4,000	1.6	1.75	2,002 / 2,374	1,923	58	2	1,770	208/3/60	
AC-3W	KITCHEN	WEST COURTYARD ROOF	9,000	9,000	9,000	8.8	20 / 2 / 4	2	4,500	4.25	4.4	2,258 / 2,532	1,427	66	5	1770	208/3/60	-	-	-	-	-	-	-	-	-	-	-	-	-	

AC UNITS SCHEDULE CONTINUATION

GENERAL	CHILLED WATER COOLING COIL DATA													STEAM HEATING COIL DATA									PRE-FILTER		FILTER				
TAG No.	TOTAL AIR FLOW CFM	No OF COILS	TOTAL CAPACITY MBH	SENSIBLE CAPACITY MBH	FACE VELOCITY FPM	ROWS / FINS PER INCH	EAT DB / WB °F	LAT DB / WB °F	AIR PD IN.W.C.	EWT °F	LWT °F	TOTAL FLOW RATE GPM	WATER PD FT.W.C.	FIN DIMENSION (LxH) INCH (EACH COIL)	TOTAL CAPACITY MBH	No OF COILS	FACE VELOCITY FPM	ROWS / FINS PER INCH	STEAM PRESSURE PSIG	FLOW RATE LBS/H	EAT DB °F	LAT DB °F	AIR PD IN.W.C.	FIN DIMENSION (LxH) INCH (EACH COIL)	TYPE	SIZE	TYPE	SIZE	TOTAL WEIGHT LBS	MAX. UNIT DIMENSION (LxWxH) INCH	REMARKS
AC-1W	14,500	2	850	557.69	452	6 / 10	83.7/70.5	52.5/ 52	0.86	42	52	165.54	8.27	70.0 / 33.0	990	2	580	1 / 9	6	1,042	30	93	0.16	60.0 / 30.0	2" PLEATED MERV 8	AS NEEDED 24" X 24"	12" PLEATED MERV 15 WITH 2" FRAME SUPPORT	AS NEEDED 24" X 24"	APPRPOX. 5,500	409" x 135" x 70"	SEE NOTES
AC-2W	9,000	1	422	250.85	436	6 / 10	80.0/67	52/51.5	0.77	42	52	65.69	11.76	66.0 / 45.0	297	1	514	1 / 5	6	317	65	95	0.10	60.0 / 42.0	2" PLEATED MERV 8	AS NEEDED 24" X 24"	12" PLEATED MERV 15 WITH 2" FRAME SUPPORT	AS NEEDED 24" X 24"	APPRPOX. 3,500	351" x 125" x 60"	SEE NOTES
AC-3W	9,000	1	688	450	436	5 / 9	95.00 / 75.00	52 / 51	0.68	42	52	116.73	12.82	66.0 / 45.0	772	1	514	1 / 10	6	808	0	80	0.14	60.0 / 42.0	2" PLEATED MERV 8	AS NEEDED 24" X 24"	12" PLEATED MERV 15 WITH 2" FRAME SUPPORT	AS NEEDED 24" X 24"	APPRPOX. 3,000	291" x 125" x 58"	SEE NOTES

NOTES:
1. PROVIDE VFD RATED MOTORS.
2. ELECTRIC MOTORS SHALL BE TEFC AND SHALL HAVE CLASS F INSULATION.
3. SMOKE DAMPERS SHALL BE FACTORY MOUNTED AND SHALL UL LISTED AS PER SPECIFICATION.
4. SMOKE DAMPERS SHALL BE PROVIDED ON THE SUPPLY AND RETURN OPENINGS. OUTDOOR AIR DAMPERS SHALL BE PROVIDED WITH INTEGRAL AIR FLOW MONITORING STATION.
5. BACKDRAFT DAMPERS SHALL BE PROVIDED ON THE SUPPLY FANS TO PREVENT SHORT CIRCUITING.
6. COILS SHALL BE AHRI CERTIFIED.
7. PROVIDE AIR FLOW MONITORING SYSTEM MEASURING THE AIR FLOW ACROSS THE FAN INLET VENTURI, EQUAL TO GREENHECK SURE-AIR METHOD.
8. FLOW MONITORING SHALL NOT USE AIR RESTRICTING PROBES THAT REDUCE FAN PERFORMANCE OR CREATE ADDITIONAL FAN SOUND.
9. FOUR (4) LOW-PRESSURE SENSOR ORRIFICES, EQUALLY SPACED, SHALL BE LOCATED AT THE SMALLEST DIAMETER OF THE INLET CONE VENTURI.
10. FLOW MONITORING STATION SHALL ACCURATELY MEASURE THE PRESSURE DIFFERENTIAL TO WITHIN 3% AND SHALL BE INSTALLED BY THE FAN MANUFACTURER AS PART OF THE FAN ASSEMBLY.
11. UNITS TO BE DELIVERED IN SECTIONS AND SHALL BE ASSEMBLED ON SITE BY THE MANUFACTURER CERTIFIED PERSONNEL.
12. PROVIDE DISCONNECT SWITCHES.
13. PROVIDE INSULATED ROOF CURBS.
14. TOTAL WEIGHT VARIES WITH VENDOR.

CHILLED WATER BOOSTER PUMP SCHEDULE

"BELL AND GOSSETT" AS STANDARD

TAG No.	SERVICE	LOCATION	WATER FLOW GPM	TDH FT.	MOTOR DATA					TYPE	EFFICIENCY %	IMPELLER SIZE DIAMETER IN.	NPSHR FT	MODEL NUMBER	OPERATING WEIGHT LBS	REMARKS
					BHP	HP	RPM	V/PH/HZ	HOUSE FRAME							
P-7A	UNITS AC-1W, 2W, 3W	SUBCELLAR	350	90	10.7	15	1800	208/3/60	254T	END SUCTION CENTRIFUGAL	75.8	10	6.08	BG-E1510-3EB-SS-254T-S	300	
P-8A	UNITS AC-1W, 2W, 3W	SUBCELLAR	350	90	10.7	15	1800	208/3/60	254T	END SUCTION CENTRIFUGAL	75.8	10	6.08	BG-E1510-3EB-SS-254T-S	300	STAND-BY

NOTES:
1. PROVIDE VFD FOR EACH PUMP.
2. PROVIDE PUMP SEQUENCER.
3. PROVIDE INERTIA BASE, 4"H CONCRETE PAD.
4. PROVIDE PIPING HOOK-UP AS PER DETAILS.

VENTILATION SCHEDULE

ROOM	DESCRIPTION	# PEOPLE	AREA (SF)	CFM/PERSON	CFM/SF	REQUIRED OA, CFM	PROVIDED OA, CFM
101	FIRST FLOOR DINING ROOM	532	7600	7.5	0.18	5358	6000
001	CELLAR FLOOR BOOK STORE	73	7270	5	0.12	1237	1300

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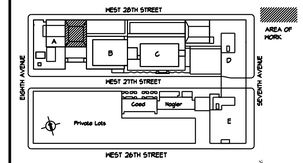

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340 8TH AVENUE
AC UNITS REPLACEMENT

DRAWING TITLE:
MECHANICAL SCHEDULES 1

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DOB NOW JOB •

SEAL & SIGNATURE:

DATE:	05/31/2022
PROJECT No:	8969.29
DRAWING BY:	MY
CHK BY:	DNE
DWG No:	M-701.00
SCALE: NTS	11 OF 19

AC UNIT SCHEDULE — BASED ON COOLBREEZE

GENERAL					SUPPLY FAN DATA													SEE CONTINUATION
									SINGLE FAN DATA									
TAG No.	SERVICE	LOCATION	TOTAL AIR FLOW CFM	MIN. OUTSIDE AIR FLOW CFM	TOTAL AIR FLOW CFM	TOTAL OPERATING POWER (HP)	SIZE / CLASS / ARRANGEMENT	No. OF FANS	AIR FLOW CFM	TOTAL ESP IN. W.C.	OPERATING POWER (HP)	FAN RPM / MAX FAN RPM	OUTLET VELOCITY FPM	STATIC EFFICIENCY %	MOTOR HP	MOTOR RPM	V/PH/HZ	
AC-5D	4TH FLOOR	4TH FLOOR MECHANICAL ROOM	9,000	1000	9,000	10.1	20 / 1 / 4	2	4500	3	5.1	2,258 / 2,532	1,475	66	7.5	1770	208/3/60	

AC UNITS SCHEDULE CONTINUATION

GENERAL	CHILLED WATER COOLING COIL DATA														FILTER		FILTER		TOTAL WEIGHT LBS	MAX. UNIT DIMENSION (LxWxH) INCH	REMARKS
TAG No.	TOTAL AIR FLOW CFM	No OF COILS	TOTAL CAPACITY MBH	SENSIBLE CAPACITY MBH	FACE VELOCITY FPM	ROWS / FINS PER INCH	EAT DB / WB °F	LAT DB / WB °F	AIR PD IN.W.C.	EWT °F	LWT °F	TOTAL FLOW RATE GPM	WATER PD FT.W.C.	FIN DIMENSION (LxH) INCH (EACH COIL)	TYPE	SIZE	TYPE	SIZE			
AC-5D	9,000	1	411.4	275.7	436	6 / 10	77.0/62.0	52.5/52	0.76	42	52	84	4.4	60.0 / 42.0	2" MERV 8 PREFILTERS	AS NEEDED 24" X 24"	12" MERV 15 FINAL FILTERS	AS NEEDED 24" X 24"	-	126"x88x63	

NOTES:
1. PROVIDE VFD RATED MOTORS.
2. ELECTRIC MOTORS SHALL BE TEFC AND SHALL HAVE CLASS F INSULATION.
3. ELECTRIC MOTORS SHALL BE EC MOTORS
4. AIR FLOW STATION SHALL BE INSTALLED ON THE INLET CONE OF THE FAN AND SHALL NOT INTRODUCE ADDITIONAL PRESSURE DROP.
5. BACKDRAFT DAMPERS SHALL BE PROVIDED ON THE SUPPLY FANS TO PREVENT SHORT CIRCUITING.
6. COILS SHALL BE AHRI CERTIFIED.
7. PROVIDE AIR FLOW MONITORING SYSTEM MEASURING THE AIR FLOW ACROSS THE FAN INLET VENTURI.
8. FLOW MONITORING SHALL NOT USE AIR RESTRICTING PROBES THAT REDUCE FAN PERFORMANCE OR CREATE ADDITIONAL FAN SOUND.
9. FOUR (4) LOW-PRESSURE SENSOR ORRIFICES, EQUALLY SPACED, SHALL BE LOCATED AT THE SMALLEST DIAMETER OF THE INLET CONE VENTURI.
10. FLOW MONITORING STATION SHALL ACCURATELY MEASURE THE PRESSURE DIFFERENTIAL TO WITHIN 3% AND SHALL BE INSTALLED BY THE FAN MANUFACTURER AS PART OF THE FAN ASSEMBLY.
11. UNITS TO BE DELIVERED IN SECTIONS AND SHALL BE ASSEMBLED ON SITE BY THE MANUFACTURER CERTIFIED PERSONNEL. THE SECTION SHALL BE NOT MORE THAN 34 INCHES WIDE AND SHALL ALLOW RIGGING THROUGH A STANDARD DOOR.
12. PROVIDE DISCONNECT SWITCHES.
13. PROVIDE SUPPORT FOR THE UNIT. THE UNIT SHALL NOT BE INSTALLED DIRECTLY ON THE FLOOR. SEE THE SPECIFICATION.

CHILLED WATER BOOSTER PUMP SCHEDULE

"ARMSTRONG" AS STANDARD

TAG No.	SERVICE	LOCATION	WATER FLOW GPM	TDH FT.	MOTOR DATA				TYPE	EFFICIENCY %	IMPELLER SIZE DIAMETER IN.	NPSHR FT	MODEL NUMBER	OPERATING WEIGHT LBS	REMARKS
					BHP	HP	RPM	V/PH/HZ							
P-24D	UNIT AC-5D	4TH FLOOR MECHANICAL	55	65	1.37	2	3108	208/1/60	CLOSE-COUPLED VERTICAL IN-LINE PUMP	65.91	4.96	6.68	SQFGQ002024_1	80.7	
P-25D	UNIT AC-5D	4TH FLOOR MECHANICAL	55	65	1.37	2	3108	208/1/60	CLOSE-COUPLED VERTICAL IN-LINE PUMP	65.91	4.96	6.68	SQFGQ002024_1	80.7	STAND-BY

NOTES:
1. PROVIDE VFD FOR EACH PUMP.
2. PUMPS SHALL HAVE BACNET COMMUNICATION CAPABILITIES.
3. PROVIDE PIPING HOOK-UP AS PER DETAILS.

VENTILATION SCHEDULE

ROOM	DESCRIPTION	# PEOPLE	AREA (SF)	CFM/PERSON	CFM/SF	REQUIRED OA, CFM	PROVIDED OA, CFM
D447	LECTURE CLASSROOM	26	1373	7.5	0.06	277	325
D446	LECTURE CLASSROOM	28	1446	7.5	0.06	297	342
D442	SECURITY OFFICE	3	680	5	0.06	56	61
D445	OFFICE	2	238	5	0.06	24	56
D444	OFFICE	2	237	5	0.06	24	56
D443	SECRETARY	1	97	5	0.06	11	23
D443A	OFFICE	1	153	5	0.06	14	36

ELECTRICAL HEATERS

UNIT NO.	LOCATION	SERIES / MODEL	SERVICE	HEATING CAPACITY		CFM	TOTAL LINE AMPERAGE			SHP WT. (LBS)	MANUFACTURER
				WATTS	BTU/HR		VOLTS	PHASE	AMPS		
EUH-1D	SEE PLANS	OXFORD/ASHU3083CTCHAR	SEE PLANS	30000	102381	1400	208	3	NA	87	STELPRO
EUH-2D	SEE PLANS	OXFORD/ASHU3083CTCHAR	SEE PLANS	30000	102381	1400	208	3	NA	87	STELPRO

BID SET 06/08/2022

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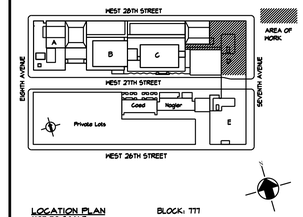

LOCATION PLAN NOT TO SCALE

BLOCK: 777
LOT: 37

Fashion Institute of Technology

300 7th Avenue
New York, NY 10001

MEP Consultants

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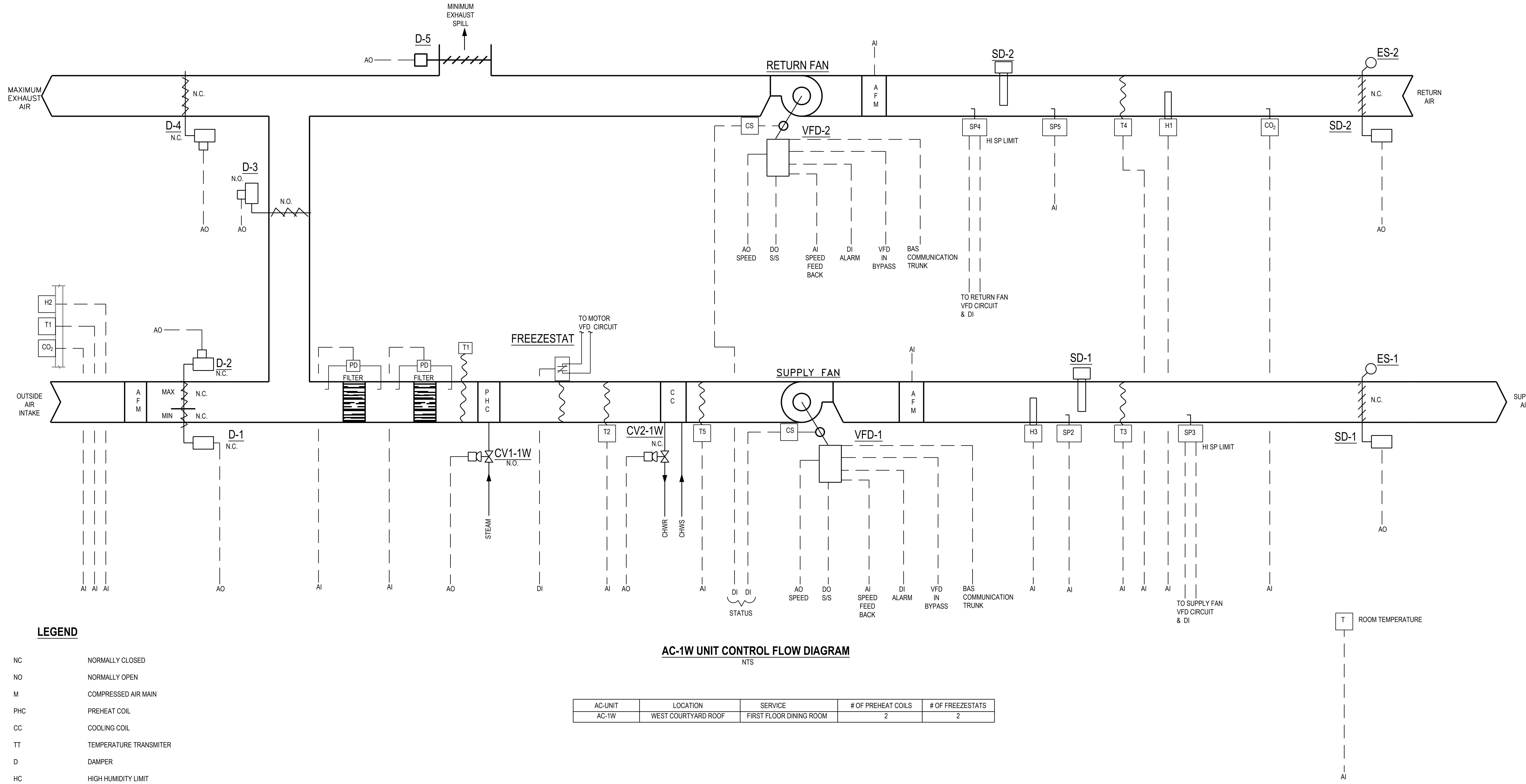
PROJECT:
POMERANTZ CENTER
300 7TH AVENUE
AC UNIT REPLACEMENT

DRAWING TITLE:
MECHANICAL SCHEDULES 2

DOB NOW JOB •

SEAL & SIGNATURE:

DATE: 05/31/2022
PROJECT No: 8969.29
DRAWING BY: MY
CHK BY: DNE
DWG No: M-702.00
SCALE: NTS
12 OF 19



AC-1W UNIT CONTROL FLOW DIAGRAM

NTS

AC-UNIT	LOCATION	SERVICE	# OF PREHEAT COILS	# OF FREEZESTATS
AC-1W	WEST COURTYARD ROOF	FIRST FLOOR DINING ROOM	2	2

LEGEND

NC	NORMALLY CLOSED
NO	NORMALLY OPEN
M	COMPRESSED AIR MAIN
PHC	PREHEAT COIL
CC	COOLING COIL
TT	TEMPERATURE TRANSMITER
D	DAMPER
HC	HIGH HUMIDITY LIMIT
DPS	HIGH STATIC PRESSURE LIMIT
ES	END SWITCH
SD	SMOKE DETECTOR/SMOKE DAMPER
HT	HUMIDITY TRANSMITTER
CHWS/.R	CHILLED WATER SUPPLY/RETURN
V	VALVE
VD	SUPPLY VANES
AI	ANALOG INPUT
AO	ANALOG OUTPUT
DI	DIGITAL INPUT
DO	DIGITAL OUTPUT
AFM	AIR FLOW MEASURING STATION
PT	PRESSURE TRANSDUCER
PD	PRESSURE DIFFERENTIAL SENSOR
CO2	CARBON DIOXIDE SENSOR
SP	STATIC PRESSURE SENSOR
RH	REHEAT COIL
VFD	VARIABLE FREQUENCY DRIVE
SS	START / STOP
CS	CURRENT SENSOR (STATUS)
(#)	PNEUMATIC TUBING CONNECTIONS # DESIGNATES EXISTING PNEUMATIC TUBE FROM EXISTING PNEUMATIC PANEL

NOTES

1. MULTIPLE SETS OF PREHEAT COIL CONTROLS REQUIRED. SEE AC UNIT SCHEDULE FOR QUANTITIES.
2. MULTIPLE FREEZESTATS. SEE AC UNIT SCHEDULE FOR QUANTITIES.
3. DEMAND CONTROL VENTILATION (DCV). PROVIDE NEW CO_2 SENSORS IN OUTSIDE AIR & RETURN AIR. EXISTING OUTSIDE AIR INTAKE AIR FLOW MEASURING STATION. TYPICAL FOR AC-1W.

BAS POINTS MATRIX

SYSTEM APPARATUS, OR AREA POINT DESCRIPTION	INPUTS																												OUTPUTS												SYSTEM FEATURES																			GENERAL					SUPPLEMENTARY NOTES
	ANALOG																		BINARY										DIGITAL							ANALOG					ALARMS								PROGRAMS																
	MEASURED										CALC.																																																					
	TEMPERATURE	PRESSURE (DIFF.)	RH	KW	AIR FLOW	ROOM TEMP.	CARBON DOIXIDE	STATIC PRESSURE	PRESSURE		KWH	ENTHALPY	RUN TIME	EFFICIENCY		CHW SYSTEM LOAD	TANK OVER FLOW		STATUS	FILTER	SMOKE	FREEZE	AIR FLOW	METER	PANEL ALARM	INTERLOCKS	WATER FLOW	WATER LEAK SWITCH	SUMMER AUTO WINTER	OFF-AUTO-ON	OFF-HI-LO	OPEN-CL-VALVE/DAMPER	SUMMER AUTO WINTER	MIN. O.A. DAMPER		DMPR POS	VALVE POS		SUPPLY/RETURN FAN VFD'S		HI ANALOG	LOW ANALOG	HI BINARY	LOW BINARY	PROOF	STATIC PRESS.	CONDENSATE FCU	PANEL DRY CONTACT	TIME SCHEDULING	DEMAND LIMITING	DUTY CYCLE	START/STOP OPT.	ENTHALPY OPT.	SMOKE CNT.	TREND	ALARM INSTRUCT	MAINT. WK ORD.	DDC	EVENT PROGR.	COLOR GRAPHIC					
AC-1W	6	1	4		3	1	2	3				X	X						2			1							1	1		1				4	2		2		X	X			X	X	X		X			X	X	X	X	X	X	X	X	X					

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BID SET 06/08/2022

rev. no.	date	revisions
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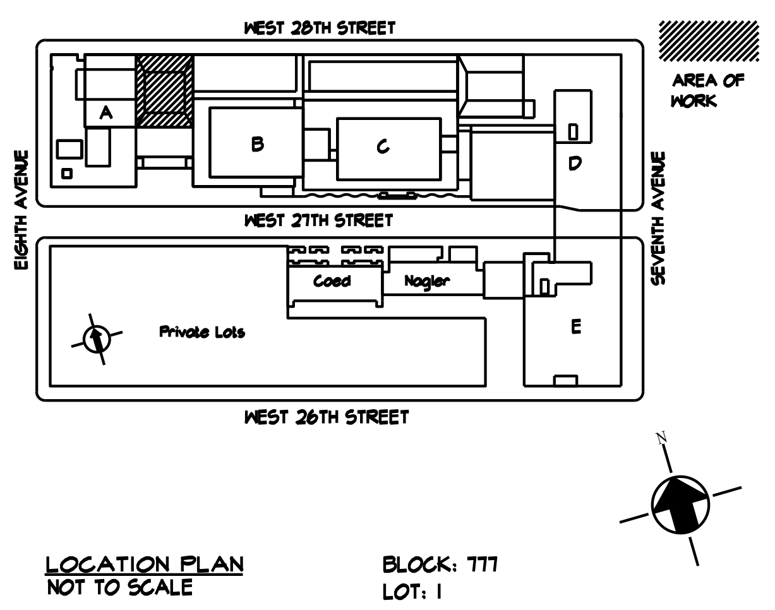

LOCATION PLAN
NOT TO SCALE

BLOCK: 777
LOT: 1

Fashion Institute of Technology

340 8th Avenue
New York, NY 10001

MEP Consultants

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PROJECT:
WEST COURTYARD
340 8TH AVENUE
AC UNITS REPLACEMENT

DRAWING TITLE:
AC-1W UNIT TEMPERATURE
CONTROL DIAGRAM 1

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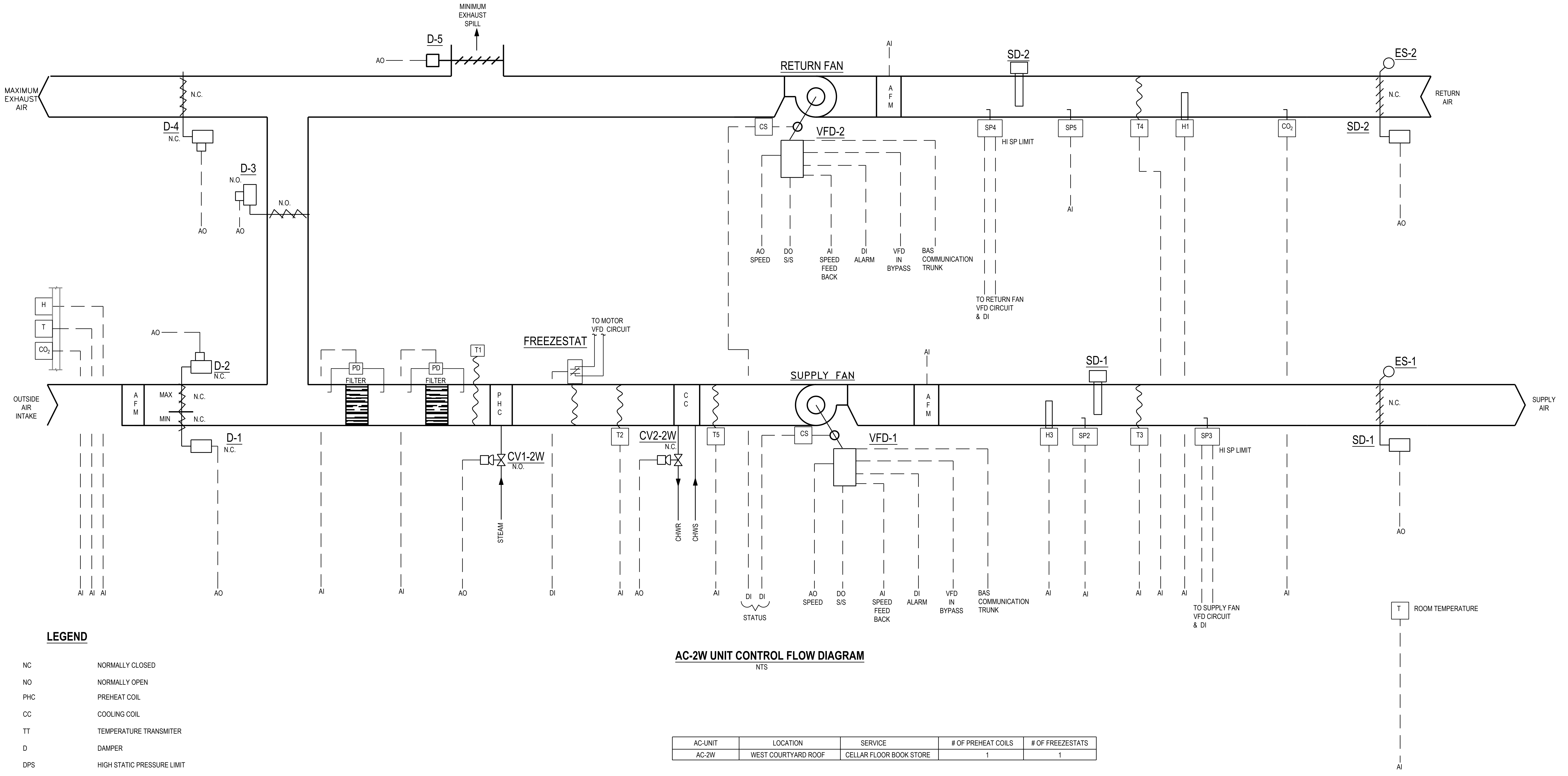
DATE:	05/31/2022
PROJECT No:	8969.29
DRAWING BY:	MY
CHK BY:	DNE
DWG No:	M-801.00
SCALE: NTS	13 OF 19



AC-2W UNIT CONTROL FLOW DIAGRAM

NTS

AC-UNIT	LOCATION	SERVICE	# OF PREHEAT COILS	# OF FREEZESTATS
AC-2W	WEST COURTYARD ROOF	CELLAR FLOOR BOOK STORE	1	1

LEGEND

NC	NORMALLY CLOSED
NO	NORMALLY OPEN
PHC	PREHEAT COIL
CC	COOLING COIL
TT	TEMPERATURE TRANSMITER
D	DAMPER
DPS	HIGH STATIC PRESSURE LIMIT
ES	END SWITCH
SD	SMOKE DETECTOR/SMOKE DAMPER
HT	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
PT	PRESSURE TRANSDUCER
PD	PRESSURE DIFFERENTIAL SENSOR
CO2	CARBON DIOXIDE SENSOR
SP	STATIC PRESSURE SENSOR
VFD	VARIABLE FREQUENCY DRIVE
SS	START / STOP
CS	CURRENT SENSOR (STATUS)

NOTES

1. MULTIPLE SETS OF PREHEAT COIL CONTROLS REQUIRED. SEE AC UNIT SCHEDULE FOR QUANTITIES.
2. MULTIPLE FREEZESTATS. SEE AC UNIT SCHEDULE FOR QUANTITIES.
3. DEMAND CONTROL VENTILATION (DCV). PROVIDE NEW CO_2 SENSORS IN OUTSIDE AIR & RETURN AIR. EXISTING OUTSIDE AIR INTAKE AIR FLOW MEASURING STATION. TYPICAL FOR AC-2W.

BAS POINTS MATRIX

SYSTEM APPARATUS, OR AREA POINT DESCRIPTION	INPUTS																												OUTPUTS												SYSTEM FEATURES																			GENERAL					SUPPLEMENTARY NOTES
	ANALOG																		BINARY										DIGITAL							ANALOG					ALARMS								PROGRAMS																
	MEASURED										CALC.																																																						
	TEMPERATURE	PRESSURE (DIFF.)	RH	KW	AIR FLOW	ROOM TEMP.	CARBON DOIXIDE	STATIC PRESSURE	PRESSURE		KWH	ENTHALPY	RUN TIME	EFFICIENCY		CHW SYSTEM LOAD	TANK OVER FLOW		STATUS	FILTER	SMOKE	FREEZE	AIR FLOW	METER	PANEL ALARM	INTERLOCKS	WATER FLOW	WATER LEAK SWITCH	SUMMER AUTO WINTER	OFF-AUTO-ON	OFF-HI-LO	OPEN-CL-VALVE/DAMPER	SUMMER AUTO WINTER	MIN. O.A. DAMPER		DMPR POS	VALVE POS		SUPPLY/RETURN FAN VFD'S		HI ANALOG	LOW ANALOG	HI BINARY	LOW BINARY	PROOF	STATIC PRESS.	CONDENSATE FCU	PANEL DRY CONTACT	TIME SCHEDULING	DEMAND LIMITING	DUTY CYCLE	START/STOP OPT.	ENTHALPY OPT.	SMOKE CNT.	TREND	ALARM INSTRUCT	MAINT. WK ORD.	DDC	EVENT PROGR.	COLOR GRAPHIC					
AC-2W	6	1	4		3	1	2	3				X	X						2			1							1	1		1				4	2		2		X	X			X	X	X		X			X	X	X	X	X	X	X	X	X					

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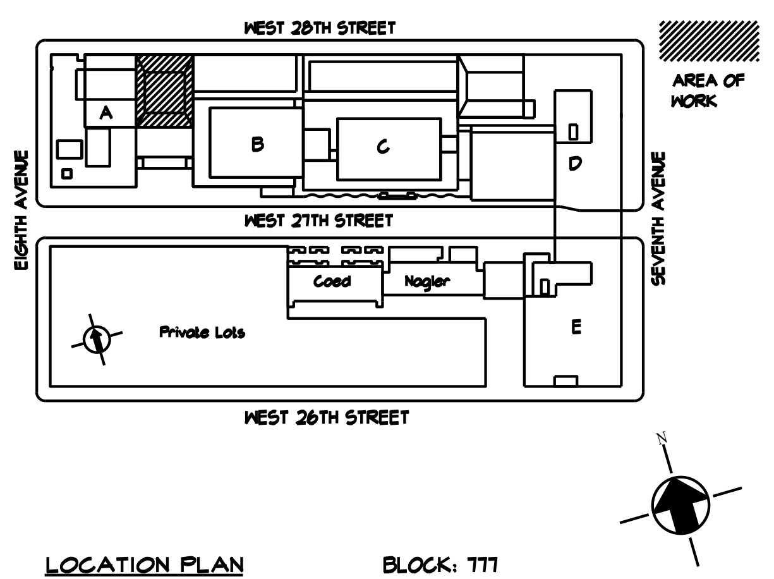

LOCATION PLAN
NOT TO SCALE

BLOCK: 777
LOT: 1

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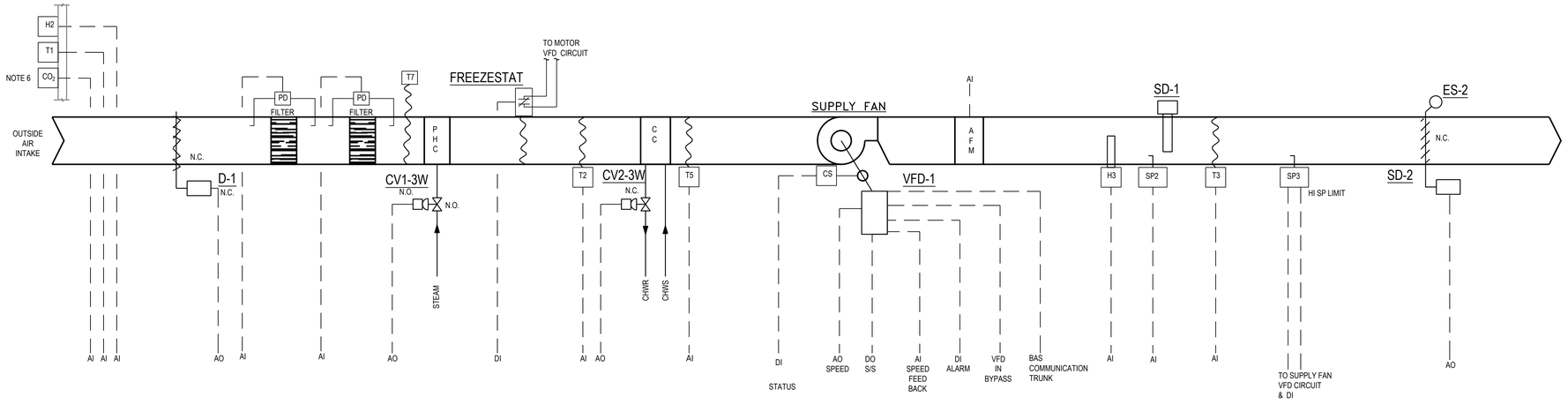
PROJECT:
WEST COURTYARD
340 8TH AVENUE
AC UNITS REPLACEMENT

DRAWING TITLE:
AC-2W UNIT TEMPERATURE
CONTROL DIAGRAM 2

DOB NOW JOB #

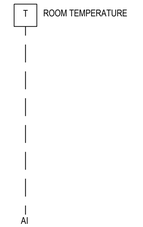
SEAL & SIGNATURE:

DATE:	05/31/2022
PROJECT No:	8969.29
DRAWING BY:	MY
CHK BY:	DNE
DWG No:	M-802.00
SCALE: NTS	14 OF 19



AC-3W UNIT CONTROL FLOW DIAGRAM

NTS



NOTES

1. MULTIPLE SETS OF PREHEAT COIL CONTROLS REQUIRED. SEE AC UNIT SCHEDULE FOR QUANTITIES.
2. MULTIPLE FREEZESTATS. SEE AC UNIT SCHEDULE FOR QUANTITIES.
3. AC-3W DDC/BAS PANEL & CONTROLS
4. AC-3W SHALL BE INTERLOCKED WITH THE KITCHEN HOOD OPERATION.

AC-UNIT	LOCATION	SERVICE	# OF PREHEAT COILS	# OF FREEZESTATS
AC-3W	WEST COURTYARD ROOF	KITCHEN	1	1

LEGEND

NC	NORMALLY CLOSED
NO	NORMALLY OPEN
PHC	PREHEAT COIL
CC	COOLING COIL
TT	TEMPERATURE TRANSMITER
D	DAMPER
DPS	HIGH STATIC PRESSURE LIMIT
ES	END SWITCH
SD	SMOKE DETECTOR/SMOKE DAMPER
HT	HUMIDITY TRANSMITTER
CHWS/R	CHILLED WATER SUPPLY/RETURN
V	CONTROL VALVE
AI	ANALOG INPUT
AO	ANALOG OUTPUT
DI	DIGITAL INPUT
DO	DIGITAL OUTPUT
AFM	AIR FLOW MEASURING STATION
PT	PRESSURE TRANSDUCER
PD	PRESSURE DIFFERENTIAL SENSOR
CO2	CARBON DIOXIDE SENSOR
SP	STATIC PRESSURE SENSOR
RH	REHEAT COIL
VFD	VARIABLE FREQUENCY DRIVE
SS	START / STOP
CS	CURRENT SENSOR (STATUS)

BAS POINTS MATRIX

SYSTEM APPARATUS, OR AREA POINT DESCRIPTION	INPUTS: ANALOG: MEASURED: TEMPERATURE	PRESSURE (DIFF.)	RH	KW	AIR FLOW	ROOM TEMP	CARBON DIOXIDE	STATIC PRESSURE	PRESSURE	INPUTS: ANALOG: CALC.: KWH	RUNTIME	EFFICIENCY	CHW SYSTEM LOAD	TANK OVER FLOW	INPUTS: BINARY: STATUS	FILTER	SMOKE	FREEZE	AIR FLOW	METER	PANEL ALARM	INTERLOCKS	WATER FLOW	WATER LEAK SWITCH	OUTPUTS: DIGITAL: SUMMER AUTO WINTER	OFF-AUTO-ON	OFF-HI-LO	OPEN-CA VALVE/DAMPER	SUMMER AUTO WINTER	MIN. O.A. DAMPER	OUTPUTS: ANALOG: DMPR POS	VALVE POS	SUPPLY/RETURN FAN VFDS	SYSTEM FEATURES: ALARMS: HI ANALOG	LOW ANALOG	HI BINARY	LOW BINARY	PROOF	STATIC PRESS	CONDENSATE H2O	PANEL COMM FAULT	SYSTEMS: PROGRAMS: TIME SCHEDULING	DEMAND LIMITING	DUTY CYCLE	STARTUP/SHUTDOWN	EXTERNAL P/V OPT.	SMOKE CNT.	TREND	ALARM INSTRUCT	MAINT. TRK./ORD.	DDC	EVENT PROGR.	COLOR GRAPHIC	GENERAL	SUPPLEMENTARY NOTES
AC-3W	6	1	4	3	1	2	3			X	X				2				1						1	1		1			4	2	2	X	X						X																

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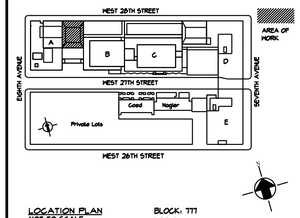

LOCATION PLAN
NOT TO SCALE

BLOCK: 777
LOT: 1

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PROJECT:
WEST COURTYARD
340 8TH AVENUE
AC UNITS REPLACEMENT

DRAWING TITLE:
AC-3W UNIT TEMPERATURE CONTROL DIAGRAM 3

DOB NOW JOB •

SEAL & SIGNATURE:

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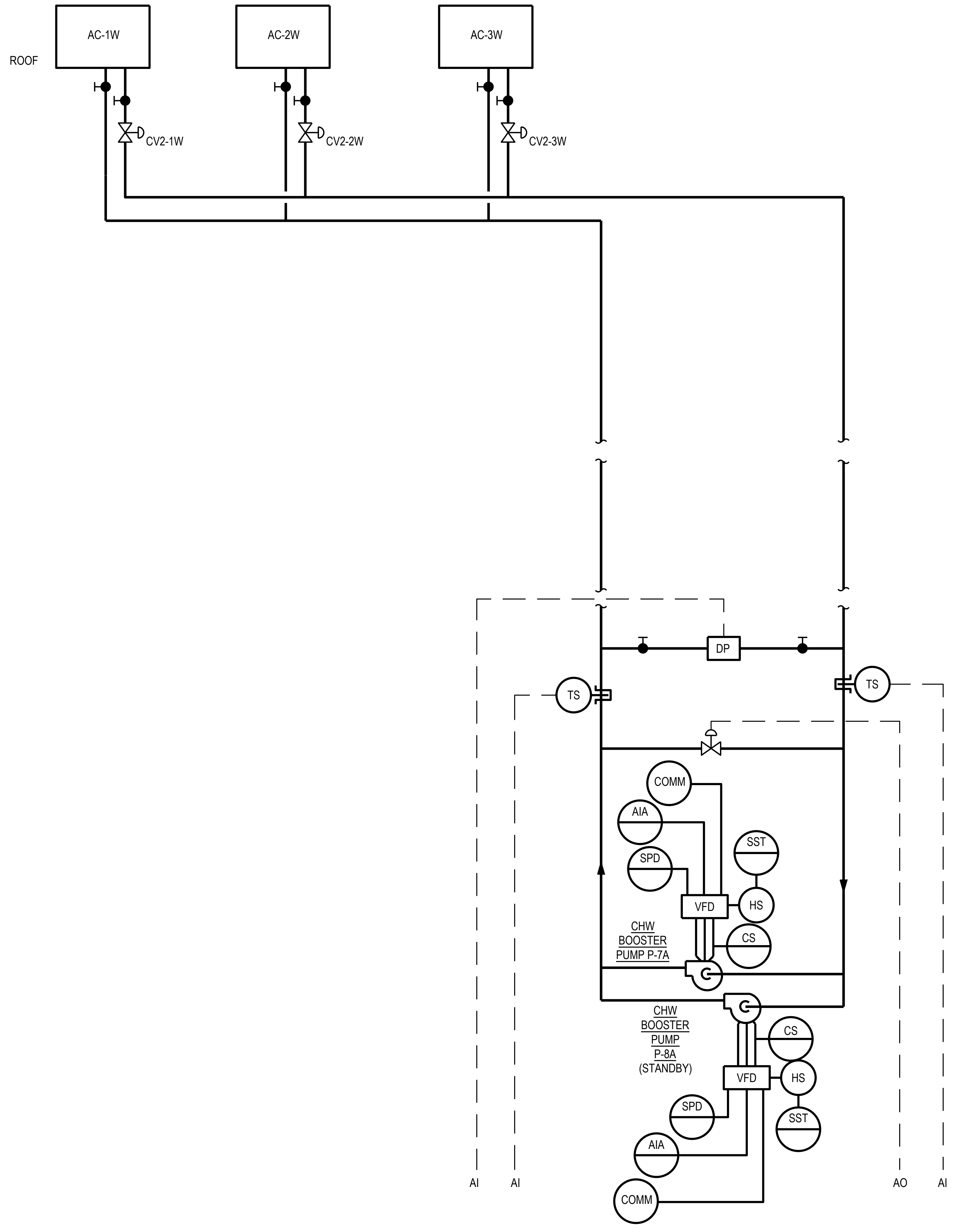
DWG No:	M-803.00
SCALE: NTS	15 OF 19



CHILLED WATER BOOSTER PUMPS

PUMP NO.	SERVICE	LOCATION	DIFFERENTIAL PRESSURE SENSOR LOCATION
P-7A & P-8A	WEST COURTYARD	A CELLAR MER	AC-1W, AC-2W, AC-3W ROOF

NOTES:

1. SEE SEQUENCE OF OPERATION ON THE SPECIFICATION 23 09 00.

CONTROLS SYMBOLS

HS	HAND SWITCH (HAND-OFF-AUTO SWITCH)
CS	CURRENT SENSOR
VFD	VARIABLE FREQUENCY DRIVE
DP	DIFFERENTIAL PRESSURE TRANSMITTER
COMM	BACNET COMMUNICATION
AIA	ANALOG INPUT
SPD	SPEED CONTROL
SST	START, STOP
⋈	VALVE
●	VALVE
AI	ANALOG INPUT
AO	ANALOG OUTPUT
DI	DIGITAL INPUT
DO	DIGITAL OUTPUT
AC	AIR CONDITIONING UNIT
CHWS/R	CHILLED WATER SUPPLY/RETURN
TS	TEMPERATURE SENSOR

CONTROL DIAGRAM FOR CHILLED WATER BOOSTER PUMP SYSTEMS

NTS

CHILLED WATER SYSTEM

SYSTEM APPARATUS, OR AREA POINT DESCRIPTION	INPUTS																											OUTPUTS												SYSTEM FEATURES																			GENERAL					SUPPLEMENTARY NOTES
	ANALOG																		BINARY									DIGITAL							ANALOG					ALARMS								PROGRAMS																
	MEASURED										CALC.																																																					
	TEMPERATURE	DIFFERENTIAL PRESSURE	RH	KW	WATER FLOW						KWH	ENTHALPY	RUN TIME	EFFICIENCY					STATUS	FILTER		FREEZE	WATER FLOW	METER				OFF-ON	OFF-AUTO-ON	OFF-HI-LO	OPEN-CLOSE				DMPR POS	VALVE POS	SET POINT ADJ.	SPEED DRIVE		HI ANALOG	LOW ANALOG	HI BINARY	LOW BINARY	PROOF	VFD COMMON			TIME SCHEDULING	DEMAND LIMITING	DUTY CICLE	START/STOP OPT.	ENTHALPY OPT.	SMOKE CNT.	TREND	ALARM INSTRUCT	MAINT. WK ORD.			COLOR GRAPHIC					
CHW BOOSTER PUMP													X						X										X									X						X	X									X	X	X			X					NOTE 1
CHW BOOSTER PUMP													X						X										X									X						X	X									X	X	X			X					NOTE 1
CHWS	X	X																																		X																X	X				X					NOTE 2
CHWR	X	X																					X																													X	X				X					NOTE 2
D.P. VALVE V-1																																			X																	X	X				X					

NOTES:

1. PROVIDE ECC/DDC BACNET COMMUNICATION TO PUMP VFD'S.
2. PROVIDE DIFFERENTIAL PRESSURE READINGS ACROSS (2) AC UNITS COOLING COILS AND IN MER.

NEW YORK CITY BUILDING DEPARTMENT NOTE

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NEW YORK CITY ENERGY CONSERVATION CODE

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BID SET 06/08/2022

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-	06/08/2022	ISSUED TO BID
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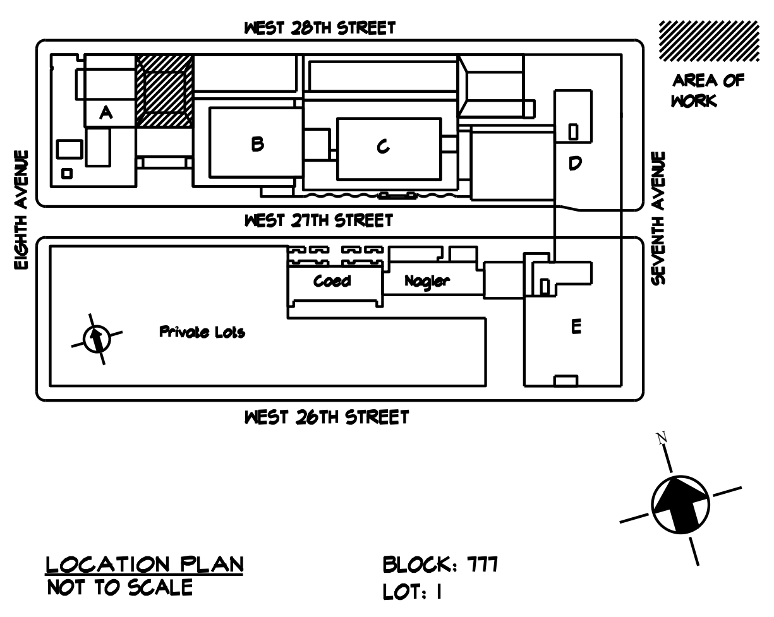

LOCATION PLAN
NOT TO SCALE

BLOCK: 777
LOT: 1

Fashion Institute of Technology

340 8th Avenue
New York, NY 10001

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PROJECT:
WEST COURTYARD
340 8TH AVENUE
AC UNITS REPLACEMENT

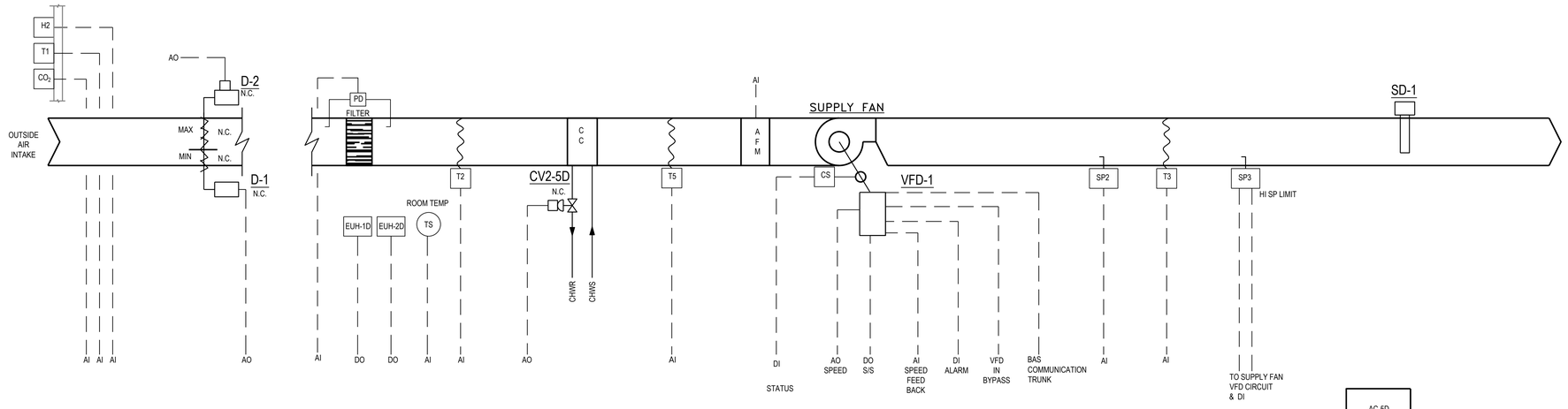
DRAWING TITLE:

CHILLED WATER BOOSTER
SYSTEMS CONTROLS DIAGRAM

DOB NOW JOB #

SEAL & SIGNATURE:

DATE:	05/31/2022
PROJECT No:	8969.29
DRAWING BY:	MY
CHK BY:	DNE
DWG No:	M-804.00
SCALE: NTS	16 OF 19



AC-5D UNIT CONTROL FLOW DIAGRAM
NTS

NOTES

1. SEE SEQUENCE OF OPERATION ON THE SPECIFICATION 23 09 00.
2. AC-5D DDC/BAS PANEL & CONTROLS
3. ROOM TEMP (TS) SHALL CONTROL THE ELECTRIC HEATERS TO MAINTAIN THE SPACE AT SETPOINT 50 DEG F (ADJUSTABLE)
4. STATUS OF THE ELECTRIC HEATERS SHALL BE SHOWN ON THE BMS.

AC-UNIT	LOCATION	SERVICE	# OF PREHEAT COILS	# OF FREEZESTATS
AC-5D	4TH FLOOR MECHANICAL ROOM	4TH FLOOR	0	1

CHILLED WATER BOOSTER PUMPS			
PUMP NO.	SERVICE	LOCATION	DIFFERENTIAL PRESSURE SENSOR LOCATION
P-24D & P-25D	4TH FLOOR OFFICES	4TH FLOOR MER	AC-5D

NOTES:

1. SEE SEQUENCE OF OPERATION ON THE SPECIFICATION 23 09 00.

BAS POINTS MATRIX

SYSTEM APPARATUS, OR AREA POINT DESCRIPTION	INPUTS: ANALOG: MEASURED: TEMPERATURE	PRESSURE (DIFF.)	KW	AIR FLOW	ROOM TEMP	CARBON DIOXIDE	STATIC PRESSURE	PRESSURE	CALC.: KWH	ENTHALPY	RUN TIME	EFFICIENCY	CHW SYSTEM LOAD	TANK OVER FLOW	BINARY: STATUS	FILTER	SMOKE	FREEZE	METER	PANEL ALARM	INTERLOCKS	WATER FLOW	VFD BYPASS SWITCH	SUMMER/AUTO WINTER	OUTPUTS: DIGITAL: OFF-AUTO-ON	OFF-HI-LO	OPEN-CL-VALVE/DAMPER	OPEN-CLOSE-VALVE/DAMPER	MIN. O.A. DAMPER	ANALOG: DMPR POS.	VALVE POS.	SUPPLY/RETURN FAN VFD'S	SYSTEM FEATURES: ALARMS: HI ANALOG	LOW ANALOG	HI BINARY	LOW BINARY	PROOF	STATIC PRESS.	CONDENSATE FCU	ANALOG OUTPUT	PROGRAMS: TIME SCHEDULING	DEMAND LIMITING	DUTY CYCLE	START/STOP OPT.	ENTHALPY OPT.	SMOKE CNT.	TREND	ALARM INSTRUCT	MAINT. WK ORD.	SD	EVENT PROGR.	COLOR GRAPHIC	GENERAL	SUPPLEMENTARY NOTES
AC-5D	6	1	4		3	1	2	3		X	X				2									1	1		1				4	2	2	X	X																					

CHILLED WATER SYSTEM

SYSTEM APPARATUS, OR AREA POINT DESCRIPTION	INPUTS: ANALOG: MEASURED: TEMPERATURE	DIFFERENTIAL PRESSURE	RH	KW	WATER FLOW	CALC.: KWH	ENTHALPY	RUN TIME	EFFICIENCY	BINARY: STATUS	FILTER	SMOKE	FREEZE	WATER FLOW	METER	OUTPUTS: DIGITAL: OFF-ON	OFF-AUTO-ON	OFF-HI-LO	OPEN-CLOSE	DMPR POS.	VALVE POS.	ANALOG: SET POINT ADJ.	SPEED DRIVE	SYSTEM FEATURES: ALARMS: HI ANALOG	LOW ANALOG	HI BINARY	LOW BINARY	PROOF	VFD COMMON	PROGRAMS: TIME SCHEDULING	DEMAND LIMITING	DUTY CYCLE	START/STOP OPT.	ENTHALPY OPT.	SMOKE CNT.	TREND	ALARM INSTRUCT	MAINT. WK ORD.	COLOR GRAPHIC	GENERAL	SUPPLEMENTARY NOTES
CHW BOOSTER PUMP								X			X						X						X					X	X						X	X	X	X			NOTE 1
CHW BOOSTER PUMP								X			X						X						X					X	X						X	X	X	X			NOTE 1
CHWS	X	X																					X												X	X					
CHWR	X	X												X																					X	X					
D.P. VALVE V-1																						X													X	X					

NOTES:
1. PROVIDE ECC/DDC BACNET COMMUNICATION TO PUMP VFD'S.

LEGEND

NC	NORMALLY CLOSED	HS	HAND SWITCH (HAND-OFF-AUTO SWITCH)
NO	NORMALLY OPEN	CS	CURRENT SENSOR
PHC	PREHEAT COIL	VFD	VARIABLE FREQUENCY DRIVE
CC	COOLING COIL	DP	DIFFERENTIAL PRESSURE TRANSMITTER
TT	TEMPERATURE TRANSMITER		
D	DAMPER		
DPS	HIGH STATIC PRESSURE LIMIT	COMM	BACNET COMMUNICATION
ES	END SWITCH		
SD	SMOKE DETECTOR/SMOKE DAMPER	AIA	ANALOG INPUT
HT	HUMIDITY TRANSMITTER		
CHWS/.R	CHILLED WATER SUPPLY/RETURN	SPD	SPEED CONTROL
V	CONTROL VALVE		
AI	ANALOG INPUT	SST	START, STOP
AO	ANALOG OUTPUT		
DI	DIGITAL INPUT		VALVE
DO	DIGITAL OUTPUT		VALVE
AFM	AIR FLOW MEASURING STATION		
PT	PRESSURE TRANSDUCER	AI	ANALOG INPUT
PD	PRESSURE DIFFERENTIAL SENSOR	AO	ANALOG OUTPUT
CO2	CARBON DIOXIDE SENSOR	DI	DIGITAL INPUT
SP	STATIC PRESSURE SENSOR	DO	DIGITAL OUTPUT
RH	REHEAT COIL	AC	AIR CONDITIONING UNIT
VFD	VARIABLE FREQUENCY DRIVE	CHWS/R	CHILLED WATER SUPPLY/RETURN
SS	START / STOP	TS	TEMPERATURE SENSOR
CS	CURRENT SENSOR (STATUS)	EUH	ELECTRIC UNIT HEATER

CONTROL DIAGRAM FOR CHILLED WATER BOOSTER PUMP SYSTEMS
NTS

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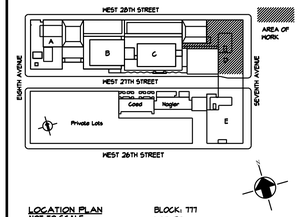

LOCATION PLAN NOT TO SCALE

BLOCK: 777
LOT: 37

Fashion Institute of Technology

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New York, NY 10001

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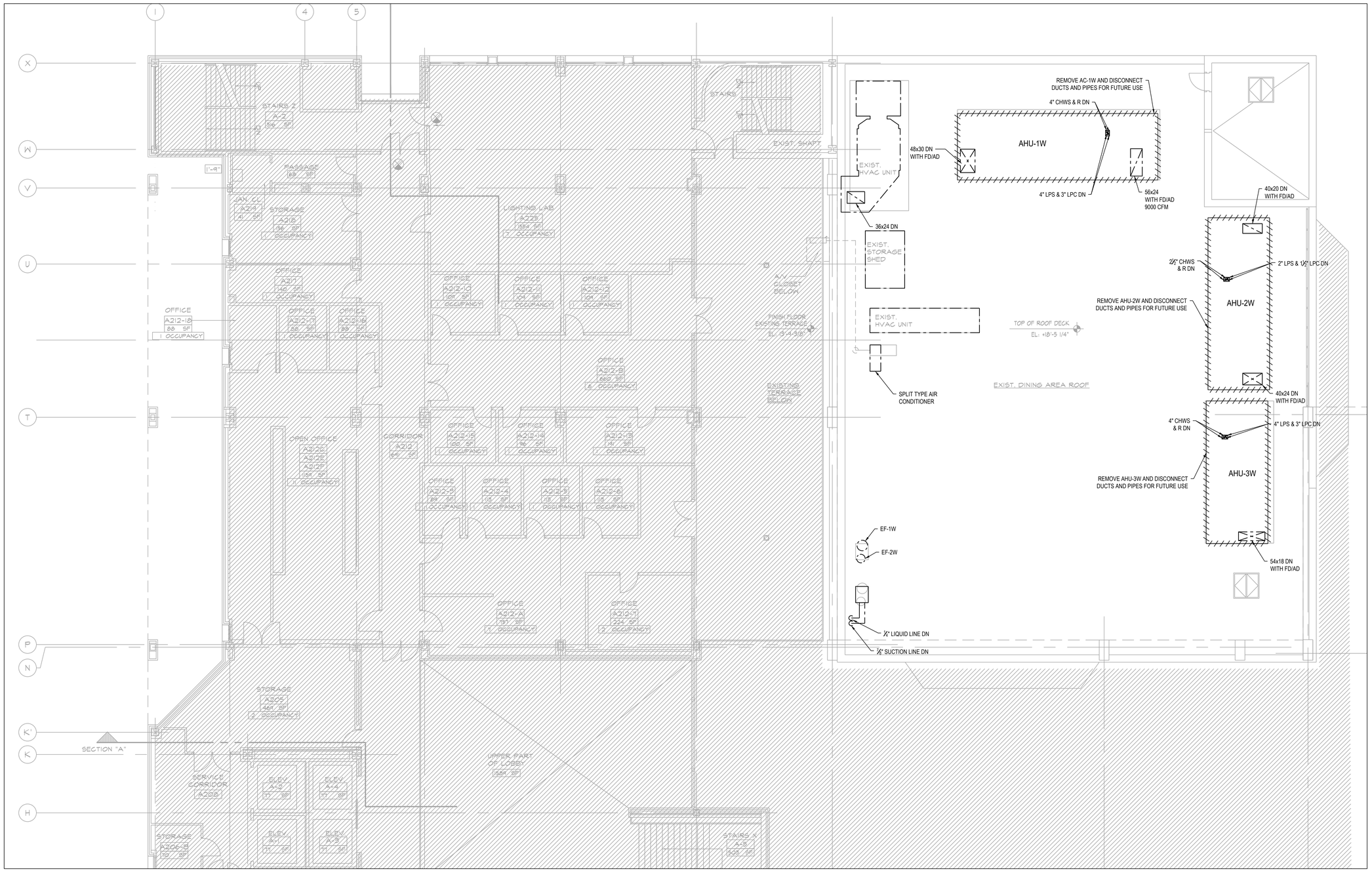
PROJECT:
POMERANTZ CENTER
300 7TH AVENUE
AC UNIT REPLACEMENT

DRAWING TITLE:
AC-5D UNIT TEMPERATURE CONTROL DIAGRAM 5

DOB NOW JOB •

SEAL & SIGNATURE:

DATE:	05/31/2022
PROJECT No:	8969.29
DRAWING BY:	MY
CHK BY:	DNE
DWG No:	M-805.00
SCALE:	NTS



NOTES

1. PRIOR TO START THE DEMOLITION WORK AND REMOVAL OF THE AC UNITS, THE CONTRACTOR SHALL SUBMIT THE CONSTRUCTION SCHEDULE WITH THE SHIPPING DATE AND DELIVERY AT THE SITE DATE FOR EACH AC UNIT.
2. THE CONTRACTOR SHALL COORDINATE THE ENTIRE WORK WITH THE NEW ROOF.
3. ALL AC COMPONENTS ARE TO BE REMOVED INCLUDING CURBS.
4. THE CONTRACTOR SHALL PROVIDE TEMPORARY PROTECTION OF THE DUCT, PIPES AND CONDUIT OPENINGS.
5. THE CONTRACTOR SHALL PROVIDE TEMPORARY ROOF PROTECTION ON THE ROOF AREA COVERED BY THE EXISTING AC UNITS UNTIL THE NEW AC UNITS ARE INSTALLED.

⑧ ROOF MECHANICAL DEMOLITION PLAN

1/8" = 1'-0"

0 4' 8' 16'

SCALE: 1/8" = 1'-0"

BID SET 06/08/2022

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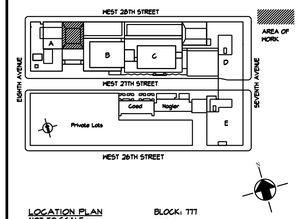

LOCATION PLAN NOT TO SCALE

BLOCK: 777
LOT: 1

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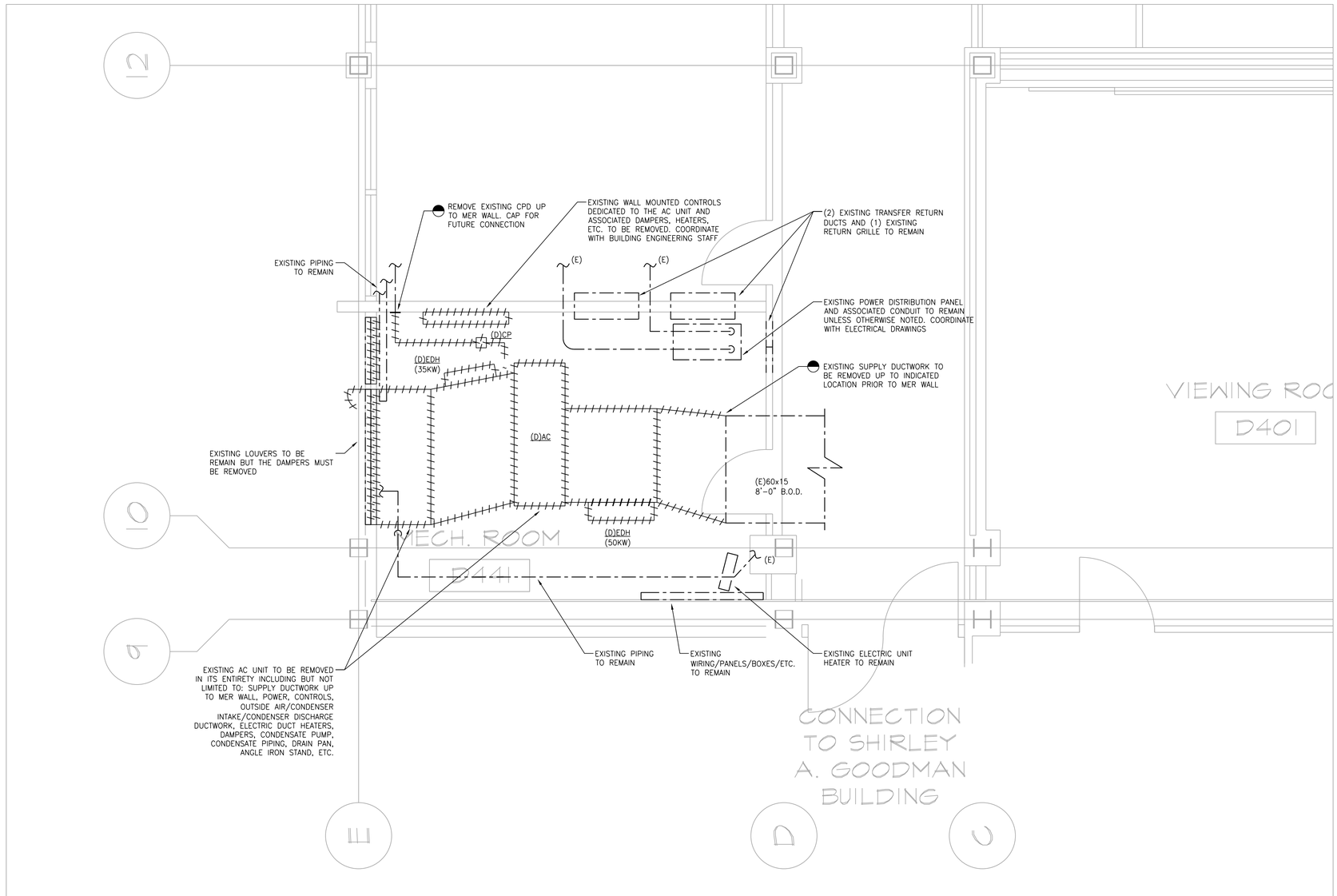
PROJECT:
WEST COURTYARD
340 8TH AVENUE
AC UNITS REPLACEMENT

DRAWING TITLE:
ROOF
MECHANICAL DEMOLITION
PLAN

DOB NOW JOB •

SEAL & SIGNATURE:

DATE:	05/31/2022
PROJECT No:	8969.29
DRAWING BY:	MY
CHK BY:	DNE
DWG No:	M-901.00
SCALE: 1/8"=1'	18 OF 19



⑨ 4TH FLOOR MECHANICAL DEMOLITION PLAN

3/8" = 1'-0"

0 2' 4' 6'

SCALE: 3/8" = 1'-0"

NOTES

1. THE CONTRACTOR SHALL COORDINATE ALL THE DEMOLITION WORK WITH FIT. ALL THE DEMOLITION WORK SHALL BE PERFORMED AFTER HOURS OR WEEKENDS UNLESS FIT APPROVES THE DEMOLITION WORK DURING REGULAR HOURS.
2. THE CONTRACTOR SHALL KEEP THE EXISTING LOUVERS. CLEAN UP THE LOUVERS AND REPLACE THE DAMAGED WIRE MESH.

BID SET 06/08/2022

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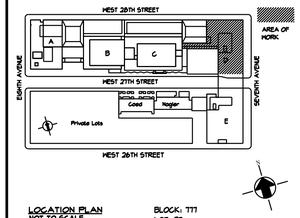

LOCATION PLAN NOT TO SCALE

BLOCK: 777
LOT: 37

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PROJECT:
POMERANTZ CENTER
300 7TH AVENUE
AC UNIT REPLACEMENT

DRAWING TITLE:
4TH FLOOR
MECHANICAL DEMOLITION
PLAN

SEAL & SIGNATURE:

DATE:	05/31/2022
PROJECT No:	8969.29
DRAWING BY:	MY
CHK BY:	DNE
DWG No:	M-902.00
SCALE: 3/8"=1'	19 OF 19

ELECTRICAL - SYMBOLS

	WALL MOUNTED EXIT LIGHT.
	CEILING MOUNTED EXIT LIGHT WITH SELF CONTAINED BATTERY PACK. SHADED AREA INDICATES ILLUMINATED FACE(S). DIRECTIONAL ARROWS ARE INDICATED.
OR	PANELBOARD
	DISTRIBUTION OR POWER PANELBOARD.
	GROUND BAR
C/T	CT CABINET
M	METER (DIRECT / UTILITY)
SM	SUB-METER
CK#	HOMERUN TO DESIGNATED PANELBOARD - NUMERALS INDICATE CIRCUIT NUMBER.
	GROUND CONNECTION
CK# WP GFI	DUPLEX RECEPTACLE. SUBSCRIPT INDICATES: WP - WEATHERPROOF ENCLOSURE GFI - GROUND-FAULT CIRCUIT-INTERRUPTER RECEPTACLE IG - ISOLATED GROUNDING RECEPTACLE 20A - 20 AMP RECEPTACLE HG - HOSPITAL GRADE RECEPTACLE C - AUTOMATICALLY CONTROLLED RECEPTACLE F - FUTURE SWITCHED RECEPTACLES FOR MOTORIZED SHADES # - IDENTIFIES PANELBOARD CIRCUIT NUMBER (TYPICAL FOR ALL RECEPTACLES) USB - USB RECEPTACLE - NEMA 5-20R USB. PASS & SEYMOUR CAT# TM8-USB-CC6 OR EQUIVALENT
	DOUBLE DUPLEX CONVENIENCE RECEPTACLE WALL MOUNTED IN GANG BOX
	HALF-SWITCHED DUPLEX RECEPTACLE.
	NEMA 5-20R, 20A RECEPTACLE (GFCI)
	RECEPTACLE, NEMA 6-50R 208V, 50A COORDINATE WITH MANUFACTURER
	DOUBLE DUPLEX RECEPTACLE
	STUB UP FACE PLATE TO BE MTD. ON MILLWORK FOR RECEPTACLE
	DUPLEX RECEPTACLE GFI
	FLOOR MOUNTED DUPLEX / DOUBLE DUPLEX / SIMPLEX RECEPTACLE, 20A, 3 WIRE, 125 VOLT, POKE-THRU SERVICE FITTING, UON.
	SPECIAL PURPOSE OUTLET. (COORDINATE REQUIREMENTS WITH VENDOR FOR EACH EQUIPMENT)
	SIMPLEX RECEPTACLE
CH	NEMA 5-20R RECESSED SIMPLEX CLOCK-HANGAR RECEPTACLE
	SINGLE CEILING MOUNTED CONVENIENCE RECEPTACLE
	SPECIAL PURPOSE CEILING MOUNTED RECEPTACLE
$ 3 b	SINGLE POLE SWITCH. LOWER CASE LETTER INDENTIFIES OUTLET(S) CONTROLLED, UPPER CASE LETTER AND OR NUMERAL INDICATES: 2 - DOUBLE POLE 3 - THREE WAY 4 - FOUR WAY P - WITH PILOT LIGHT H - HORSEPOWER RATED WITH HASP FOR LOCK K - KEY OPERATED D - DIMMER SWITCH T - TIMER SWITCH J - DOOR JAM SWITCH L - LOCKING - WITH HASP FOR LOCK MM - MANUAL MOTOR STARTER SWITCH (LOCKING) TS - THERMAL SWITCH OS - OCCUPANCY SENSOR SWITCH VS - VACANCY SENSOR SWITCH SS - SCENE SELECTOR OV - OVER-RIDE SWITCH
OC	CEILING MOUNTED DUAL TECHNOLOGY OCCUPANCY SENSOR
VS	CEILING MOUNTED DUAL TECHNOLOGY VACANCY SENSOR
PC	PHOTO-CELL
DS	DAYLIGHT SENSOR
WP	3-POLE UNFUSED DISCONNECT (SAFETY) SWITCH. NUMERAL INDICATES AMPACITY, "WP" DENOTES WEATHERPROOF ENCLOSURE. NO NUMBER INDICATES 30A OR LESS.
WP	3-POLE FUSED DISCONNECT (SAFETY) SWITCH. NUMERAL INDICATES SWITCH AMPACITY/FUSE SIZE, "WP" DENOTES WEATHERPROOF ENCLOSURE. NO NUMBER INDICATES 30A OR LESS.
WP	3-POLE COMBINATION DISCONNECT & MOTOR STARTER. NUMERAL INDICATES FUSE SIZE, "WP" DENOTES WEATHERPROOF ENCLOSURE.
WP	3-POLE MOTOR STARTER. NUMERAL INDICATES FUSE SIZE, "WP" DENOTES WEATHERPROOF ENCLOSURE.
VFD / VFD	VARIABLE FREQUENCY DRIVE
#	MOTOR, # INDICATES HORSEPOWER
	FUSIBLE SWITCH
BPS	BOLTED PRESSURE SWITCH
	CIRCUIT BREAKER

ELECTRICAL - SYMBOLS

K#	KIRK KEY INTERLOCK. NUMBERS INDICATE MATCHING KEYS.
D G	DIESEL GENERATOR
N G	NATURAL GAS GENERATOR
T	TRANSFORMER
N L E	ATS, OPEN TRANSITION
N L E	ATS, CLOSED TRANSITION
N L E	ATS, MAINTENANCE BYPASS
PEM	POWER & ENERGY METER (PEM), SATEC CAT# PM135EH OR EQUIVALENT. CONTRACTOR TO FURNISH AND INSTALL ELECTRICAL POWER & ENERGY METER AND ASSOCIATED CURRENT TRANSFORMERS & WIRING. PEM SHALL BE ABLE TO INTERFACE VIA RS-485 AND MODBUS OVER ETHERNET CABLING WITH BLDG CENTRAL POWER & ENERGY MANAGEMENT SYSTEM, TO BE PROVIDED BY OTHERS.
ELR	EMERGENCY LIGHTING RELAY (ELR). CONTRACTOR TO FURNISH, INSTALL AND WIRE EMERGENCY LIGHTING RELAY, WATTSTOPPER (LEGRAND) CAT# ELCU-200 OR EQUAL APPROVED IN WRITING BY ENGINEER. CONTRACTOR TO PROVIDE TEST BUTTON AND BACK-BOX FLUSH-MOUNTED PREFERRABLY 66" AFF. COORDINATE EXACT LOCATION AND HEIGHT OF TEST BUTTON WITH ARCHITECT. RELAY SHALL BE CONFIGURED SO THAT UNDER NORMAL CONDITIONS, LIGHT FIXTURES ARE CONTROLLED BY DIMMER (OR SWITCH) AND SUPPLIED BY NORMAL POWER FROM LOCAL LIGHTING PANEL. UNDER POWER FAILURE OF CIRCUIT, RELAY SHALL PROVIDE UN-DIMMED (OR UN-SWITCHED) EMERGENCY POWER FROM EMERGENCY LIGHTING PANEL.
RAN	GENERATOR REMOTE ANNUNCIATOR AND ATS REMOTE CONTROL PANEL
RT	REMOTE LIGHTING TRANSFORMER
FCO	FUSE CUT OUT
FDS	FIRE ALARM FUSED DISCONNECT SWITCH
DGP	FIRE ALARM DATA GATHERING PANEL
FACP	FIRE ALARM CONTROL PANEL
FAA	FIRE ALARM REMOTE ANNUNCIATOR
S D / C/S	SMOKE ALARM. "C/S" DENOTES SELF-CONTAINED COMBINATION CARBON MONOXIDE / SMOKE ALARM DETECTOR D - DENOTES DUCT DETECTOR
C	120V CARBON MONOXIDE DETECTOR. CONNECT TO CIRCUIT NOT PROTECTED BY A GFCI CIRCUIT BREAKER
FSD	FIRE SMOKE DAMPER
HT	HEAT TRACE
M	MOTORIZED SHADE
MD	MOTORIZED DAMPER
BG	BREAK GLASS SWITCH
EPO	EMERGENCY POWER OFF
ES	EMERGENCY STOP
T	THERMOSTAT
J / J / J	CEILING/WALL/FLOOR MOUNTED JUNCTION BOX
SB	SPLICE BOX
PB	PULLBOX
TC	TIME CLOCK
C / R	CONTACTOR / RELAY
LD	LEAK DETECTOR
A	CONNECTOR - LETTER DESIGNATES UNIQUE CONNECTION POINT
	PUSHBUTTON
	DOOR CONTACT. SEE LIGHTING PLANS FOR LOCATIONS.

GENERAL NOTES

1. ELECTRICAL CONTRACTOR IS RESPONSIBLE TO VISIT AND INSPECT SITE TO BECOME FAMILIAR WITH THE EXISTING CONDITIONS ASSOCIATED WITH, BUT NOT LIMITED TO THE FOLLOWING: CONTRACTOR'S INSPECTION SHALL BE CONDUCTED PRIOR TO FINAL BID, AND ANY ADDITIONAL WORK REQUIRED DUE TO FAILURE TO VISIT SITE OR INADEQUATE INSPECTION SHALL NOT BE CONSIDERED FOR COMPENSATION.
2. ELECTRICAL CONTRACTOR SHALL VERIFY ELECTRICAL AND GROUNDING REQUIREMENTS OF ALL NEW AND EXISTING EQUIPMENT TO BE USED. ALL SPECIAL PURPOSE RECEPTACLES INDICATED ON PLAN SHALL BE VERIFIED WITH EQUIPMENT MANUFACTURER TO INSURE PROPER WIRING.
3. CIRCUIT NUMBERS ARE FOR GUIDANCE ONLY. CONTRACTOR SHALL BE RESPONSIBLE TO BALANCE PHASES. REFER TO PANEL SCHEDULES FOR BRANCH CIRCUIT REQUIREMENTS.
4. CIRCUIT WIRE SIZES OTHER THAN 2 #12-3/4"C ARE INDICATED ON PLAN. REFER TO PANEL SCHEDULES FOR BRANCH CIRCUIT BREAKERS OTHER THAN 1 POLE, 20 AMP. ALL CIRCUITS AND FEEDERS SHALL HAVE A FULL SIZE INSULATED GREEN GROUND CONDUCTOR AND BE CONNECTED TO GROUND BUS IN RESPECTIVE PANEL. MINIMUM SIZE CONDUCTOR AND CONDUIT IS #12 THHN CU, 3/4"C (EMT).
5. THE CONTRACTOR IS RESPONSIBLE FOR DETERMINING AND PROVIDING THE ACTUAL NUMBER OF CONDUCTORS REQUIRED FOR ALL BRANCH CIRCUIT WIRING TO SERVE THE INTENDED FUNCTION.
6. ALL DEVICE PLATE FINISHES/COLORS SHALL BE AS INDICATED BY ARCHITECT. REFER TO ARCHITECTS TELECOM AND ELECTRIC PLANS FOR ADDITIONAL ELECTRICAL INFORMATION.
7. FOR EXACT LOCATION AND QUANTITY OF RECEPTACLES, TELEPHONE AND OTHER OUTLETS, REFER TO THE ARCHITECT'S DRAWINGS.
8. MOUNT ALL WALL SWITCHES, DIMMERS, ETC., AT 4'0" A.F.F. TO CENTER LINE OF DEVICES, UON. RECEPTACLES SHALL BE MOUNTED AT 15" A.F.F., UON. REFER TO ARCHITECTURAL PLANS FOR EXACT LOCATION AND MOUNTING HEIGHT.
9. THIS CONTRACTOR IS TO NOTIFY ENGINEER/ARCHITECT OF ANY CONTRADICTIONS FOUND ON THE DESIGN DOCUMENTS AND BASE THE BID ON THE MORE "STRINGENT & EXPENSIVE" CONDITIONS.
10. ELECTRONIC AS-BUILT DRAWINGS, SHOWING CONDUIT RUNS AND CIRCUITING MUST BE GIVEN TO ARCHITECT, ENGINEER AND OWNER AT THE COMPLETION OF THE JOB.
11. THE CONTRACTOR SHALL REMOVE AND/OR RELOCATE ALL EXISTING ELECTRICAL WORK WHICH INTERFERES WITH THE NEW ARCHITECTURAL AND ELECTRICAL LAYOUTS. ALL WORK WHICH IS NO LONGER REQUIRED TO FUNCTION SHALL BE DE-ENERGIZED AND DISCONNECTED AT THE SOURCE OF POWER SUPPLY.
12. PANEL DIRECTORIES SHALL BE MODIFIED AND COMPLETELY FILLED IN AT COMPLETION OF JOB.
13. ANY EXISTING WORK NOT STATED FOR REMOVAL AND DAMAGED AS A RESULT OF PERFORMING THE WORK OF THIS CONTRACT SHALL BE REPAIRED OR REPLACED AS REQUIRED. MATERIAL AND FINISH TO MATCH EXISTING TO THE SATISFACTION OF THE OWNER'S REPRESENTATIVE.
14. CONNECT NEW WORK TO EXISTING WORK IN A NEAT AND ACCEPTABLE MANNER.
15. DISPOSE OF REMOVED RACEWAYS, WIRE, PANELS, ETC., AS DIRECTED BY CM & OWNER.
16. ALL ELECTRICAL WORK IN ADJOINING AREAS WHICH IS REQUIRED TO FUNCTION BUT IS AFFECTED BY THIS WORK SHALL BE RECONNECTED AND RESTORED TO ITS PRESENT FUNCTION AS PART OF THE ELECTRICAL SYSTEM OF THE BUILDING(S).
17. ALL RACEWAYS WHICH BECOME EXPOSED BEYOND FINISHED SURFACES BECAUSE OF THE ALTERATION WORK SHALL BE REMOVED AND RE-ROUTED BEHIND THE FINISHED SURFACES.
18. ANY FIRE SAFETY EQUIPMENT AND THIS ASSOCIATED CONDUIT AND WIRING SYSTEM SHALL NOT BE HARMED DURING DEMOLITION AND/OR CONSTRUCTION AND SHALL BE PROTECTED FROM ANY PHYSICAL DAMAGE.
19. ALL NEW VOICE AND DATA WIRING IN CEILING PLENUM SHALL BE TEFLON-COATED OR RUN IN EMT CONDUIT. NEW WALL OUTLETS SHALL RECEIVE 3/4" EMPTY CONDUIT STUB-UP WITH DRAG WIRE AND JUNCTION BOX.
20. EACH COMBINATION DATA/TELEPHONE AND DATA OUTLET SHALL UTILIZE 1" E.M.T. STUBBED UP TO HUNG CEILING FROM JUNCTION BOX.
21. ALL NEW TELEPHONE, ELECTRIC AND DATA OUTLETS TO BE INSTALLED ON AN EXISTING WALL SHOULD BE FLUSH MOUNTED WITH THE FINISHED WALL SURFACE.
22. CONTRACTOR SHALL COORDINATE ALL NEW TELEPHONE CONDUIT RUNS WITH TELECOM COMPANY REPRESENTATIVE BEFORE STARTING WORK.
23. CONTRACTOR TO PROVIDE AN EMPTY CONDUIT SYSTEM AND OUTLET BOXES FOR INSTALLATION OF NEW SECURITY SYSTEM. VERIFY EXACT REQUIREMENTS WITH SECURITY VENDOR.
24. ALL OPEN FLOOR OUTLETS, NOT USED, SHALL BE CAPPED.
25. ALL HOLES IN SLABS OR WALLS SHALL BE FIRE STOPPED VIA LISTED FIRE-STOPPING ASSEMBLIES. SUBMIT TO ENGINEER FOR APPROVAL.
26. PROVIDE A GROUND BUS IN NEW PANELS.
27. CONTRACTOR TO DE-RATE CONDUCTORS IN ACCORDANCE WITH APPLICABLE ELECTRICAL CODES WHEN INSTALLING MORE THAN THREE (3) CIRCUITS IN A 3/4"C HOMERUN AND OTHERWISE REQUIRED.
28. REFER TO PROJECT 'BOOK' SPECIFICATIONS FOR ADDITIONAL, IMPORTANT REQUIREMENTS.

GENERAL DEMOLITION NOTES

1. THE CONTRACTOR SHALL INCLUDE ALL COSTS FOR REMOVALS AND RELOCATIONS IN THE CONTRACT. THESE COSTS SHALL INCLUDE WORK DESCRIBED IN THE SPECIFICATIONS AND SHOWN ON THE ARCHITECTURAL, MECHANICAL AND ELECTRICAL DRAWINGS WITH ALLOWANCES FOR NORMAL UNFORESEEN DIFFICULTIES WHEN CONCEALED WORK HAS BEEN OPENED. NO CLAIMS FOR ADDITIONAL WORK ASSOCIATED WITH DEMOLITION WILL BE ACCEPTED, EXCEPT IN SPECIFIC CASES CONSIDERED JUSTIFIABLE BY THE ARCHITECT.
2. THE CONTRACTOR SHALL REMOVE AND/OR RELOCATE ALL EXISTING ELECTRICAL WORK WHICH INTERFERES WITH THE NEW ELECTRICAL LAYOUTS. ALL WORK WHICH IS NO LONGER REQUIRED TO FUNCTION SHALL BE DE-ENERGIZED AND DISCONNECTED AT THE SOURCE OF POWER SUPPLY.
3. ALL PRESENT ELECTRICAL MATERIAL AND EQUIPMENT WHICH ARE TO BE REMOVED UNDER THIS CONTRACT SHALL BE REMOVED BY THE ELECTRICAL CONTRACTOR AND SHALL BECOME THE PROPERTY OF BUILDING MANAGEMENT, U.O.N.
4. ALL RACEWAYS WHICH BECOME EXPOSED BEYOND FINISHED SURFACES BECAUSE OF THE ALTERATION WORK SHALL BE REMOVED AND REROUTED BEHIND THE FINISHED SURFACES.
5. PORTIONS OF FEEDER LINES THAT HAVE TO BE REMOVED OR ABANDONED AS A RESULT OF DEMOLITION WORK BUT ARE REQUIRED TO CONTINUE TO FUNCTION SHALL BE CUT AT CONVENIENT LOCATIONS, REROUTED AND RECONNECTED FOR CONTINUATION OF THEIR PRESENT FUNCTION. NEW FEEDER EXTENSIONS SHALL MATCH EXISTING ONES IN ALL RESPECTS, CONDUCTOR CAPACITY, CONDUITS SIZE, ETC.
6. EXISTING ELECTRICAL ITEMS AND/OR CONDUIT AND WIRE IN WALLS, HUNG CEILINGS, ETC., OR AREAS NOT BEING UTILIZED, SHALL BE DISCONNECTED AND REMOVED.
7. ANY FIRE SAFETY EQUIPMENT AND THIS ASSOCIATED CONDUIT AND WIRING SYSTEM SHALL NOT BE HARMED DURING DEMOLITION AND/OR CONSTRUCTION AND SHALL BE PROTECTED FROM ANY PHYSICAL DAMAGE.
8. THIS DEMOLITION NOTES ARE DIAGRAMMATIC DESCRIPTION OF THE REMOVAL SCOPE OF WORK. THE CONTRACTOR, BY SITE INVESTIGATION, SHALL BE RESPONSIBLE FOR DETERMINING THE EXACT SCOPE OF THE WORK INVOLVED PRIOR TO SUBMITTING HIS BID. COORDINATE WITH ARCHITECT, BUILDING MANAGEMENT AND MECHANICAL CONTRACTORS BEFORE ANY WORK.

EXISTING CONDITION & RELOCATION NOTES

1. GENERALLY, IN AREAS SCHEDULED FOR DEMOLITION AND REMODELING, REMOVE ALL ELECTRICAL DEVICES SUCH AS LIGHTING FIXTURES, WIRING DEVICES, TELEPHONE BOXES, SPEAKERS, FIRE ALARM DEVICES, TELEVISION OUTLETS, DISCONNECT, MOTORS, ETC., THAT ARE LOCATED ON EXISTING WALLS OR PARTITIONS WHICH ARE TO BE DEMOLISHED. REMOVE EXPOSED PORTIONS OF THE BRANCH AND SIGNAL CIRCUIT WIRING AND CONDUITS AND BE RESPONSIBLE FOR MAINTAINING THE CONTINUITY OF EXISTING CIRCUITS FEEDING DEVICES THAT ARE TO REMAIN. MAINTAIN THE CONTINUITY OF EXISTING CIRCUITS SERVING OTHER SPACES BUT PASSING THROUGH THE AREA OF RENOVATION.
2. ALL RACEWAYS AND FEEDERS SERVING PANEL BOARDS SCHEDULED FOR DEMOLITION SHALL BE REMOVED IN THEIR ENTIRETY BACK TO THEIR SOURCE. UPDATE PANEL SCHEDULES AND LABELS OF UPSTREAM PANEL BOARDS TO REFLECT DEMOLITION.
3. CIRCUITS STILL IN USE WHICH ARE DERIVED FROM PANELS SCHEDULED TO BE DEMOLISHED SHALL BE REROUTED TO ALTERNATE PANELS. NOTIFY OWNER'S REPRESENTATION AND ARCHITECT FOR RECOMMENDATIONS.
4. IN SUCH CASES WHERE EXISTING WALLS ARE TO REMAIN, EXPOSED RACEWAYS, SURFACE AND RECESSED OUTLET BOXES, ETC., WHICH ARE NOT TO BE REUSED SHALL BE COMPLETELY REMOVED. IN SUCH CASES, WHERE NEW CONDUITS AND OUTLETS ARE TO BE INSTALLED IN EXISTING WALLS, IN FURNISHED ROOMS, THEY SHALL BE CONCEALED BY CUTTING AND PATCHING THE WALLS FOR THE CONDUITS AND OUTLET BOXES UNLESS OTHERWISE NOTED.
5. CONDUITS OR SLEEVES, THAT ARE NO LONGER REQUIRED, WHICH ARE PROTRUDING THROUGH THE FLOOR SLAB, SHALL BE CUT BACK AND CAPPED. ALL FEEDERS TO BE REMOVED BACK TO PANEL BOARD.
6. ELECTRICAL EQUIPMENT REMOVED SHALL BE RETURNED TO OWNER OR DISCARDED PER OWNER DIRECTIVE.
7. REMOVE TELEPHONE AND DATA CABLES BACK TO CLOSET OF ORIGINATION. THE ELECTRICAL CONTRACTOR SHALL COORDINATE WITH THE OWNER'S TELECOMMUNICATION DEPARTMENTS FOR THE DISCONNECTION AND REMOVAL LOW TENSION DEVICES.
8. ELECTRICAL CONTRACTOR SHALL MAINTAIN THE INTEGRITY OF EXISTING SYSTEM CIRCUITS FOR FIRE ALARM, POWER AND TELE COMMUNICATIONS, ETC., DURING DEMOLITION.
9. THE ELECTRICAL CONTRACTOR SHALL REMOVE ALL ABANDONED WIRING/CABLING NO LONGER IN USE FROM RACEWAYS.
10. UTILIZE, WHENEVER POSSIBLE, PRACTICAL, AND APPROVED BY ARCHITECT, EXISTING OUTLET BOXES, ETC., COMPATIBLE WITH THE MATERIAL SPECIFIED FOR INSTALLATION IN THE NEW CONSTRUCTION AREAS. WHENEVER EXISTING RACEWAY SYSTEMS ARE UTILIZED, REMOVE ALL EXISTING WIRING. IN SUCH CASES, ALL ASSOCIATED CONDUITS AND WIRING SHALL BE ARRANGED TO ACCOMMODATE THE NEW CIRCUITING AS SHOWN ON THE DRAWING.
11. THE ELECTRICAL DEMOLITION PLANS INDICATE GENERAL INTENT AND ARE NOT INTENDED TO SHOW ALL COMPONENTS AND ITEMS TO BE REMOVED OR RETAINED. THE ELECTRICAL CONTRACTOR SHALL VISIT THE SITE PRIOR TO SUBMISSION OF THEIR BID TO BECOME FAMILIAR WITH THE ACTUAL WORKING CONDITIONS AND EXTENT OF WORK. DEVICES AND EQUIPMENT LOCATED ON THE WALLS AND OR CEILINGS DESIGNATED TO BE REMOVED SHALL BE DISCONNECTED AND MADE SAFE. THE ELECTRICAL CONTRACTOR SHALL IMMEDIATELY NOTIFY THE OWNER'S REPRESENTATION AND ARCHITECT OF ANY UNANTICIPATED OR HIDDEN CONDITIONS ENCOUNTERED DURING DEMOLITION.
12. THE ELECTRICAL CONTRACTOR SHALL CIRCUIT TRACE AND LABEL ALL EXISTING BRANCH AND FEEDERS WITHIN OR ASSOCIATED WITH DEMOLITION SCOPE PRIOR TO DEENERGIZING AND DISCONNECTION. ALL CIRCUITS WITHIN PANELBOARDS, LOAD CENTERS, MOTOR CONTROL CENTERS AND SWITCHBOARDS, IDENTIFIED FOR REMOVAL SHALL BE TRACED AND FIELD LABELED TO ENSURE THAT NO AREA OUTSIDE THE SCOPE LIMIT IS AFFECTED.
13. COORDINATE ALL TEL/DATA WIRING DEMOLITION WITH FIT INFORMATION SYSTEMS STAFF PRIOR TO THE START OF ANY DEMOLITION AFTER PROPERLY IDENTIFYING TEL/DATA WIRING, CABLES ARE TO BE COMPLETELY REMOVED FROM ALL TERMINATION INCLUDING JACKS, WALL PLATES AND PATCH PANELS.
14. CONTRACTOR TO OPEN EXISTING CEILING AS REQUIRED FOR INSTALLATION OF NEW WORK OR REMOVAL/MODIFICATION OF EXISTING SYSTEMS AND EQUIPMENT. CEILINGS TO BE CLOSED UPON COMPLETION OF WORK.

ELECTRICAL DRAWING LIST

DWG No.	DRAWING TITLE
E-001.00	ELECTRICAL SYMBOL LIST, ABBREVIATIONS, AND DRAWING LIST
E-100.00	SUBCELLAR & CELLAR POWER PART PLAN
E-101.00	4TH FLOOR DEMOLITION AND NEW WORK POWER PLANS
E-102.00	1ST FLOOR AND ROOF POWER PART PLANS

LEGEND

	NEW WORK
	EXISTING
XXXXXXXX	DEMO
	U/G / CONCRETE ENCASED
	MULTI-OUTLET RACEWAY ASSEMBLY (PLUGMOLD-WIREMOLD)
	BUSWAY
	CONDUIT BANK
	CONDUIT TURNING UP
	CONDUIT TURNING DOWN
	FLEX TYPE FMC / LFMC CONDUIT AS REQUIRED
	CAPPED CONDUIT

MISCELLANEOUS SYMBOLS

SYMBOLS	DESCRIPTION
XX # RISER DESIGNATION	RISER SERVICE RISER NUMBER
XXX # RISER DESIGNATION	RISER SERVICE RISER NUMBER
XX # RISER DESIGNATION	RISER SERVICE RISER NUMBER
A M-2 SECTION	DETAIL DRAWING LOCATION
# M-120 DETAIL	DETAIL DRAWING LOCATION
1	REVISION NUMBER

ABBREVIATIONS

	DESCRIPTION		DESCRIPTION
A	AMPERE	LTG	LIGHTING
AC AFF	ABOVE COUNTER TOP	MCM/KCMIL	THOUSAND CIRCULAR MILS
AWG	ABOVE FINISHED FLOOR	MECH	MECHANICAL
BLDG	AMERICAN WIRE GAUGE	MISC	MISCELLANEOUS
C	BUILDING	MTD	MOUNTED
CB	CONDUIT	NIC	NOT-IN-CONTRACT
CCTV	CIRCUIT BREAKER	NL	NIGHT LIGHT
CKT	CLOSED CIRCUIT TELEVISION CIRCUIT	NTS	NOT TO SCALE
CLG	CEILING	PB	PULL BOX
CU	COPPER	PNL	PANEL
DISC	DISCONNECT	R	REMOVE
DWG	DRAWING	RE	RELOCATED EXISTING DEVICE
E	EXISTING	RM	ROOM
EC	EMPTY CONDUIT	SPECS	SPECIFICATIONS
ELEC	ELECTRICAL	SW	SWITCH
EM	EMERGENCY	TV	TELEVISION
ER	EXISTING TO BE RELOCATED	TYP	TYPICAL
FA	FIRE ALARM	UC	UNDER COUNTER
FT	FEET	UF	UNFUSED
GD	GROUND	UON	UNLESS OTHERWISE NOTED VOLT OR
GFI	GROUND FAULT INTERRUPTER	V	VOLTAGE
HP	HORSEPOWER	W	WATT
KAIC	INTERRUPTING CAPACITY	WP	WEATHER-PROOF
JB	JUNCTION BOX		
KVA	KILOVOLT AMPERE		
KW	KILOWATT		

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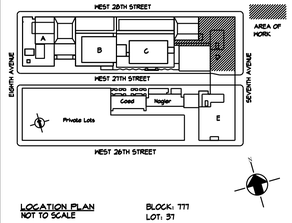

LOCATION PLAN
NOT TO SCALE

BLOCK: 777
LOT: 37

Fashion Institute of Technology

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New York, NY 10001

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PROJECT:
POMERANTZ CENTER
300 7TH AVENUE
AC UNIT REPLACEMENT

DRAWING TITLE:
ELECTRICAL
LEGEND, ABBREVIATIONS,
AND GENERAL NOTES

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DATE:	05/31/2022
PROJECT No:	896929
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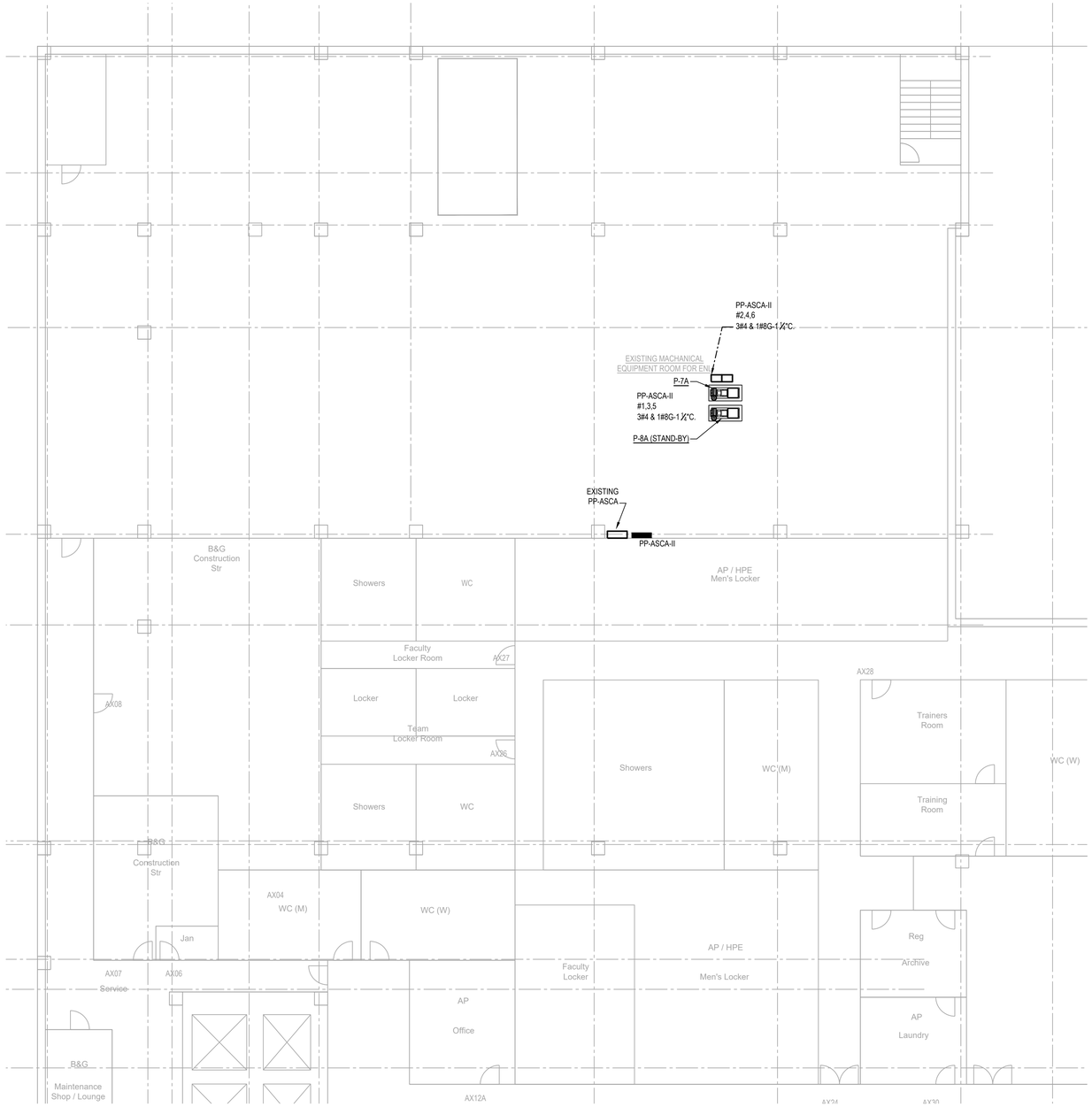
CHK BY:	KB
DWG No:	E-001.00
SCALE: AS NOTED	1 OF 4

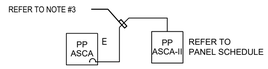


① SUBCELLAR & CELLAR MER ELECTRICAL PLAN
1/8" = 1'-0"

0 4' 8' 16'
SCALE: 1/8" = 1'-0"

POWER NOTES:

1. REFER TO MECHANICAL DRAWINGS FOR THE EXACT LOCATION AND MOUNTING HEIGHTS OF ALL ELECTRICAL CONNECTIONS.
2. CIRCUIT NUMBERS ARE INDICTED FOR GROUPING INTENT ONLY. THE ELECTRICAL CONTRACTOR SHALL REUSE EXISTING CIRCUIT BRANCH WIRING PREVIOUSLY FEEDING LIGHTING FIXTURES IN THE AREA. PROVIDE NEW LIGHTING CONTROL AS INDICATED. PROVIDE REQUIRED CONDUIT AND WIRING. ALL BRANCH CIRCUIT WIRING ORIGINATES IN A NEW 20A/1P CIRCUIT BREAKER IN PANEL INDICATE. PROVIDE 2# 12 & 1# 12G-3/4"C.UON FOR BRANCH WIRING FEEDERS U.O.N. SPARE BRANCH CIRCUITS WILL BE PRODUCE FROM THE SCOPE OF THIS PROJECT. CONTRACTOR MAY UTILIZE EXISTING BRANCH CIRCUIT WIRING FOR INDICATED WORK WERE FEASIBLE.
3. PROVIDE A NEW 100A/3P CIRCUIT BREAKER IN EXISTING PANEL PP-ASCA. UTILIZE 4#2 & 1#6G- 1 ¼"C. AND TO ENGERIZE NEW PANEL PP-ASCA-II.REFER TO PARTIAL POWER RISER DIAGRAM FOR ADDITIONAL INFORMATION.



PARTIAL POWER RISER DIAGRAM

PANEL: PP-ASCA-II (NEW)

MFR/CAT NO.: SIEMEN		MAIN BUS:	100A TIN PLATED NEUTRAL BUS
MCB TRUE:	X	MCB:	65KAIC RATED MLO
FED FROM: 100 AMPS	X	SURFACE	X EQUIPMENT GND BUS
LOCATION: CELLAR MER		FLUSH	DEDICATED CIRCUITS

208 /120V, 3 PHASE, 4 WIRE

CATEGORY				VOLTAGE				CATEGORY		
#	POLE	TRIP	LOAD DESCRIPTION	VA	A	B	C	VA	LOAD DESCRIPTION	TRIP	POLE	#
1				5000	5000							2
3	3	60	SPARE	5000		5000			SPARE	60	3	4
5			3#4/0, 1#8G-1 1/4"C.	3000			3000		3#4-1#8G-1 1/4"C.			6
7			SPACE						SPACE			8
9			SPACE						SPACE			10
11			SPACE						SPACE			12
13			SPACE						SPACE			14
15			SPACE						SPACE			16
17			SPACE						SPACE			18
19			SPACE						SPACE			20
21			SPACE						SPACE			22
23			SPACE						SPACE			24
25			SPACE						SPACE			26
27			SPACE						SPACE			28
29			SPACE						SPACE			30
31												32
33												34
35												36
CONNECTED VA					5000	5000	3000					
TOTAL CONNECTED KVA					5.00	5.00	3.00					
CONNECTED AMPS					13.88	13.88	8.33					
TOTAL CONNECTED AMPS					41.61							

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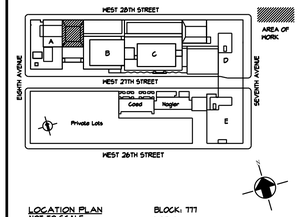

LOCATION PLAN
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BLOCK: 777
LOT: 1

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PROJECT:
WEST COURTYARD
340 8TH AVENUE
AC UNITS REPLACEMENT

DRAWING TITLE:
SUBCELLAR & CELLAR
MER ELECTRICAL
PLAN

DOB NOW JOB •

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DATE:	05/31/2022
PROJECT No:	8969.29
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DWG No:	E-100.00
SCALE: 1/8"=1'	2 OF 4

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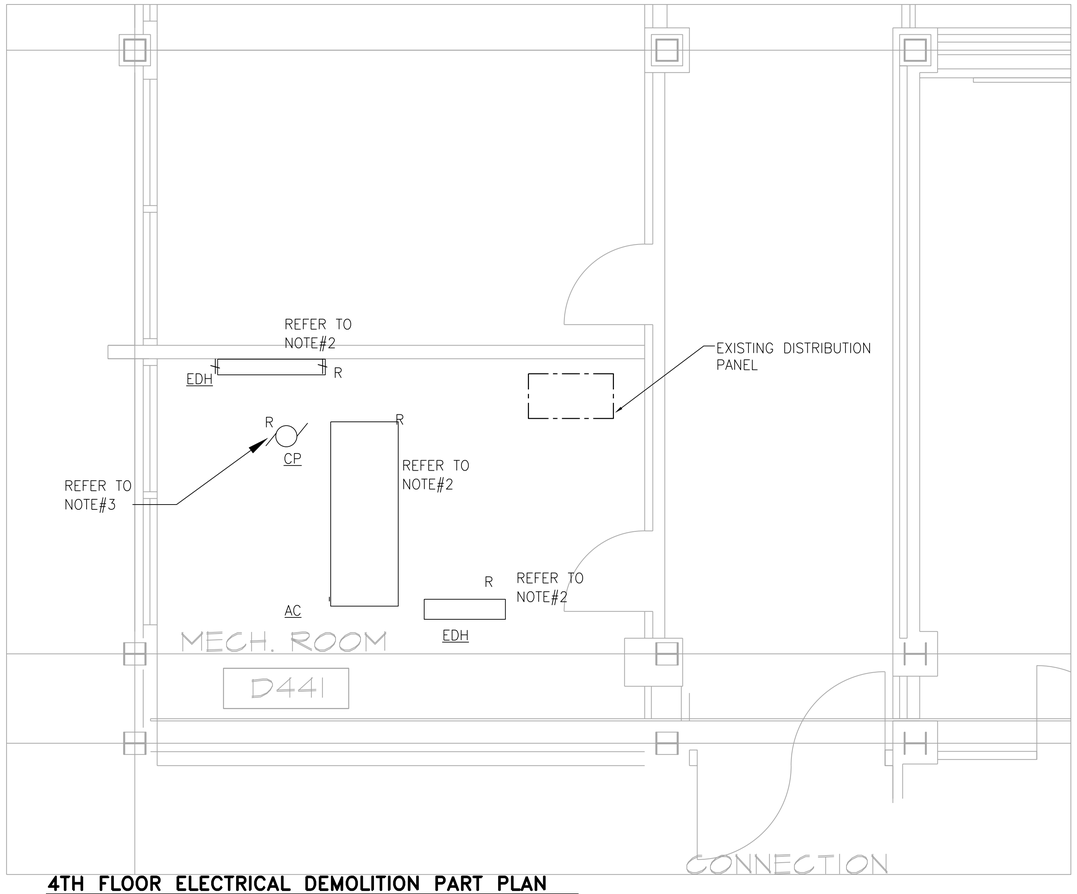


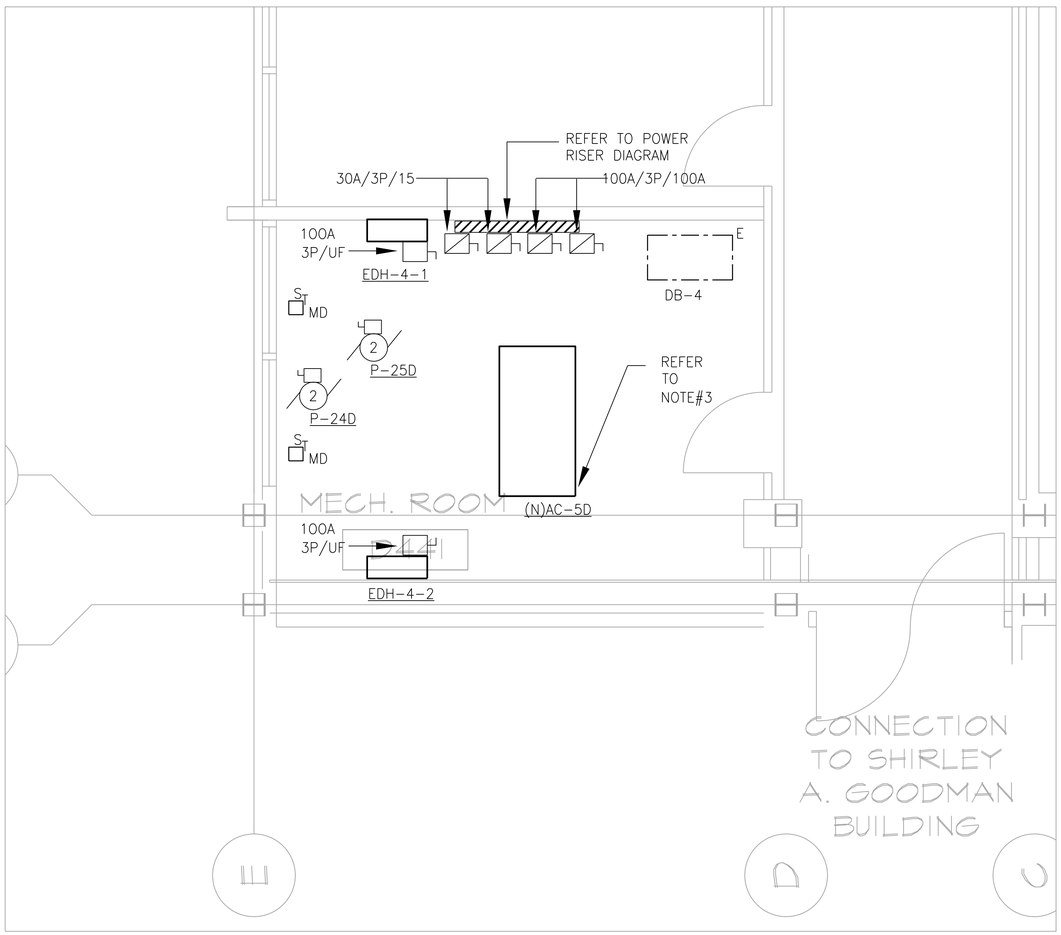
4TH FLOOR ELECTRICAL DEMOLITION PART PLAN
3/8" = 1'-0"

REMOVAL NOTES:

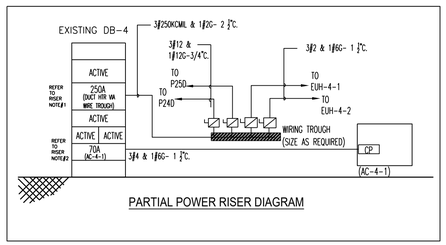
1. COORDINATE WITH MECHANICAL CONTRACTOR FOR EXACT LOCATION OF ELECTRICAL CONNECTIONS TO BE DISCONNECT.

2. DISCONNECT EXISTING CONDUIT AND WIRING BACK TO SOURCE. UPDATE AND LABELO SWITCH IN DISTRIBUTION BOARD.

3. DISCONNECT EXISTING CONDUIT AND WIRE. COIL AND PREPARE FOR REUSE WITHIN THE SCOPE OF THIS WORK.



4TH POWER PART PLAN(NEW WORK)
3/8" = 1'-0"



PARTIAL POWER RISER DIAGRAM

RISER NOTES:

1. UTILIZE SPARE SWITCH MADE AVAILABLE BY THE SCOPE OF WORK OF THIS PROJECT. PROVIDE (3) 250A FUSES AND EXTEND INDICATED FEEDERS TO WIRE TROUGH.

2. UTILIZE SPARE SWITCH MADE AVAILABLE BY THE SCOPE OF WORK OF THIS PROJECT. PROVIDE (3) 70A FUSES AND EXTEND INDICATED FEEDERS TO HVAC UNIT.

POWER NOTES:

1. REFER TO MECHANICAL DRAWINGS FOR THE EXACT LOCATION AND MOUNTING HEIGHTS OF ALL ELECTRICAL CONNECTIONS.

2. CIRCUIT NUMBERS ARE INDICTED FOR GROUPING INTENT ONLY. THE ELECTRICAL CONTRACTOR SHALL REUSE EXISTING CIRCUIT BRANCH WIRING PREVIOUSLY FEEDING LIGHTING FIXTURES IN THE AREA., ALL BRANCH CIRCUIT WIRING ORIGINATES IN A NEW 20A/1P CIRCUIT BREAKER IN PANEL INDICATED U.O.N. PROVIDE 2# 12 & 1# 12G-3/4"C.UON FOR BRANCH WIRING FEEDERS U.O.N. SPARE BRANCH CIRCUITS WILL BE PRODUCE FROM THE SCOPE OF THIS PROJECT. CONTRACTOR MAY UTILIZE EXISTING BRANCH CIRCUIT WIRING FOR INDICATED WORK WERE FEASIBLE.

3. CONTRACTOR SHALL CONNECT FEEDER TO INTERNAL CONTROL FOR AHU POWER. EXISTING FEEDERS SHALL BE EXTENDED TO ENERGIZE NEW AHU. PROVIDE CONDUIT AND WIRE AS REQUIRED.

4. CONTRACTOR SHALL UTILIZE EXISTING BRANCH WIRING IN AREA THAT WAS PREVIOUSLY ENERGIZING CONDENSATE PUMP

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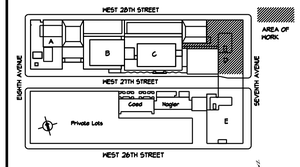

LOCATION PLAN
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PROJECT:
POMERANTZ CENTER
300 7TH AVENUE
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DRAWING TITLE:
4TH FLOOR
DEMOLITION
AND NEW WORK PART PLANS

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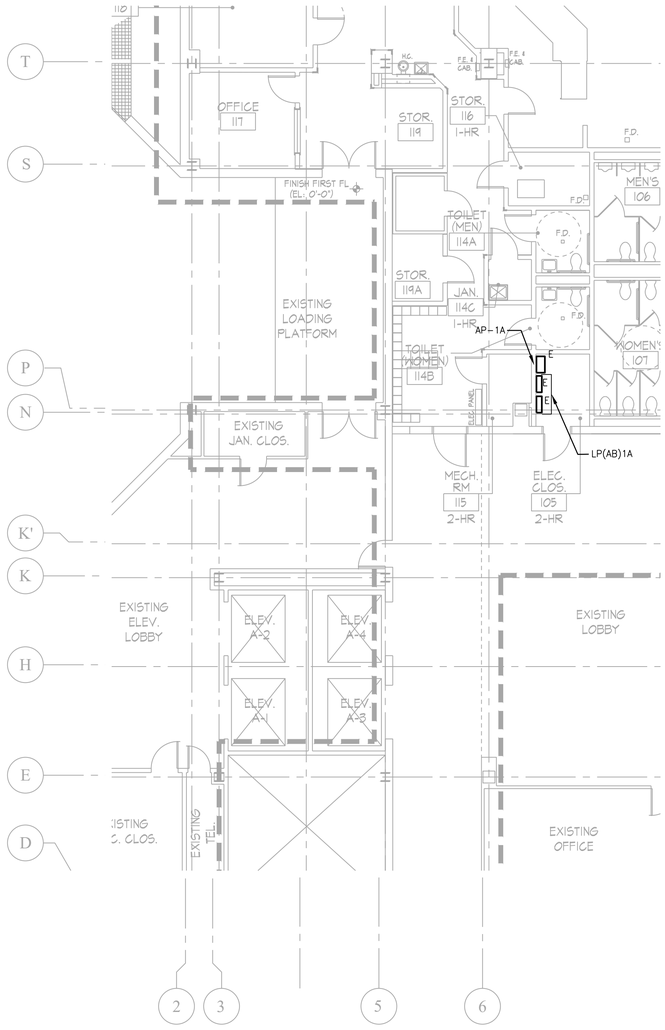
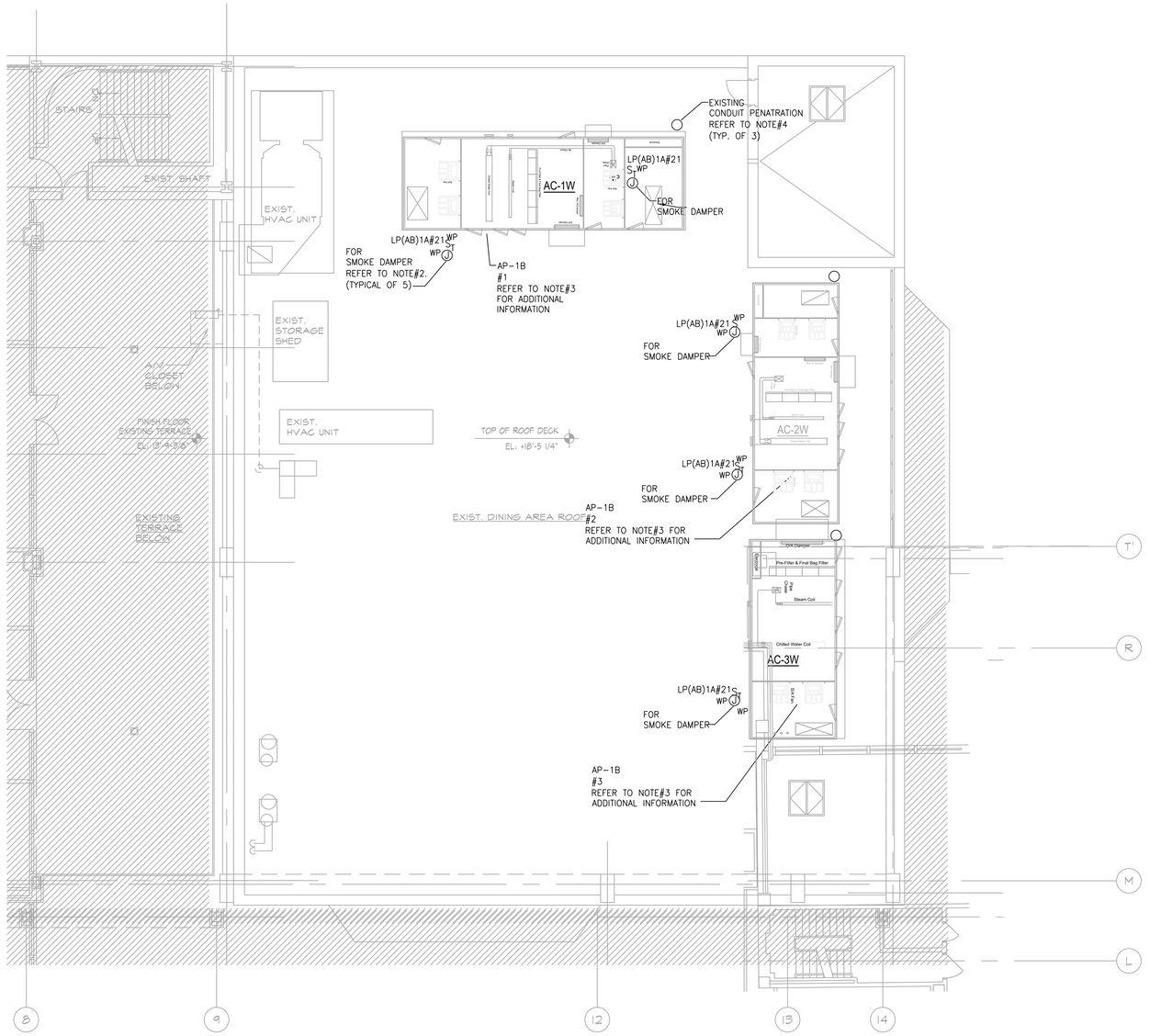
DWG No:	E-101.00
SCALE: AS NOTED	3 OF 4



1ST FLOOR POWER PLAN

1/8" = 1'-0"



ROOF POWER PART PLAN

1/8" = 1'-0"

POWER NOTES:

1. REFER TO MECHANICAL DRAWINGS FOR THE EXACT LOCATION AND MOUNTING HEIGHTS OF ALL ELECTRICAL CONNECTIONS.

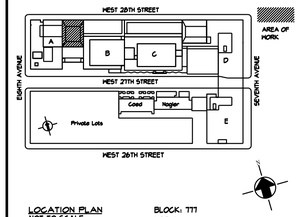
2. CIRCUIT NUMBERS ARE INDICTED FOR GROUPING INTENT ONLY. THE ELECTRICAL CONTRACTOR SHALL REUSE EXISTING CIRCUIT BRANCH WIRING PREVIOUSLY FEEDING LIGHTING FIXTURES IN THE AREA. PROVIDE NEW LIGHTING CONTROL AS INDICATED. PROVIDE REQUIRED CONDUIT AND WIRING. ALL BRANCH CIRCUIT WIRING ORIGINATES IN A NEW 20A/1P CIRCUIT BREAKER IN PANEL INDICATED. PROVIDE FEEDERS TO MATCH EXISTING (2# 12 & 1# 12G-3/4"C. AS A MINIMUM) FOR BRANCH WIRING FEEDERS U.O.N. SPARE BRANCH CIRCUITS WILL BE PRODUCE FROM THE SCOPE OF THIS PROJECT. CONTRACTOR MAY UTILIZE EXISTING BRANCH CIRCUIT WIRING FOR INDICATED WORK WERE FEASIBLE.

3. CONTRACTOR SHALL CONNECT FEEDER TO INTERNAL VFD FOR AHU POWER. EXISTING FEEDERS SHALL BE EXTENDED TO ENERGIZE NEW AHU. PROVIDE CONDUIT AND WIRE AS REQUIRED.

4. EXISTING ROOF PENETRATION FOR EXISTING ELECTRICAL FEEDRS. CONTRACTOR SHALL UTILIZE EXISTING PENATRATION AND EXTEND CONDUITS TO NEW UNITS VIA CURB SUPPORTS.

BID SET 06/08/2022

rev. no.	date	revisions
-	06/08/2022	ISSUED TO BID



LOCATION PLAN
NOT TO SCALE

BLOCK: 777
LOT: 1

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PROJECT:
WEST COURTYARD
340 8TH AVENUE
AC UNITS REPLACEMENT

DRAWING TITLE:
ELECTRICAL
1ST FLOOR AND ROOF
POWER PART PLANS

DOB NOW JOB •

SEAL & SIGNATURE:

DATE:	05/31/2022
PROJECT No:	8969.29
DRAWING BY:	KB
CHK BY:	KB
DWG No:	E-102.00
SCALE: 1/8"=1'	4 OF 4

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PLUMBING SYMBOLS

	DOMESTIC COLD WATER PIPING
	DOMESTIC HOT WATER PIPING (120°)
	DOMESTIC HOT WATER RETURN PIPING (120°)
	VENT PIPING
	SOIL, WASTE OR SANITARY PIPING
	ELBOW TURNED UP
	ELBOW TURNED DOWN
	CAPPED PIPE WITH SHUT-OFF VALVE
	CONNECT NEW WORK TO EXISTING
	DISCONNECT EXISTING WORK & CAP

2014 NYC PLUMBING NOTES

THE PLUMBING SYSTEMS (SANITARY, WASTE, STORM, VENT, GAS, WATER DISTRIBUTION) AND ALL ASSOCIATED EQUIPMENT WILL BE INSTALLED AND MAINTAINED IN ACCORDANCE WITH THE FULL REQUIREMENTS OF THE 2014 BUILDING CODE OF THE CITY OF NEW YORK AS CITED IN CHAPTER 29, THE 2014 NEW YORK CITY PLUMBING CODE AND THE 2014 FUEL GAS CODE.

1. THE SANITARY SYSTEM SHALL BE PROVIDED IN FULL ACCORDANCE WITH THE GENERAL PROVISIONS OF CHAPTER 7.
2. THE MATERIALS USED IN THE PLUMBING SYSTEM SHALL BE PROVIDED IN FULL ACCORDANCE WITH CHAPTER 3.
3. EQUIPMENT HOOK-UP AND THE JOINING OF PIPING SHALL BE IN FULL COMPLIANCE WITH CHAPTER 4.
4. THE INSTALLATION OF FIXTURES SHALL BE IN FULL ACCORDANCE WITH SECTION PC CHAPTER 4.
5. TRAPS FOR FIXTURES AND DRAIN LINES SHALL BE PROVIDED AND CLEANOUTS INSTALLED IN FULL COMPLIANCE WITH CHAPTER 10 AND CLEANOUTS INSTALLED IN FULL COMPLIANCE WITH CHAPTER 7.
6. VERTICAL AND HORIZONTAL PIPING SHALL BE HUNG AND SUPPORTED AS DIRECTED IN SPECIFICATIONS AND WITH THE FULL COMPLIANCE WITH SECTION CHAPTER 3.
7. THE WATER SUPPLY SYSTEMS SHALL BE INSTALLED AND MAINTAINED IN FULL COMPLIANCE WITH CHAPTER 6.
8. THE SANITARY DRAINAGE SYSTEM SHALL BE SIZED AND INSTALLED IN FULL COMPLIANCE WITH SECTIONS CHAPTER 7.
9. THE VENT PIPING FOR THE SANITARY DRAINAGE SYSTEM SHALL BE INSTALLED IN FULL COMPLIANCE WITH CHAPTER 9.
10. THE STORM DRAINAGE SYSTEM AND PIPING SHALL BE INSTALLED IN FULL COMPLIANCE WITH CHAPTER 11.
11. RODENT PROOFING SHALL BE IN ACCORDANCE WITH SECTION PC 304.
12. TEMPORARY TOILET FACILITIES SHALL BE PROVIDED FOR WORKMAN AS PER SECTION PC 311.
13. ALL TRENCHING SHALL BE DONE IN ACCORDANCE WITH SECTION PC 306.

PLUMBING ABBREVIATIONS

CW	COLD WATER
CWVO	COLD WATER VALVED OUTLET
DN	DOWN
DR	DRAIN
DWG	DRAWING
EA	EACH
EL	ELEVATION
EQUIP	EQUIPMENT
EX	EXISTING
FL	FLOOR
FT	FEET
GALV	GALVANIZED
GPM	GALLONS PER MINUTE
HB	HOSE BIBB
HW	HOT WATER
JC	JANITOR'S CLOSET
MAX	MAXIMUM
MFR	MANUFACTURER
MIN	MINIMUM
MISC	MISCELLANEOUS
NIC	NOT IN CONTRACT
NO	NORMALLY OPEN
NTS	NOT TO SCALE
PO	PLUGGED OUTLET
PSIG	POUNDS PER SQUARE INCH (GAUGE)
REV	REVISED
RM	ROOM
S	SANITARY/SOIL
SK	SINK
SLV	SLEEVE
SIM	SIMILAR (TO)
SPO	SOIL PLUGGED OUTLET
SQ.FT.	SQUARE FOOT (ft^2)
STOR	STORAGE
TOS	TOP OF SLAB
TYP.	TYPICAL
UON	UNLESS OTHERWISE NOTED
V	VENT
VB	VACUUM BREAKER
VCO	VALVED & CAPPED OUTLET
VERT	VERTICAL
VO	VALVED OUTLET
VPO	VENT PLUGGED OUTLET
W	WASTE
W/	WITH
WPO	WASTE PLUGGED OUTLET
WH	WALL HYDRANT

GENERAL PLUMBING NOTES:

1. EACH BIDDER SHALL VISIT THE SITE AND BECOME INFORMED AS TO THE CONDITION OF THE PREMISES AND THE EXTENT AND CHARACTER OF WORK REQUIRED. NO ADDITIONAL COMPENSATION WILL BE APPROVED DUE TO THE FIELD CONDITIONS.
2. ALL EXISTING SYSTEMS SHALL BE LEFT IN PERFECT WORKING ORDER UPON COMPLETION OF ALL NEW WORK.
3. EXACT SIZES AND LOCATIONS OF ALL EXISTING PIPING SHALL BE VERIFIED ON THE SITE.
4. NO EXISTING OR REMOVED PIPING SHALL BE REUSED UNLESS OTHERWISE INDICATED.
5. THIS CONTRACTOR SHALL NOT INTERRUPT ANY OF THE SERVICES OF THE EXISTING BUILDING NOR INTERFERE WITH THE SERVICES IN ANY WAY WITHOUT THE EXPRESSED PERMISSION OF THE OWNER. SUCH INTERRUPTIONS AND INTERFERENCES SHALL BE MADE AS BRIEF AS POSSIBLE.
6. UNDER NO CIRCUMSTANCES WILL THIS CONTRACTOR OR HIS WORKMEN BE PERMITTED TO USE ANY PART OF THE BUILDING AS A SHOP, EXCEPT PART DESIGNATED BY THE OWNER FOR SUCH PURPOSES.
7. UNNECESSARY NOISE SHALL BE AVOIDED AT ALL TIMES AND NECESSARY NOISE SHALL BE REDUCED TO A MINIMUM.
8. WHERE THE WORK MAKES TEMPORARY SHUT DOWN OF SERVICES UNAVOIDABLE, THEY SHALL BE MADE AT NIGHT OR AT SUCH TIMES THAT WILL CAUSE THE LEAST INTERFERENCE WITH THE ESTABLISHED OPERATING ROUTINE OF THE BUILDING.
9. THIS CONTRACTOR SHALL ARRANGE ALL WORK CONTINUOUSLY, INCLUDING OVERTIME AS REQUIRED, TO ASSURE THAT SERVICES WILL BE SHUT DOWN AND CUT-INS ONLY DURING THE TIME ACTUALLY REQUIRED TO MAKE THE NECESSARY CONNECTION TO EXISTING WORK.
10. THIS CONTRACTOR SHALL GIVE AMPLE WRITTEN NOTICE IN ADVANCE TO THE OWNER OF ANY REQUIRED SHUT DOWNS.
11. ANY AND ALL REQUIRED DEMOLITION WORK TO BE PERFORMED ABOVE EXISTING SUSPENDED CEILINGS AND FURRED OUT WALLS SHALL BE DONE AT THE TIME WHEN THE EXISTING CEILINGS AND FURRED OUT WALLS ARE REMOVED BY THE GENERAL CONTRACTOR.
12. TO ENSURE CONTINUOUS OPERATION, MAKE ALL NECESSARY TEMPORARY CONNECTIONS BETWEEN NEW AND EXISTING WORK. ALL COST RESULTING FROM TEMPORARY SHUTDOWNS SHALL BE BORNE BY THIS CONTRACTOR.
13. ALL VENT, HOT WATER CIRCULATION, HOT AND COLD WATER PIPING ARE AT CEILING OR IN HUNG CEILING: EXCEPT IN PIPE CHASES OR OTHERWISE NOTED.
14. CONTRACTOR SHALL CHECK AND VERIFY THE EXACT LOCATION OF ALL PIPE PENETRATIONS, PIPE ELEVATIONS, DRAINS, ETC.
15. ACCESS DOORS SHALL BE PROVIDED FOR ALL CLEANOUTS, VALVES, FLUSH VALVES, AND ANY OTHER EQUIPMENT AND ACCESSORIES THAT MAY REQUIRE ACCESS FOR MAINTENANCE OR OPERATION WHICH ARE LOCATED BEHIND WALLS AND PARTITIONS OR CONCEALED IN HUNG CEILINGS. COORDINATE INSTALLATION WITH GENERAL CONTRACTOR.
16. THIS CONTRACTOR SHALL OBTAIN A COPY OF THE BUILDING RULES AND REGULATIONS AND PROVIDE ALL WORK AS REQUIRED TO CONFORM TO ALL REQUIREMENTS.
17. THIS CONTRACTOR SHALL PROVIDE ALL WORK AT THE CEILING OF THE FLOOR BELOW AS INDICATED ON THE DRAWINGS. CORDINATE EXACT ROUTING OF PIPING IN THE FIELD WITH EXISTING CONDITIONS AND WORK OF OTHER TRADES. ALL WORK SHALL BE SCHEDULED AND COORDINATED TO ACCOMMODATE TENANT AND BUILDING ENGINEER.
18. THIS CONTRACTOR SHALL PROVIDE CUTTING AND PATCHING OF ALL WORK AS REQUIRED INCLUDING WORK OUTSIDE OF THE GENERAL PROJECT LIMIT LINES (I.E. CEILING OF THE FLOOR BELOW).
19. THIS CONTRACTOR SHALL PROVIDE CAPPED/VALVED OUTLETS FOR FUTURE CONNECTIONS WHENEVER CONNECTING INTO AN EXISTING CAPPED/ VALVED OUTLET. SIZE OF NEW CAPPED/VALVED OUTLET SHALL MATCH EXISTING.

PLUMBING DEMOLITION NOTES

1. THE CONTRACTOR SHALL INCLUDE IN HIS PRICE ALL COSTS ASSOCIATED WITH REMOVALS AND RELOCATIONS OF PLUMBING WORK AS DESCRIBED ON THE DRAWINGS AND IN THE SPECIFICATIONS WITH ALLOWANCES FOR EXPECTED OR UNFORESEEN DIFFICULTIES WHEN CONCEALED WORK HAS BEEN EXPOSED. NO CLAIMS FOR ADDITIONAL WORK ASSOCIATED WITH DEMOLITION WILL BE ACCEPTED, EXCEPT IN CERTAIN CASES CONSIDERED JUSTIFIABLE BY THE ARCHITECT.
2. THE CONTRACTOR SHALL REMOVE AND/OR RELOCATE ALL EXISTING PLUMBING WORK WHICH INTERFERES WITH THE NEW ARCHITECTURAL LAYOUTS. ALL SYSTEMS WHICH ARE NO LONGER REQUIRED TO FUNCTION SHALL BE REMOVED BACK TO ACTIVE LINES AND SHALL BE CAPPED/PLUGGED ORMVALVED OFF AS NEEDED.
3. THE CONTRACTOR SHALL PERFORM DEMOLITION AND REMOVAL WORK WITH MINIMUM INTERFERENCE TO FUNCTIONING PLUMBING SYSTEMS. ALL AFFECTED SYSTEMS SHALL BE RECONNECTED AND RESTORED.
4. DEMOLITION AND REMOVAL WORK SHALL BE PERFORMED IN A NEAT AND WORKMANLIKE MANNER. THE CONTRACTOR SHALL PATCH, REPAIR, OR OTHERWISE RESTORE ANY DAMAGED INTERIOR OR EXTERIOR BUILDING SURFACE TO ITS ORIGINAL CONDITION.
5. THE CONTRACTOR SHALL REMOVE ALL PIPING SUPPORTS, ETC. FROM PARTITIONS THAT ARE TO BE REMOVED. WHERE THE REMOVAL OF THESE ITEMS DISRUPTS EXISTING PIPING THAT IS TO REMAIN, THE CONTRACTOR SHALL INSTALL AND PROVIDE BYPASS CONNECTIONS AS NECESSARY.
6. ALL PIPING WHICH BECOMES EXPOSED DURING THE ALTERATION WORK SHALL BE REMOVED AND REROUTED CONCEALED BEHIND FINISHED SURFACES.
7. PORTIONS OF MAINS TO BE REMOVED OR ABANDONED AS A RESULT OF DEMOLITION WORK, BUT ARE REQUIRED TO REMAIN ACTIVE, SHALL BE CUT AT CONVENIENT LOCATIONS, REROUTED AND RECONNECTED.
8. THE CONTRACTOR SHALL NOTIFY THE OWNER AT THE APPROPRIATE TIME OF THE PROJECTED DEMOLITION AND PHASING SCHEDULE SO THAT REMOVAL OR RELOCATION OF AFFECTED UTILITIES MAY BE CARRIED OUT IN COORDINATION WITH THE PROJECT REQUIREMENTS.
9. ALL EXISTING MATERIAL AND EQUIPMENT IN USABLE CONDITION, WHICH IS TO BE REMOVED UNDER THIS CONTRACT SHALL REMAIN THE PROPERTY OF THE OWNER OR SHALL BE DISPOSED OF BY THE PLUMBING CONTRACTOR, AS DIRECTED BY THE OWNER.
10. ARRANGE TO WORK CONTINUOUSLY, INCLUDING OVERTIME, IF REQUIRED, TO ASSURE THAT SYSTEMS WILL BE SHUT DOWN ONLY DURING TIME REQUIRED TO MAKE THE NECESSARY CONNECTIONS TO THE EXISTING SYSTEMS.
11. ALL PIPING TO BE REMOVED SHALL BE PROPERLY PLUGGED OR CAPPED SO THAT UPON COMPLETION OF ALL NEW WORK, ALL ABANDONED PIPING SHALL BE REMOVED FROM FINISHED AREAS.
12. NO DEAD ENDS SHALL BE LEFT ON ANY PIPING UPON COMPLETION OF THE PROJECT.
13. EXISTING EXPOSED PIPING NOT SPECIFICALLY NOTED OR SHOWN ON DRAWINGS TO BE ABANDONED SHALL BE COMPLETELY REMOVED.

PLUMBING DRAWING LIST

SPECIAL & PROGRESS INSPECTION NOTES

1. AN INDEPENDENT SPECIAL INSPECTOR SHALL BE RETAINED TO PERFORM SPECIAL INSPECTIONS AS WELL AS FILE FORM TR-1 FOR PLUMBING SYSTEM DESIGN AS DOCUMENTED ON THESE PLANS IN ACCORDANCE WITH THE NYC BUILDING CODE.
2. SPECIAL INSPECTION REQUIRED FOR FIRE-RESISTANT PENETRATIONS AND JOINTS PER 2014 NYCBC 1704.27.
3. SPECIAL INSPECTION REQUIRED FOR POST-INSTALLED ANCHORS PER 2014 NYCBC 1704.32.
4. FINAL INSPECTION REQUIRED PER 2014 NYCBC 28-116.2.4.2, BC110.5, DIRECTIVE 14 OF 1975, & 1RCNY 101-10.

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.

BID SET 06/08/2022

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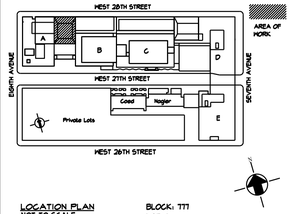

LOCATION PLAN
NOT TO SCALE

BLOCK: 777
LOT: 1

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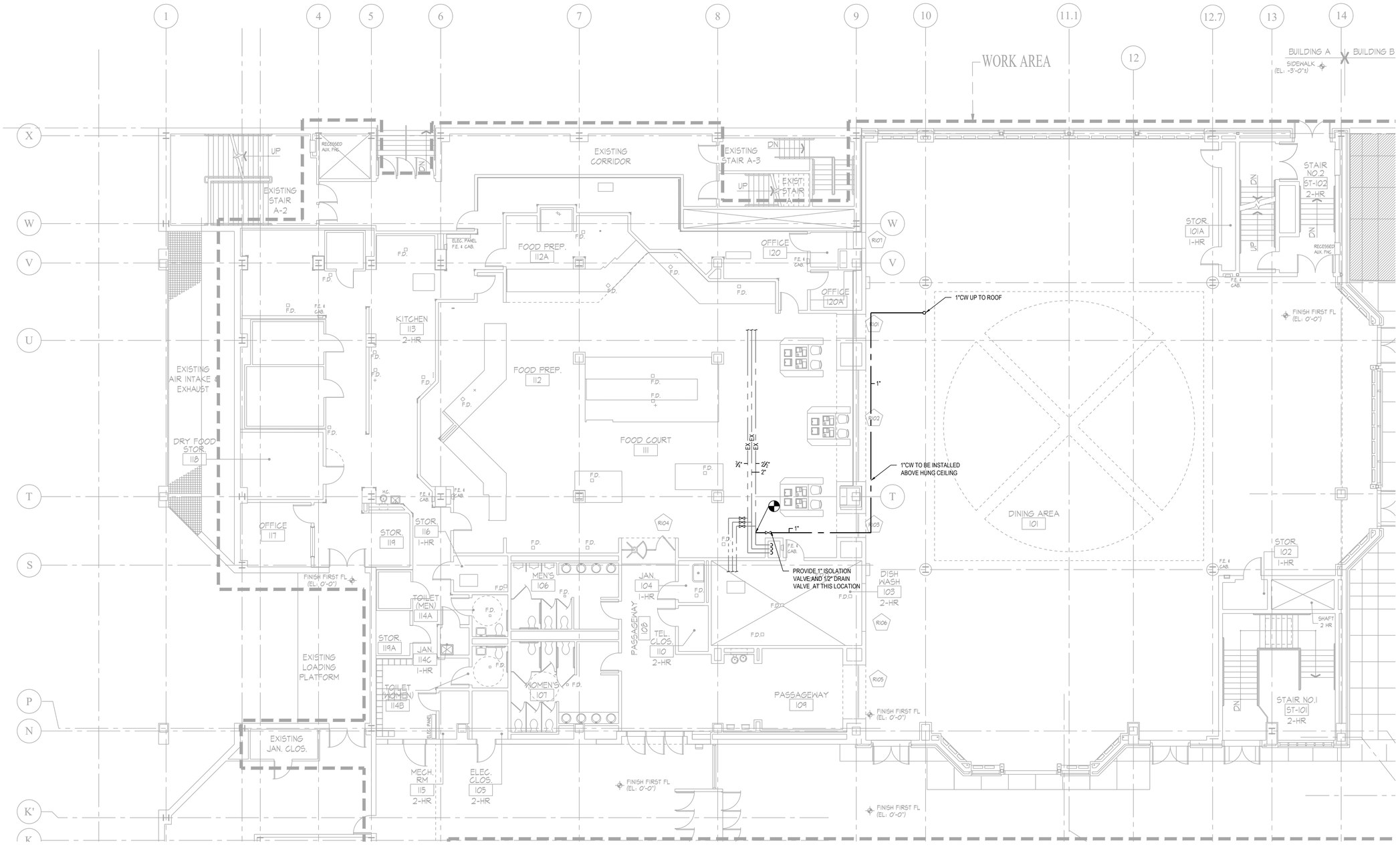
PROJECT:
WEST COURTYARD
340 8TH AVENUE
AC UNITS REPLACEMENT

DRAWING TITLE:
PLUMBING SYMBOL LIST,
ABBREVIATIONS, AND NOTES

DOB NOW JOB •

SEAL & SIGNATURE:

DATE:	05/31/2022
PROJECT No:	8969.29
DRAWING BY:	CN
CHK BY:	DN
DWG No:	P-001.00
SCALE: NTS	1 OF 4



NOTES:

1. COORDINATE SHUTDOWN AND DRAIN DOWN OF PLUMBING PIPING WITH BUILDING MANAGEMENT AND BUILDING ENGINEER.
2. PROVIDE OPENINGS IN THE CEILING TO ROUTE PIPE. RESTORE ALL OPENINGS TO ORIGINAL FINISH. PROVIDE PROTECTION OF SPACE DURING ALL WORK.
3. PROVIDE CORE DRILLS FOR ALL PENETRATIONS THROUGH SLABS AND WALLS. PROVIDE FIRE PROOFING & SLEEVE.
4. CONFIRM PRESSURE ON FLOOR AND PROVIDE PRV IF PRESSURE EXCEEDED 80PSI

① 1ST FLOOR PLUMBING PLAN

1/8" = 1'-0"

0 4' 8' 16'

SCALE: 1/8" = 1'-0"

NEW YORK CITY BUILDING DEPARTMENT APPROVAL NOTE

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BID SET 06/08/2022

rev. no.	date	revisions
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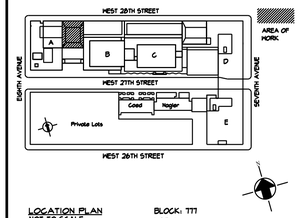

LOCATION PLAN
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BLOCK: 777
LOT: 1

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PROJECT:
WEST COURTYARD
340 8TH AVENUE
AC UNITS REPLACEMENT

DRAWING TITLE:
1ST FLOOR
PLUMBING
PLAN

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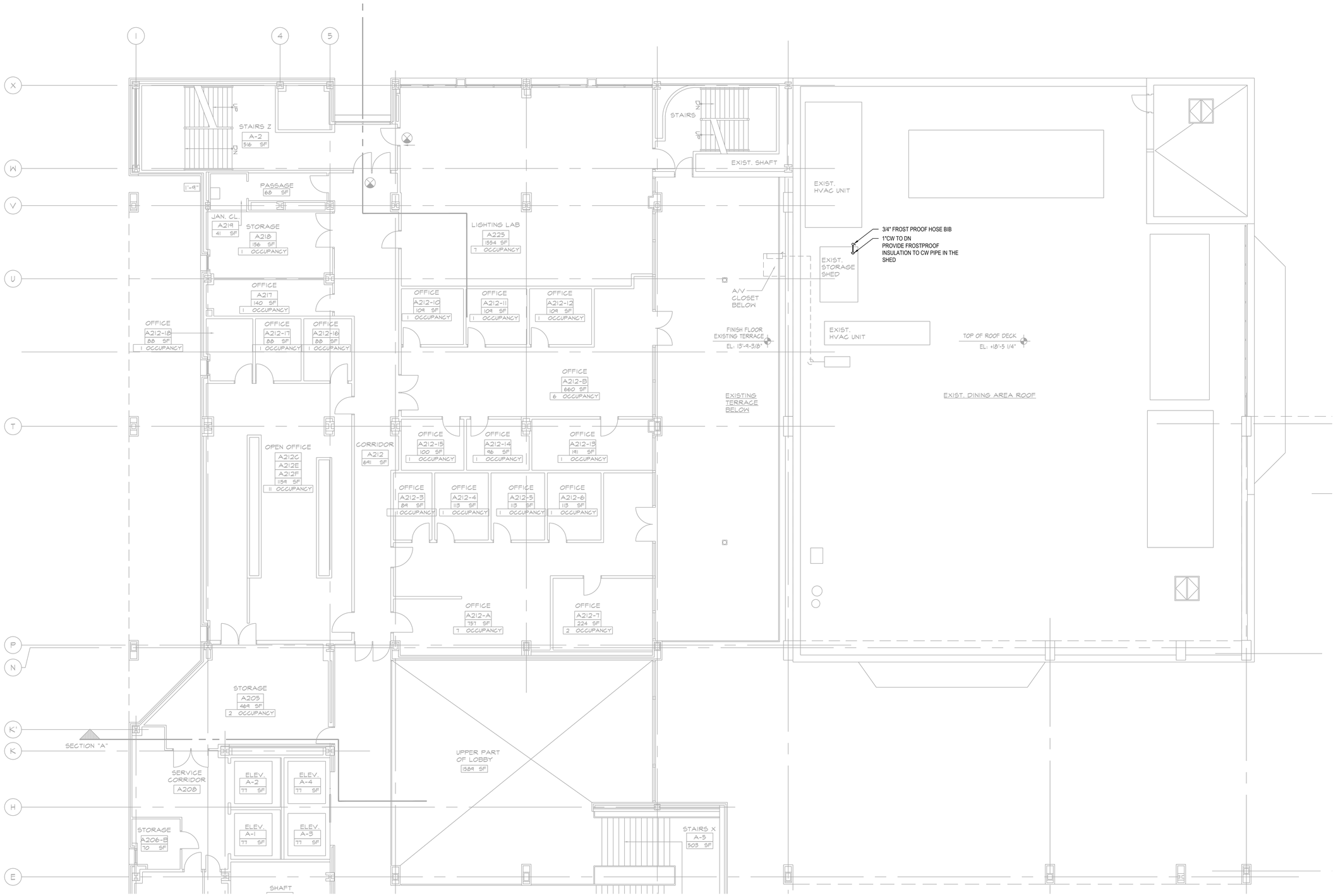
DATE:	05/31/2022
PROJECT No:	8969.29
DRAWING BY:	CN
CHK BY:	DN
DWG No:	P-101.00
SCALE: 1/8"=1'	2 OF 4



② ROOF PLUMBING PLAN
1/8" = 1'-0"

0 4' 8' 16'
SCALE: 1/8" = 1'-0"

BID SET 06/08/2022

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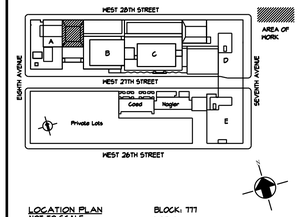

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PROJECT:
WEST COURTYARD
340 8TH AVENUE
AC UNITS REPLACEMENT

DRAWING TITLE:
ROOF
PLUMBING
PLAN

DOB NOW JOB •

SEAL & SIGNATURE:

DATE:	05/31/2022
PROJECT No:	8969.29
DRAWING BY:	CN
CHK BY:	DN
DWG No:	P-102
SCALE: 1/8"=1'	3 OF 4

PLUMBING SPECIFICATIONS

1. GENERAL

A. THE APPLICABLE PROVISIONS OF THE GENERAL CONSTRUCTION SPECIFICATIONS SHALL BE ADHERED TO AND SHALL BE CONSIDERED A PART OF THESE SPECIFICATIONS.

B. THE CONTRACTOR SHALL ADHERE TO ALL BUILDING RULES AND REGULATIONS, BUILDING STANDARDS, CONSTRUCTION SPECIFICATIONS AND DETAILS.

C. EXAMINE THE ARCHITECTURAL DRAWINGS AND THE DRAWINGS OF ALL OTHER TRADES AND FIELD VERIFY THE LOCATION OF ALL EXISTING EQUIPMENT THAT AFFECTS THIS WORK.

D. REMOVE EXISTING PLUMBING PIPING AND EQUIPMENT WHERE INDICATED ON THE PLUMBING AND/OR ARCHITECTURAL DRAWINGS. PLUG & CAP PIPING BEHIND FINISHED SURFACES. LEAVE ALL PLUGGED ENDS OF DRAINS AND VENTS LESS THAN 2 FEET LONG TO AVOID DEAD ENDS.

E. REPAIR OR REPLACE ALL EXISTING PIPING AND FIXTURES DAMAGED AS A RESULT OF PERFORMING THE WORK OF THIS CONTRACT. THE MATERIALS SHALL MATCH THE EXISTING AS CLOSE AS POSSIBLE.

F. INSTALL ALL PLUMBING WORK IN STRICT ACCORDANCE WITH 2008 NEW YORK CITY BUILDING CODE AND CONFORM TO THE REQUIREMENTS ALL OTHER AUTHORITIES HAVING JURISDICTION.

G. OBTAIN ALL NECESSARY PERMITS AND APPROVALS THAT ARE REQUIRED TO PERFORM THIS WORK.

2. NOTICE TO BIDDERS

A. THE SPECIFICATIONS AND DRAWINGS ARE INTENDED TO SERVE JOINTLY AS A BASIS UPON WHICH THE CONTRACTOR SHALL SUBMIT A PRICE FOR THE MATERIAL AND LABOR PROVISIONS.

B. WHEN CONFLICTS OCCUR BETWEEN THE SPECIFICATIONS AND THE DRAWINGS, THE ITEMS OF GREATER QUANTITY OR HIGHER COST SHALL BE PROVIDED.

C. THE CONTRACTOR SHALL PROVIDE ALL ITEMS OF LABOR AND MATERIALS NOT SPECIFICALLY INDICATED, BUT REQUIRED TO COMPLETE THE INTENDED INSTALLATIONS.

D. THE CONTRACTOR SHALL COORDINATE HIS WORK AND ADJUST SAME, AS REQUIRED, WITH THAT OF OTHER CONTRACTORS IN ORDER THAT CONFLICTS IN SPACE LOCATIONS DO NOT OCCUR.

E. THE WORK UNDER THIS CONTRACT SHALL BE PERFORMED SIMULTANEOUSLY WITH THE WORK OF OTHER TRADES SO AS NOT TO DELAY THE OVERALL PROGRESS OF WORK.

F. THIS CONTRACTOR SHALL BE RESPONSIBLE FOR HIS WORK AND ITS COMPLETION, INCLUDING ITS FINAL ACCEPTANCE. ALL DAMAGED OR DEFECTIVE WORK SHALL BE REPAIRED OR REPLACED BY THIS CONTRACTOR AT NO ADDITIONAL COST TO THE OWNER.

G. THE DRAWINGS ARE DIAGRAMMATIC AND INDICATE THE GENERAL ARRANGEMENT AND LOCATION OF ALL PIPING AND EQUIPMENT. THIS CONTRACTOR SHALL FURNISH ALL ADDITIONAL OFFSETS AND FITTINGS THAT MAY BE REQUIRED TO PERFORM THIS WORK.

H. VISIT AND CAREFULLY EXAMINE THE EXISTING SPACE TO BECOME FAMILIAR WITH THE EXISTING CONDITIONS AND DIFFICULTIES THAT MAY BE ENCOUNTERED. SUBMISSION OF A PROPOSAL SHALL BE CONSTRUED AS EVIDENCE THAT SUCH AN EXAMINATION HAS BEEN MADE, AND LATER CLAIMS FOR LABOR, EQUIPMENT OR MATERIALS REQUIRED BECAUSE OF SUCH DIFFICULTIES, WHICH COULD HAVE BEEN FORESEEN HAD SUCH AN EXAMINATION BEEN MADE, WILL NOT BE RECOGNIZED.

I. BASE ALL LABOR PRICING ON REGULAR TIME (NON-PREMIUM). HOWEVER, ALL CONNECTION SCHEDULING LANDLORD PRIOR TO INTERRUPTION OF ANY BUILDING SERVICES. SUBMIT ADDITIONAL COST FOR EVALUATION TO MAKE EACH NEW CONNECTION ON PREMIUM TIME.

4. SHOP DRAWINGS

A. PRIOR TO PURCHASING ANY EQUIPMENT OR INSTALLING ANY SYSTEM COMPONENTS, SUBMIT THE FOLLOWING FOR REVIEW AND APPROVAL:

1) A MINIMUM OF FOUR (4) SETS OF SHOP DRAWINGS INDICATING EXACT PIPING LAYOUT, SIZES, VALVES, EQUIPMENT LOCATIONS AND PIPING ELEVATIONS.

2) EQUIPMENT SUBMITTALS INDICATING CAPACITIES AND PERFORMANCE DATA.

B. PRIOR TO INSTALLING OR SUBMITTING FOR APPROVAL ANY PORTION OF THE WORK, COORDINATE THIS WORK WITH THE WORK OF ALL OTHER TRADES. AFFIX INDICATION OF THIS COORDINATION TO EACH SHOP DRAWING SUBMITTED FOR APPROVAL.

C. USE OF THE CONTRACT DOCUMENTS AS SHOP DRAWINGS WILL NOT BE ACCEPTED.

5. RECORD DRAWINGS

A. SUPPLY REPRODUCIBLE RECORD DRAWINGS INDICATING AN ACCURATE AND COMPLETE RECORD OF THE WORK AS INSTALLED.

B. IN ADDITION TO THE REPRODUCIBLE DRAWINGS, PROVIDE AN AUTOCAD FILE FOR ALL WORK IN A DWG FORMAT.

6. TESTING

A. TEST ALL PLUMBING PIPING IN ACCORDANCE WITH THE REQUIREMENTS OF THE AUTHORITIES HAVING JURISDICTION.

B. PERFORM TESTS ON ALL NEW WORK PRIOR TO CONCEALING SAME AND BEFORE INSULATION IS INSTALLED.

7. CLEANING

A. AT THE COMPLETION OF THE WORK AND BEFORE FINAL INSPECTION IS MADE, THOROUGHLY CLEAN ALL FIXTURES, APPARATUS, APPURTENANCES, PIPING, BRASS AND CHROME WORK AND LEAVE SAME FREE FROM ALL MARKS, SCRATCHES, STAINS, ETC. REMOVE ALL TOOLS, DEBRIS, ETC., FROM THE PREMISES.

8. PIPING AND FITTINGS

A. CONFORM TO THE LATEST ASTM AND/OR FS STANDARDS.

B. THE BUILDING STANDARDS SHALL TAKE PRECEDENCE OVER THESE SPECIFICATIONS.

C. DOMESTIC WATER DISTRIBUTION (COLD, HOT) ABOVE GROUND:

1) PIPE: COPPER TUBING TYPE "L" HARD DRAWN, ASTM B88.

2) FITTINGS:WROUGHT COPPER AND BRONZE SOLDER JOINT PRESSURE FITTINGS: ANSI B.16.22 OR CAST BRONZE SOLDER JOINT PRESSURE FITTING: ANSI B.16.18.

3) JOINTS: 95-5 TIN-ANTIMONY SOLDER, ASTM B32, GRADE 95TA FOR PRESSURE PIPING.

4) EXPOSED PIPING AT FIXTURES: CP BRASS.

9. VALVES

A. SHUT-OFF VALVES AND BALANCING VALVES 3" AND SMALLER: BRONZE BODY, UNION/THREADED END BALL VALVES, 600 WOG, APOLLO 70-100 SERIES.

B. CHECK VALVES 2" AND SMALLER: BRONZE BODY, SOLDER ENDS, MILWAUKEE MODEL 510. 2.5" AND LARGER: IBBM, FLANGED ENDS, MILWAUKEE MODEL F2974M.

C. PRESSURE REDUCING VALVES: PROVIDE CLA-VAL MODEL 990 ON ALL CONNECTIONS WHERE THE PRESSURE EXCEEDS 85 PSI.

10. INSULATION

A. COVER ALL WATER PIPING .5" FIBERGLASS PIPE INSULATION, 7.25 LBS PER CUBIC FOOT DENSITY WITH A MAXIMUM K FACTOR OF 0.24 AT 75°F. PROVIDE INSULATION WITH A FACTORY APPLIED, ALL-PURPOSE VAPOR BARRIER JACKET WITH A SELF-SEALING LAP. INSULATION SHALL HAVE A COMPOSITE FIRE & SMOKE HAZARD RATINGS NOT TO EXCEED 25 FLAME SPREAD AND 50 SMOKE DEVELOPED.

B. ALL FITTINGS, VALVES, AND ROOF DRAIN BODIES SHALL BE COVERED WITH A GLASS JACKET, OR APPROVED EQUAL, OF THE SAME THICKNESS AND DENSITY AS ON THE ADJACENT PIPES.

C. SEAL ALL ENDS OF INSULATION WITH BENJAMIN FOSTER BF 30-35 SEALANT.

D. PROVIDE RIGID HIGH TEMPERATURE HYDROUS CALCIUM SILICATE INSULATION, 12 LBS PER CUBIC FOOT, ON ALL WATER PIPING PASSING THROUGH FIRE-RATED WALLS OR FLOORS.

E. FOR FROSTPROOFED PIPING PROVIDE 3" INSULATION, DUAL TEMPERATURE FIRE RETADANT JACKET

11. SLEEVES

A. PROVIDE SLEEVES FOR ALL PIPING PENETRATIONS THROUGH WALLS AND POURED FLOORS.

B. SLEEVES TO HAVE AN INTERNAL DIAMETER 1" LARGER THAN THE OUTSIDE DIAMETER OF THE PIPE, INCLUDING INSULATION, UNLESS OTHERWISE NOTED HEREIN.

C. CARRY INSULATION THROUGH PIPE SLEEVES.

D. PROVIDE CAULKING BETWEEN PIPES AND PIPE SLEEVES AS FOLLOWS:

9) FLOORS: OAKUM HEMP & LEAD OR AS SPECIFIED FOR FIRE-RATED SHAFT WALLS BELOW.

10) WATERPROOF WALLS: PERMANENT PLASTIC WATER-PROOF CAULKING COMPOUND, OR FIBERGLASS TO WITHIN .5" OF THE SURFACE AND FINISHED WITH CAULKING COMPOUND. FROM PAN TO SPILL OVER NEAREST FLOOR DRAIN.

11) FIRE-RATED SHAFT WALLS: MINERAL WOOL SEALED WITH JOHNS-MANVILLE "DUCKSEAL". INSTALL ESCUTCHEON WITH SET SCREW ON BOTH SIDES OF THE WALL.

13. VACUUM BREAKER

A. PROVIDE A NON-CONTINOUS PRESSURE USE WITH BACK PRESSURE

1) CAST BRASS BODY, WITH FULL SIZE ORIFICE

2) ATMOSPHERE TYPE, WATTS NO. 288A OR EQUAL

14. DIELECTRIC FITTINGS

A. CONNECTIONS BETWEEN FERROUS AND NON FERROUS PIPE OR EQUIPMENT CONNECTIONS SHALL BE MADE USING ISOLATING UNION AS OR FLANGE JOINTS MFG. BY EPSO SALES INC. OR APPROVED EQUAL.

15. HOSE BIBBS

A. PROVIDE FROST PROOF BRASS HOSE-BIB COMPLETE WITH VACUUM BREAKER.

16. HANGERS, ANCHORS AND INSERTS

A. PROVIDE SUBSTANTIAL SUPPORT AND FASTENING FOR ALL EQUIPMENT AND PIPING. STRAP IRON OR PERFORATED STRAPS ARE NOT ACCEPTABLE. ATTACH SUPPORTS TO THE BUILDING STRUCTURE WITH BEAM CLAMPS, SHOT OR POURED INSERTS OR PHILLIPS, OR EQUAL, .75" EXPANSION BOLTS OR SHIELDS.

B. PIPING IS TO BE SUPPORTED BY INDIVIDUAL CLEVIS TYPE HANGERS OR BY TRAPEZE HANGERS AT THE FOLLOWING INTERVALS:

1) CAST IRON PIPE: EVERY 5'-0" AND ON BOTH SIDES OF EACH JOINT.

2) COPPER AND STEEL PIPE 1.5" AND LARGER: AT 10'-0" INTERVALS.

3) COPPER AND STEEL PIPE 1.25" AND SMALLER: AT 6'-0" INTERVALS.

4) PROVIDE A SEPARATE SUPPORT FOR BRANCH PIPING 5'-0" AND LONGER.

C. DO NOT SUPPORT PIPING FROM OTHER PIPING OR EQUIPMENT.

D. SUPPORT VERTICAL LINES ADEQUATELY AT THEIR BASES BY A SUITABLE HANGER PLACED ON THE HORIZONTAL LINE NEAR THE BASE OF THE RISER. AN ADDITIONAL SUPPORT SHALL BE PLACED ON THE VERTICAL LINE AT EACH STORY.

E. PROTECT INSULATED PIPES BY A SHEET STEEL INSERT AND PROVIDE A RIGID, HYDROUS CALCIUM SILICATE INSULATION INSERT AT THE HANGER.

17. CUTTING AND PATCHING

A. DO NOT DISTURB ANY EXISTING STRUCTURE, PIPING OR OTHER WORK. WHERE CUTTING, DRILLING OR REMOVALS ARE REQUIRED IN EXISTING WALLS, FLOOR OR ROOF CONSTRUCTION, PERFORM THE WORK IN A MANNER THAT WILL SAFEGUARD AND NOT ENDANGER THE STRUCTURE OR ITS OCCUPANTS PRIOR TO ANY CUTTING OR REMOVALS. INVESTIGATE BOTH SIDES OF THE SURFACE INVOLVED AND DETERMINE THE EXACT LOCATION OF ADJACENT STRUCTURAL MEMBERS BY VISUAL EXAMINATION. ALL CUTTING AND PATCHING MUST BE COORDINATED BY THE GENERAL CONTRACTOR. REFER TO THE GENERAL CONSTRUCTION SPECIFICATIONS FOR ADDITIONAL REQUIREMENTS.

B. EMPLOY MAXIMUM USE OF CORE DRILLING FOR PENETRATIONS THROUGH THE EXISTING STRUCTURE. DO NOT JACK HAMMER OR USE ANY OTHER CHOPPING METHODS EXCEPT WHERE OR WHEN SPECIFICALLY APPROVED BY THE ARCHITECT.

18. CONNECTIONS TO EXISTING WORK

A. PLAN INSTALLATION OF NEW WORK AND CONNECTIONS TO EXISTING WORK TO INSURE MINIMUM INTERFERENCE WITH THE REGULAR OPERATION OF THE EXISTING FACILITIES. SUBMIT TO THE OWNER FOR APPROVAL A DATE SCHEDULE OF NECESSARY TEMPORARY SHUTDOWNS OF EXISTING SERVICES. ALL SHUTDOWNS MUST BE MADE AT SUCH TIME AS IT WILL NOT INTERFERE WITH THE REGULAR OPERATION OF THE EXISTING FACILITIES. WRITTEN APPROVAL MUST BE OBTAINED FROM THE BUILDING MANAGEMENT PRIOR TO ANY SYSTEM SHUTDOWN.

B. CONNECT NEW WORK TO EXISTING WORK IN A NEAT AND APPROVED MANNER. RESTORE EXISTING WORK THAT HAS BEEN DISTURBED TO ITS ORIGINAL CONDITION.

C. CHECK, AND REPAIR OR REPLACE IF REQUIRED, EXISTING VALVES REQUIRED TO BE CLOSED FOR CONNECTION OF NEW WORK.

D. PROVIDE FULL SIZED VALVED, CAPPED AND PLUGGED OUTLETS ON ALL NEW CONNECTIONS TO EXISTING WORK. ARRANGE FOR EASY EXTENSION TO FUTURE TENANTS.

19. DEMOLITION

A. PROVIDE ALL MATERIALS, LABOR AND SUPERVISION REQUIRED TO REMOVE, RELOCATE AND ALTER THE EXISTING PLUMBING SYSTEMS ASP INDICATED ON THE CONTRACT DRAWINGS.

B. PERFORM THE WORK AS SCHEDULED BY THE GENERAL CONTRACTOR OR CONSTRUCTION MANAGER. PLAN THE INSTALLATION OF NEW AND INTERIM WORK TO INSURE MINIMUM INTERFERENCE WITH THE REGULAR OPERATION OF THE EXISTING FACILITIES. SUBMIT TO THE OWNER FOR APPROVAL A DATE SCHEDULE OF REQUIRED SHUTDOWNS PRIOR TO PERFORMING THE WORK.

C. THIS WORK INCLUDES DISCONNECTING PIPING AT STACKS OR RISERS AND CAPPING TO AVOID DEAD ENDS, RECONNECTING ALL SYSTEMS AS REQUIRED TO ASSURE CONTINUITY IN CIRCULATING OR SUPPLY LINES AND RAISING ALL PLUMBING LINES WHERE REQUIRED TO CLEAR NEW CEILING HEIGHTS.

D. ALL BULK DEMOLITION CONCEALED IN CONSTRUCTION AND OTHERWISE BETWEEN REMOVAL POINTS DESCRIBED ABOVE WILL BE PROVIDED UNDER OTHER WORK.

E. TURN OVER ALL FIXTURES, PIPING AND EQUIPMENT TO THE OWNER TO DISPOSE OF, OR AS OTHERWISE DIRECTED.

F. PROVIDE INTERIM WORK, IF REQUIRED, FOR CONTINUED, UNINTERRUPTED SERVICE WHERE EXTENDED SHUTDOWN IS REQUIRED.

20. ACCESS DOORS

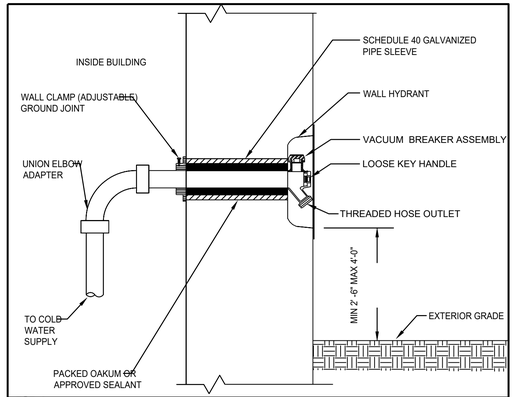
A. THIS CONTRACTOR SHALL PREPARE A LIST OF ALL ACCESS DOORS REQUIRED FOR OPERATION AND MAINTENANCE OF ALL CONCEALED EQUIPMENT, VALVES, CONTROLS, AND OTHER SIMILAR DEVICES, WHICH SHALL BE SUPPLIED TO THE GENERAL CONTRACTOR WHO SHALL FURNISH AND INSTALL SAME. ACCESS DOORS SHALL BE OF AN AMPLE SIZE (MINIMUM 12" X 12")

B. IN ADVANCE OF CEILING INSTALLATIONS, SUITABLY FIELD TAG AND IDENTIFY ALL CONCEALED ITEMS THAT REQUIRE ACCESS DOOR PROVISIONS.

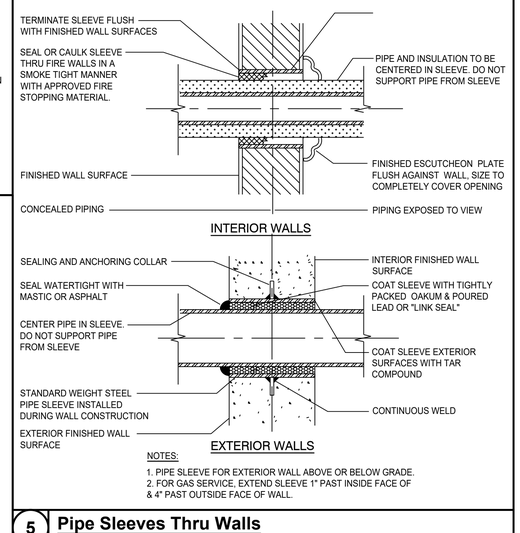
21. PERMITS

A. THE CONTRACTOR SHALL BE RESPONSIBLE FOR ALL PERMITS, APPROVALS AND INSPECTIONS.

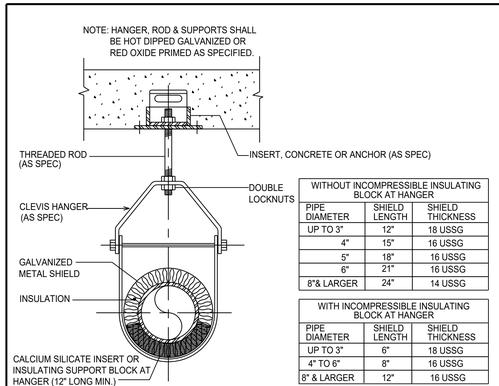
B. APPLY FOR, OBTAIN AND PAY FOR ALL PERMITS, FEES, CERTIFICATES OF INSPECTIONS AND APPROVALS AS REQUIRED.



4 **Wall Hydrant Detail**
Not to Scale



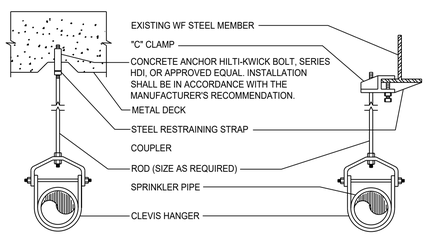
5 **Pipe Sleeves Thru Walls**
Not to Scale



WITHOUT INCOMPRESSIBLE INSULATING BLOCK AT HANGER		
PIPE DIAMETER	SHIELD LENGTH	SHIELD THICKNESS
UP TO 3"	12"	18 USSG
4"	15"	16 USSG
5"	18"	16 USSG
6"	21"	16 USSG
8"& LARGER	24"	14 USSG

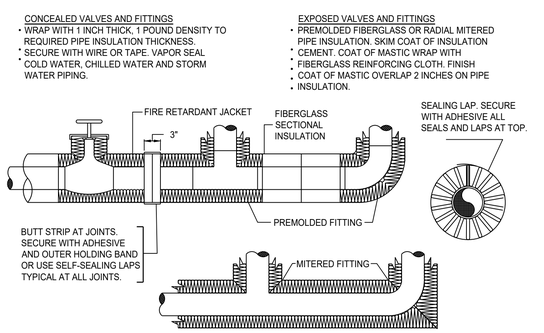
WITH INCOMPRESSIBLE INSULATING BLOCK AT HANGER		
PIPE DIAMETER	SHIELD LENGTH	SHIELD THICKNESS
UP TO 3"	6"	18 USSG
4" TO 6"	8"	16 USSG
8" & LARGER	12"	16 USSG

1 **Insulated Pipe Support**
Not to Scale



NOTES:
1. CLEVIS HANGERS REQUIRED ON PIPING LARGER THAN 1"

2 **Typical Hanger Detail**
Not to Scale



(FOR EXPOSED AND CONCEALED LOCATIONS)

3 **Insulation of Piping, Valves, and Fittings**
Not to Scale

NEW YORK CITY BUILDING DEPARTMENT APPROVAL NOTE

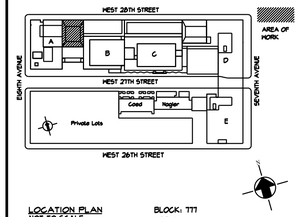
THIS PLAN IS APPROVED ONLY FOR WORK INDICATED ON THE APPLICATION SPECIFICATION SHEET. ALL OTHER MATTERS SHOWN ARE NOT TO BE RELIED UPON, OR TO BE CONSIDERED AS EITHER BEING APPROVED OR IN ACCORDANCE WITH APPLICABLE CODES.

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.

BID SET 06/08/2022

rev. no.	date	revisions
-	06/08/2022	ISSUED TO BID



LOCATION PLAN
NOT TO SCALE

BLOCK: 777
LOT: 1

Fashion Institute of Technology

340 8th Avenue
New York, NY 10001

MEP Consultants

MG Engineering D.P.C. / we engineer success
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P 212.643.9055 www.mgedpc.net

PROJECT:
WEST COURTYARD
340 8TH AVENUE
AC UNITS REPLACEMENT

DRAWING TITLE:
PLUMBING SPECIFICATIONS AND DETAILS

DOB NOW JOB •

SEAL & SIGNATURE:

DATE:	05/31/2022
PROJECT No:	8969.29
DRAWING BY:	CN
CHK BY:	DN
DWG No:	P-501.00
SCALE: NTS	4 OF 4

K&L Group
A Division of MG Engineering D.P.C.
healthcare / institutional / higher education

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SYMBOL LIST

SYMBOL	DESCRIPTION
FIRE ALARM SYSTEM DEVICES	
▽	FIRE ALARM SYSTEM SPEAKER
▼	FIRE ALARM SYSTEM SPEAKER/STROBE
●	FIRE ALARM SYSTEM STROBE, WALL MOUNTED
○	FIRE ALARM SYSTEM GONG, WALL MOUNTED
⊠	FIRE ALARM SYSTEM MANUAL PULL STATION
S	FIRE ALARM SYSTEM SMOKE DETECTOR, "EL" – ELEVATOR
S/C	FIRE ALARM SYSTEM COMBINATION SMOKE/CARBON MONOXIDE DETECTOR WITH SOUNDER BASE
S_D	FIRE ALARM SYSTEM SMOKE DETECTOR,
H	FIRE ALARM SYSTEM HEAT DETECTOR
WF	SPRINKLER ALARM SYSTEM WATER FLOW SWITCH AND MONITORING MODULE. PROVIDE WIRING BETWEEN MONITORED OR/AND MODULE.
TS	SPRINKLER ALARM SYSTEM TAMPER SWITCH AND MONITORING MODULE. PROVIDE WIRING BETWEEN MONITORED OR/AND MODULE.
CM	FIRE ALARM SYSTEM CONTROL AND MONITORING MODULE NOTE: ALL MODULES AND DUCT DETECTORS SHALL BE INSTALLED BELOW THE ROOF LINE OR INSTALLED IN WEATHERPROOF HEATED NEMA ENCLOSURES PAINTED RED AND PROPERLY LABLED.
FSD	MOTORIZED SMOKE OR COMBINATION FIRE/SMOKE DAMPER
FACP	FIRE ALARM CONTROL PANEL

ABBREVIATIONS

	DESCRIPTION
AFF	ABOVE FINISHED FLOOR
C	CONDUIT
DGP	DATA GATHERING PANEL
DWG	DRAWING
E	EXISTING
EC	EMPTY CONDUIT
ELEC	ELECTRICAL
ER	EXISTING TO RELOCATE
FA	FIRE ALARM
FACP	FIRE ALARM CONTROL PANEL
FCO	FUSED CUTOUT
NIC	NOT IN CONTRACT
R	REMOVE
RE	RELOCATED EXISTING DEVICE

INPUT/OUTPUT PROGRAMMING MATRIX

SYSTEM OUTPUT INDICATING CONTROLLED DEVICES

		IDENTIFY INDIVIDUAL DEVICE ON ALL ALPHANUMERIC DISPLAYS	ACTIVATE ALL AUDIBLE ALARMS & VOICE NOTIFICATIONS	ACTIVATE ALL VISUAL ALARMS (SYNCHRONIZED	ACTIVATE DOOR RELEASE RELAY/RELEASE MAGNETIC DOOR HOLDERS (VIA SECURITY SYSTEM)	ACTIVATE FAN SHUT DOWN	SEND A DISTINCT SIGNAL TO CENTRAL STATION	ACTIVATE NON-SILENCEABLE LOCAL BELL TONE	ACTIVATE ELEVATORS RECALL	SOUND AUDIBLE SIGNAL & VIOCE NOTIFICATIONS AT MAIN FACP	ACTIVATE LOCAL TROUBLE ALARM	SEND A TROUBLE SIGNAL TO CENTRAL STATION. (INCLUDING FIRE PUMP ANNUNCIATION IF APPLICABLE)	SEND A WATERFLOW SIGNAL TO CENTRAL STATION	SEND A SMOKE SIGNAL TO CENTRAL STATION	SEND A SUPERVISORY SIGNAL TO CENTRAL STATION. (INCLUDING FIRE PUMP ANNUNCIATION IF APPLICABLE)	ACTIVATE LOCAL SUPERVISORY ALARM	SHUTDOWN ELEVATORS MAIN POWER SUPPLY BY ACTIVATING SHUNT TRIP
No.	SYSTEM INPUT INITIATING DEVICES	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P
1	ACTIVATION OF A MANUAL STATION SHALL:	●	●	●	●	●	●										
2	ACTIVATION OF A WATER FLOW DEVICE SHALL:	●	●	●	●	●		●	●				●				
3	ACTIVATION OF AN AREA OR DUCT SMOKE DETECTOR SHALL:	●	●	●	●	●				●				●			
4	ACTIVATION OF AN ELEVATOR RELATED SMOKE DETECTOR SHALL:	●	●	●	●	●			●	●				●			
5	ACTIVATION OF HEAT DETECTOR IN ELEVATOR SHAFT OR ELEVATOR PIT SHALL:	●	●	●	●					●				●			●
6	ACTIVATION OF A TROUBLE SHALL:	●								●	●	●					
7	ACTIVATION OF A TAMPER SWITCH (SUPERVISORY) SHALL:	●								●					●	●	
8	ACTIVATION OF AUXILIARY SYSTEM (FM-200) IN EMR SHALL:						●										

GENERAL NOTES

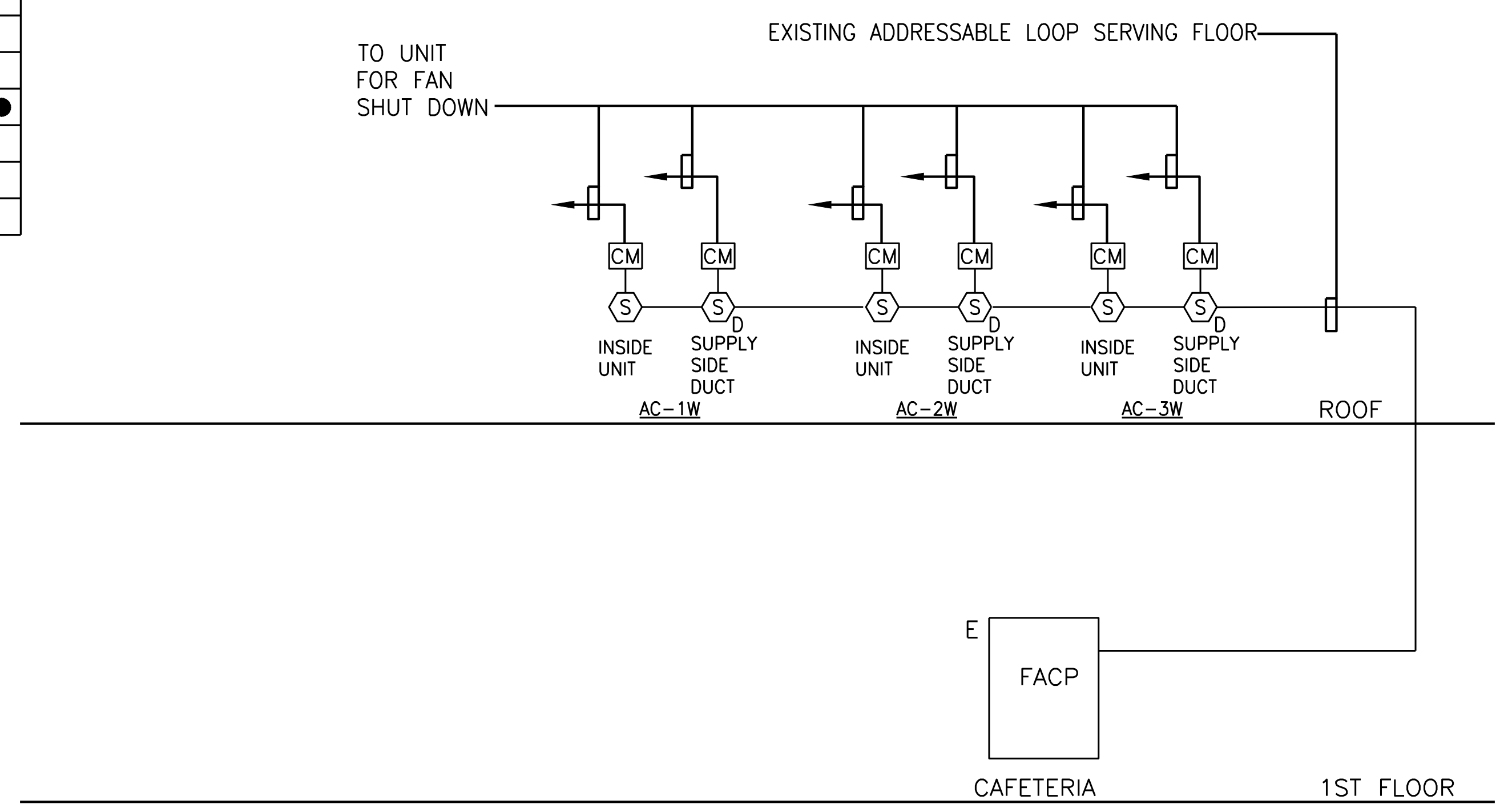
1. THE GENERAL NOTES APPLY TO ALL DRAWINGS UNDER THIS CONTRACT. REFER TO INDIVIDUAL DRAWINGS FOR ADDITIONAL NOTES.
2. DRAWINGS ARE DIAGRAMMATIC AND INDICATE GENERAL ARRANGEMENT OF SYSTEMS AND WORK. FOLLOW DRAWINGS IN LAYING OUT WORK. MAINTAIN HEADROOM AND SPACE CONDITIONS CONSISTENT WITH PROJECT CRITERIA.
3. JUNCTION AND PULL BOXES SHALL GENERALLY BE LOCATED FOR FLUSH MOUNTING IN FINISHED SPACES. WHERE NECESSARY, CONDUIT SHALL BE REROUTED OR OTHER ARRANGEMENTS SHALL BE MADE FOR CONCEALMENT. PULL BOXES SHALL BE PROVIDED AS INDICATED AND WHEREVER NECESSARY TO FACILITATE PULLING OF WIRE AND COORDINATE LOCATION WITH OTHER TRADES. COVERS OF JUNCTION AND PULL BOXES SHALL BE ACCESSIBLE.
4. ALL SUPPORTS TO BUILDING STRUCTURE SHALL BE SECURED AS NOTED IN THE SPECIFICATIONS. HORIZONTAL RUNS OF METALLIC CONDUIT SHALL BE SUPPORTED AT INTERVALS OF NOT MORE THAN 10 FEET APART. RACEWAY RISERS SHALL BE SUPPORTED AT EACH FLOOR LEVEL. EXPOSED RACEWAYS SHALL RUN PARALLEL WITH OR AT RIGHT ANGLES TO WALLS.
5. JUNCTION BOXES AND PULL BOXES SHALL BE SUPPORTED INDEPENDENTLY TO BUILDING STRUCTURE WITH NO WEIGHT BEARING ON CONDUIT.
6. NO RACEWAYS SHALL BE INSTALLED WITHIN 3 INCHES OF STEAM OR HOT WATER PIPES, OR APPLIANCES, EXCEPT FOR CROSSINGS WHERE RACEWAYS SHALL BE AT LEAST 1 INCH FROM PIPE COVER.
7. CONDUIT ENDS SHALL BE CUT SQUARE AND REAM SMOOTH. MALE THREADS OF FIELD THREADED CONDUIT SHALL BE PAINTED WITH GRAPHITE BASED PIPE COMPOUND AND DRAWN UP TIGHT WITH CONDUIT COUPLINGS.
8. WIRE COLOR CODING SHALL CONFORM TO CODE REQUIREMENTS.
9. IN UNFINISHED PORTIONS OF THE BUILDING, SUCH AS BOILER ROOM, FAN ROOMS, PIPE SPACES, ETC., LOCATIONS OF CONDUIT ARE APPROXIMATE AND SHALL CLEAR PIPING AND ALL OTHER CONSTRUCTION. CONDUITS IN THESE PORTIONS OF THE BUILDING SHALL BE RUN EXPOSED.
10. THE ELECTRICAL CONTRACTOR SHALL COORDINATE ALL CEILING WORK WITH AND DETERMINE CEILING TYPE PRIOR TO FURNISHING OF SMOKE DETECTORS, OR ANY OTHER CEILING MOUNTED ELECTRICAL ELEMENTS. ELECTRICAL WORK SHALL ALSO BE COORDINATED WITH LOCATION OF DIFFUSERS, SPRINKLERS AND OTHER MECHANICAL WORK.
11. ALL OUTLET BOXES RECEIVING 1–1/4" CONDUIT SHALL BE A MINIMUM OF 2–1/2"DEEP.
12. SUFFICIENTLY LONG WIRE SLACK SHALL BE LEFT IN RUNS TO PERMIT MAKING PROPER FINAL CONNECTIONS. ALL EMPTY CONDUIT SHALL BE PROVIDED WITH #12 AWG STEEL DRAG WIRE.
13. ALL WIRING, POWER, CONDUCTORS, CONDUITS ETC. SHALL MEET THE NYC ELECTRICAL CODE.
14. ALL WORK SHALL BE IN ACCORDANCE WITH THE NYS BUILDING CODE AND NFPA 72.
15. ALL FIRE ALARM EQUIPMENT SHALL BE APPROVED (MEA, BSA OR COA APPROVED).
16. ALL FIRE ALARM CIRCUITS SHALL BE SIZED TO A MAXIMUM OF 80% OF CAPACITY.
17. ALL FIRE ALARM CIRCUITS SHALL BE WIRED NFPA STYLE 4/Y/B (CLASS B) WITH THE EXCEPTION OF THE NETWORK CIRCUIT WHICH SHALL BE NFPA STYLE 7 (CLASS A WITH ISOLATION). DUAL CLASS B NETWORKING IS NOT STYLE 7 AND WILL NOT BE APPROVED. ALL AUDIBLE AND VISUAL CIRCUITS SHALL BE STYLE Y/CLASS B AND SPLIT A/B. SPLIT A/B CIRCUITS SHALL BE WIRED SO THAT EVERY OTHER DEVICE IS WIRED ON AN ALTERNATE CIRCUIT.
18. CONDUITS MAY NOT ENTER THE TOP OF ANY FIRE ALARM EQUIPMENT CABINET.
19. ALL FIRE ALARM EQUIPMENT SHALL BE INSTALLED WITH AESTHETICS IN MIND. CABINETS SHALL BE SEMI FLUSH MOUNTED AND CABLE TRAYS SHALL BE HIDDEN.
20. ALL FIRE ALARM WIRE SHALL BE CLEARLY LABELED IN JUNCTION BOXES AND CABINETS. ALL TERMINALS SHALL BE NUMBERED AND LABELED. ALL CONNECTIONS SHALL BE EITHER SOLDERED, 70DBA APPROVED TERMINAL STRIPS OR SCOTCH LOCKS.
21. ALL LOW VOLTAGE FIRE ALARM CONDUCTORS SHALL BE PROTECTED BY EITHER BUILDING CONSTRUCTION OR CONDUIT TO 8 FEET ABOVE THE FINISHED FLOOR. LOADING DOCKS, GARAGES, SUPPRESSION AND EXTINGUISHING SYSTEM WIRING, MECHANICAL AND ELECTRICAL ROOMS AND OTHER LOCATIONS SUBJECT TO MECHANICAL DAMAGE SHALL BE IN FULL RIGID CONDUIT. IN ALL OTHER AREAS APPROVED WIRE MAY BE RUN WITHOUT CONDUIT ABOVE 8 FT.
    ALL WIRING INSTALLATION EXPOSED IN FINISHED AREAS SHALL BE AS FOLLOWS:
    A) ON WALLS – IN SINGLE PIECE 1/2" SURFACE MOUNTED STEEL RACEWAY.
    B) WHERE CEILING IS NOT ACCESSIBLE – IN SINGLE PIECE SURFACE MOUNTED STEEL RACEWAY.
22. FIRE ALARM CABLES SHALL NOT BE MIXED WITH NON FIRE ALARM CABLING. LOW VOLTAGE FIRE ALARM CABLING SHALL NOT BE MIXED OR WIRED NEAR ANY AC CIRCUIT
23. ALL LOW VOLTAGE WIRING SHALL BE FPLP 150 DEGREE C. ALL NOTIFICATION CIRCUITS SHALL BE A MINIMUM OF 14 AWG AND ALL OTHER LOW VOLTAGE FIRE ALARM CIRCUITS SHALL BE 16 AWG MINIMUM.
24. VERTICAL RISER CABLE FOR ALL SYSTEMS SHALL BE INSTALLED IN A 2 HOUR RATED SHAFT.
25. POLARITY SHALL BE OBSERVED ON ALL CIRCUITS. T–TAPPING SHALL NOT BE ALLOWED ON ANY NOTIFICATION CIRCUITS (HORN, STROBE OR SPEAKER). T–TAPPING SHALL NOT BE PERMITTED ON ADDRESSABLE CIRCUITS.
26. ALL WIRING SHALL BE INSPECTED TO ASSURE THERE ARE NO OPENS, SHORTS OR EARTH GROUNDS.
27. SHIELDED CONDUCTORS OR RUNNING IN SEPARATE RACEWAY SHALL BE AS INSTRUCTED BY THE FIRE ALARM MANUFACTURER'S DOCUMENTATION. ALL NON–POWER LIMITED WIRING SHALL BE RUN IN A SEPARATE RACEWAY.
28. ALL AREA OR DUCT SMOKE DETECTORS SHALL BE PHOTO–ELECTRIC TYPE.
29. SMOKE DETECTORS MUST BE MOUNTED AT LEAST 3 FT AWAY FROM ANY AIR REGISTER.
30. DEVICE LOCATIONS MUST BE READILY ACCESSIBLE TO ALLOW FOR MAINTENANCE AND REPAIR.
31. DUCT MOUNTED SMOKE DETECTORS SHALL BE MOUNTED ON THE DUCTWORK IN STRICT ACCORDANCE WITH THE MANUFACTURERS INSTRUCTIONS. ALL DUCT DETECTORS SHALL BE PROVIDED WITH A REMOTE LED IN AN OBSERVABLE AREA. EACH LED STATION TO BE LABEL PER UNIT AND DEVICE MONITORY.
32. ALL STROBE LIGHTS SHALL BE UL–1971 APPROVED/LISTED. THE MINIMUM CANDELA IS 75 UNLESS OTHERWISE NOTED.
33. NOTIFICATION DEVICES THAT INCLUDE A STROBE SHALL BE MOUNTED 80 INCHES OFF THE FINISHED FLOOR TO THE BOTTOM OF THE STROBE, NOT NECESSARILY THE ELECTRICAL BOX.
34. ALL AUXILIARY RELAYS FOR FAN SHUTDOWN, DOOR RELEASE, DAMPER CONTROL, ELEVATOR CONTROL, ETC. SHALL BE WIRED A MAXIMUM OF 3 FT FROM THE CONTROLLED DEVICE. THE AUXILIARY RELAY SHALL FUNCTION WITHIN THE REQUIRED VOLTAGE AND CURRENT OF THE CONTROLLED DEVICE. SLAVE OR INTERPOSING RELAYS SHALL BE INCLUDED AND POWERED BY THE FIRE ALARM CONTROL PANEL IN A FAIL–SAFE (FIRE FUNCTION) POSITION. POWER TO THE INTERPOSING RELAY SHALL BE MONITORED BY THE FIRE ALARM SYSTEM.
35. OBTAIN APPROVAL OF PLANS BY THE FIRE DEPARTMENT PRIOR TO THE BEGINNING OF ANY WORK.
36. THE CONTRACTOR SHALL BE RESPONSIBLE FOR REMOVING ANY AND ALL ABANDONED FIRE ALARM CABINETS, DEVICES, AND WIRE. PAINT, PATCH AND CLEANUP SHALL ALSO BE INCLUDED.
37. PROVIDE AUDIBILITY LEVELS PER NFPA72.
38. COORDINATE WITH FIRE PROTECTION DRAWINGS FOR LOCATION AND CONNECTION OF POWER AND CONTROL TO THE EXISTING AND NEW TAMPER AND FLOW SWITCH DEVICES.
39. COORDINATE WITH MECHANICAL DRAWINGS FOR LOCATION AND CONNECTION OF POWER AND CONTROL TO THE EXISTING AND NEW FSD AND DUCT SMOKE DETECTOR DEVICES.
40. THE CONTRACTOR IS REQUIRED TO COORDINATE THE SCHEDULING OF ALL INSPECTIONS WITH THE NYC FIRE DEPARTMENT WITH:

    High RISE FIRE & SECURITY
    703 3RD AVE
    BROOKLYN, NY 11232

    IN ORDER TO OBTAIN THE FINAL FDNY LETTER OF APPROVAL AND SIGNOFF THE DOB APPLICATION AS PART OF THE SCOPE OF FIRE AND BUILDING CODE SERVICES, INC. AT EACH INSPECTION, A MINIMUM OF TWO FIRE ALARM TECHNICIANS WITH S97 OR S98 CERTIFICATIONS AND ONE ELECTRICIAN SHOULD BE PRESENT.
41. THE CONTRACTORS PRESENCE AT ALL OF THE OWNERS PRE–INSPECTIONS PRIOR TO THE FDNY INSPECTION AND ALL FDNY INSPECTIONS. A MINIMUM OF ONE ELECTRICAL CONTRACTOR AND TWO (2) FIRE ALARM TECHNICIANS SHALL BE PRESENT AT ALL INSPECTIONS.
42. THE CONTRACTOR IS RESPONSIBLE TO PREPARE AND PROVIDE THE AS–BUILT RISER PLAN AND THE APPLICANT OF RECORD IS PETER GERZAOUNIS WHO WILL BE SIGNING AND SEALING THE FUNCTIONALITY STATEMENT IN ACCORDANCE WITH THE REQUIREMENTS OF 3RCNY R105.01(C) (2) (A) (3) AND (4).

RISER NOTES:

1. ALL WIRING SHALL BE "TYPE FPLP NEW YORK CITY CERTIFIED FIRE ALARM CABLE" RATED, TEFLON OR EQUIVALENT.
2. ALL SPEAKERS WIRING TO BE TWISTED/SHIELDED PAIR # 16 AWG ON A & B CIRCUITS.
3. ALL STROBE WIRING TO BE TWISTED/SHIELDED PAIR 14 AWG ON A & B CIRCUITS.
4. ALL ADDRESSABLE LOOP WIRING/DATA SHALL BE 2 CONDUCTORS # 14 AWG, TWISTED/SHIELDED PAIR.
5. ALL MONITOR/CONTROL POINT WIRING TO BE 2 CONDUCTORS # 16 AWG.
6. ALL POWER WIRING TO BE # 10 GAUGE MINIMUM AND GROUND WIRE MINIMUM OF #10 AWG.
7. REMOTE ANNUNCIATOR DATA WIRING SHALL BE 3 PAIR TWISTED/SHIELDED CONDUCTORS # 14 AWG.
8. SPEAKER AND STROBE DEVICES ARE TO BE ON ALTERNATE A & B CIRCUIT ON EVERY FLOOR.
9. PROVIDE FIRE STOPPING MATERIALS FOR ALL FIRE RATED WALLS PENETRATION OF FIRE ALARM CABLES.
10. COORDINATE WITH HVAC FLOOR PLANS FOR EXACT QUANTITIES OF DEVICES, LOCATIONS AND DIMENSIONS OF HVAC DUCTS TAKE OFF'S AND SMOKE DETECTORS LOCATION.
11. PROVIDE DUCT SMOKE DETECTOR LOCATED IN RETURN DUCT AS SHOWN ON MECHANICAL DRAWINGS TO SHUTDOWN RESPECTIVE FAN SERVING THE FLOOR. COORDINATE WITH MECHANICAL FLOOR PLANS FOR EXACT LOCATION AND QUANTITIES OF DUCT SMOKE, SAMPLING TUBES, INCLUDING FIRE SMOKE DAMPERS LOCATIONS ON FLOOR PLANS.
12. THE ELECTRICAL CONTRACTOR SHALL COORDINATE WITH BUILDING FIRE ALARM MAINTENANCE CONTRACTOR, AFEC GUARDIAN FIRE PROTECTION,(516-605-0423, TOM@AFECINC.COM) FOR THE ELECTRICAL CONTRACTOR TO SUB-CONTRACT THE BASE BUILDING FIRE ALARM SYSTEM VENDOR TO PERFORM ALL MODIFICATIONS AND REPROGRAMMING OF BUILDING FIRE ALARM CONTROL PANELS AND TO PREPARE ALL FILING DOCUMENTS AND SHOP DRAWING SUBMISSIONS.



PARTIAL FIRE ALARM RISER

NOT TO SCALE

NEW YORK CITY BUILDING DEPARTMENT NOTE

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(NOTE IS APPLICABLE ONLY TO NYC DOB REVIEW PROCESS. CONTRACTOR MUST PROVIDE ALL WORK SHOWN ON PLAN)

NEW YORK CITY BUILDING DEPARTMENT APPROVAL NOTE

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NEW YORK CITY ENERGY CONSERVATION CODE

EXEMPTION WHEN COMPLIANCE WITH FIRE PROTECTION, DETECTION, ALARM AND/OR SUPPRESSION REQUIREMENTS OF TITLE 28 AND/OR THE 2014 NEW YORK CITY CONSTRUCTION CODES CONFLICTS WITH 2020 NYCECC COMPLIANCE, THE TITLE 28 AND/OR 2014 CONSTRUCTION CODES SAFETY PROVISIONS WILL TAKE PRECEDENCE OVER CONFLICTING PROVISIONS IN 2020 NYCECC.

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P 212.643.9055 www.mgedpc.net

BID SET 06/08/2022

rev. no.	date	revisions
-		-
-		-
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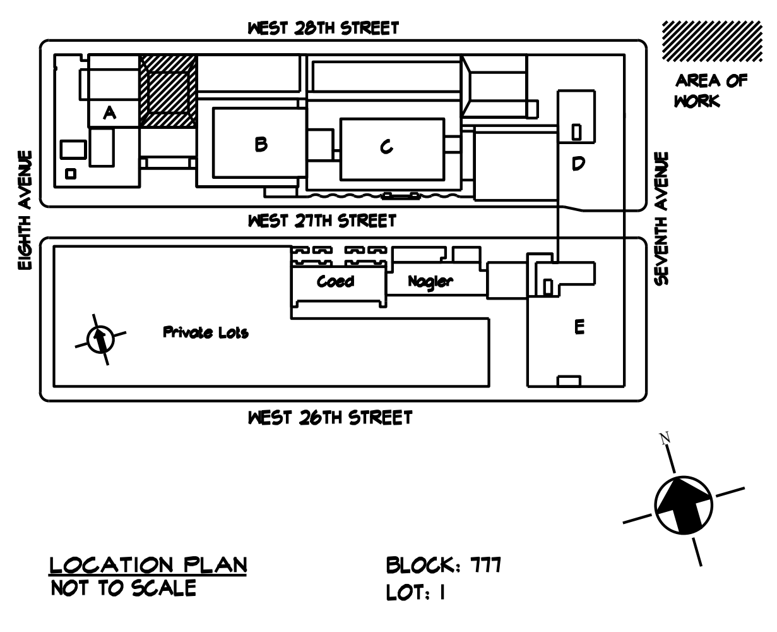
-		-
-	06/08/2022	ISSUED TO BID



LOCATION PLAN
NOT TO SCALE

BLOCK: 777
LOT: 1

Fashion Institute of Technology

340 8th Avenue
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

PROJECT:
WEST COURTYARD
340 8TH AVENUE
AC UNITS REPLACEMENT

DRAWING TITLE:
FIRE ALARM
SYMBOL LIST, ABBREVIATIONS,
RISER DIAGRAM & MATRIX

DOB NOW JOB •

SEAL & SIGNATURE:

DATE:	05/31/2022
PROJECT No:	8969.29
DRAWING BY:	KB
CHK BY:	KB
DWG No:	FA-001.00
SCALE: NONE	1 OF 4

SYMBOL LIST

SYMBOL	DESCRIPTION
	FIRE ALARM SYSTEM DEVICES
	FIRE ALARM SYSTEM SPEAKER
	FIRE ALARM SYSTEM SPEAKER/STROBE
	FIRE ALARM SYSTEM STROBE, WALL MOUNTED
	FIRE ALARM SYSTEM GONG, WALL MOUNTED
	FIRE ALARM SYSTEM MANUAL PULL STATION
(S)	FIRE ALARM SYSTEM SMOKE DETECTOR, "EL" – ELEVATOR
(S/)	FIRE ALARM SYSTEM COMBINATION SMOKE/CARBON MONOXIDE DETECTOR WITH SOUNDER BASE
$(S)_D$	FIRE ALARM SYSTEM SMOKE DETECTOR,
(H)	FIRE ALARM SYSTEM HEAT DETECTOR
WF	SPRINKLER ALARM SYSTEM WATER FLOW SWITCH AND MONITORING MODULE. PROVIDE WIRING BETWEEN MONITORED OR/AND MODULE.
TS	SPRINKLER ALARM SYSTEM TAMPER SWITCH AND MONITORING MODULE. PROVIDE WIRING BETWEEN MONITORED OR/AND MODULE.
CM	FIRE ALARM SYSTEM CONTROL AND MONITORING MODULE NOTE: ALL MODULES AND DUCT DETECTORS SHALL BE INSTALLED BELOW THE ROOF LINE OR INSTALLED IN WEATHERPROOF HEATED NEMA ENCLOSURES PAINTED RED AND PROPERLY LABLED.
FSD	MOTORIZED SMOKE OR COMBINATION FIRE/SMOKE DAMPER
FACP	FIRE ALARM CONTROL PANEL

ABBREVIATIONS

	DESCRIPTION
AFF	ABOVE FINISHED FLOOR
C	CONDUIT
DGP	DATA GATHERING PANEL
DWG	DRAWING
E	EXISTING
EC	EMPTY CONDUIT
ELEC	ELECTRICAL
ER	EXISTING TO RELOCATE
FA	FIRE ALARM
FACP	FIRE ALARM CONTROL PANEL
FCO	FUSED CUTOUT
NIC	NOT IN CONTRACT
R	REMOVE
RE	RELOCATED EXISTING DEVICE

INPUT/OUTPUT PROGRAMMING MATRIX

No.	SYSTEM INPUT INITIATING DEVICES	SYSTEM OUTPUT INDICATING CONTROLLED DEVICES: A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P
1	ACTIVATION OF A MANUAL STATION SHALL:	●	●	●	●	●	●										
2	ACTIVATION OF A WATER FLOW DEVICE SHALL:	●	●	●	●	●		●	●				●				
3	ACTIVATION OF AN AREA OR DUCT SMOKE DETECTOR SHALL:	●	●	●	●	●				●				●			
4	ACTIVATION OF AN ELEVATOR RELATED SMOKE DETECTOR SHALL:	●	●	●	●	●			●	●				●			
5	ACTIVATION OF HEAT DETECTOR IN ELEVATOR SHAFT OR ELEVATOR PIT SHALL:	●	●	●						●				●			●
6	ACTIVATION OF A TROUBLE SHALL:	●								●	●	●					
7	ACTIVATION OF A TAMPER SWITCH (SUPERVISORY) SHALL:	●								●					●	●	
8	ACTIVATION OF AUXILIARY SYSTEM (FM-200) IN EMR SHALL:						●										

SYSTEM OUTPUT INDICATING CONTROLLED DEVICES

A. ACTIVATE ALARM SIGNAL IN ALL ZONES
B. ACTIVATE ALARM SIGNAL IN ALARM ZONE AND ASSOCIATED ZONES
C. SEND ALARM SIGNAL TO CENTRAL STATION
D. ACTIVATE ALL ZONE ALARM SIGNALS EXCEPT ALARM ZONE
E. ACTIVATE ALARM SIGNAL IN ALARM ZONE ONLY
F. ACTIVATE ALL ZONE ALARM SIGNALS EXCEPT ASSOCIATED ZONES
G. SEND TROUBLE SIGNAL TO CENTRAL STATION
H. SEND SUPERVISORY SIGNAL TO CENTRAL STATION
I. SEND ALARM SIGNAL TO CENTRAL STATION
J. ACTIVATE ELEVATOR RECALL SMOKE DETECTOR
K. ACTIVATE ELEVATOR RECALL HEAT DETECTOR
L. ACTIVATE ELEVATOR RECALL MANUAL PULL STATION
M. SHUTDOWN ELEVATOR MACHINE SUPPLY BY ACTIVATING SMART TRIP
N. ACTIVATE DOOR RELEASE DEVICES
O. SEND TROUBLE SIGNAL TO CENTRAL STATION
P. SEND SUPERVISORY SIGNAL TO CENTRAL STATION

GENERAL NOTES

1. THE GENERAL NOTES APPLY TO ALL DRAWINGS UNDER THIS CONTRACT. REFER TO INDIVIDUAL DRAWINGS FOR ADDITIONAL NOTES.
2. DRAWINGS ARE DIAGRAMMATIC AND INDICATE GENERAL ARRANGEMENT OF SYSTEMS AND WORK. FOLLOW DRAWINGS IN LAYING OUT WORK. MAINTAIN HEADROOM AND SPACE CONDITIONS CONSISTENT WITH PROJECT CRITERIA.
3. JUNCTION AND PULL BOXES SHALL GENERALLY BE LOCATED FOR FLUSH MOUNTING IN FINISHED SPACES. WHERE NECESSARY, CONDUIT SHALL BE REROUTED OR OTHER ARRANGEMENTS SHALL BE MADE FOR CONCEALMENT. PULL BOXES SHALL BE PROVIDED AS INDICATED AND WHEREVER NECESSARY TO FACILITATE PULLING OF WIRE AND COORDINATE LOCATION WITH OTHER TRADES. COVERS OF JUNCTION AND PULL BOXES SHALL BE ACCESSIBLE.
4. ALL SUPPORTS TO BUILDING STRUCTURE SHALL BE SECURED AS NOTED IN THE SPECIFICATIONS. HORIZONTAL RUNS OF METALLIC CONDUIT SHALL BE SUPPORTED AT INTERVALS OF NOT MORE THAN 10 FEET APART. RACEWAY RISERS SHALL BE SUPPORTED AT EACH FLOOR LEVEL. EXPOSED RACEWAYS SHALL RUN PARALLEL WITH OR AT RIGHT ANGLES TO WALLS.
5. JUNCTION BOXES AND PULL BOXES SHALL BE SUPPORTED INDEPENDENTLY TO BUILDING STRUCTURE WITH NO WEIGHT BEARING ON CONDUIT.
6. NO RACEWAYS SHALL BE INSTALLED WITHIN 3 INCHES OF STEAM OR HOT WATER PIPES, OR APPLIANCES, EXCEPT FOR CROSSINGS WHERE RACEWAYS SHALL BE AT LEAST 1 INCH FROM PIPE COVER.
7. CONDUIT ENDS SHALL BE CUT SQUARE AND REAM SMOOTH. MALE THREADS OF FIELD THREADED CONDUIT SHALL BE PAINTED WITH GRAPHITE BASED PIPE COMPOUND AND DRAWN UP TIGHT WITH CONDUIT COUPLINGS.
8. WIRE COLOR CODING SHALL CONFORM TO CODE REQUIREMENTS.
9. IN UNFINISHED PORTIONS OF THE BUILDING, SUCH AS BOILER ROOM, FAN ROOMS, PIPE SPACES, ETC., LOCATIONS OF CONDUIT ARE APPROXIMATE AND SHALL CLEAR PIPING AND ALL OTHER CONSTRUCTION. CONDUITS IN THESE PORTIONS OF THE BUILDING SHALL BE RUN EXPOSED.
10. THE ELECTRICAL CONTRACTOR SHALL COORDINATE ALL CEILING WORK WITH AND DETERMINE CEILING TYPE PRIOR TO FURNISHING OF SMOKE DETECTORS, OR ANY OTHER CEILING MOUNTED ELECTRICAL ELEMENTS. ELECTRICAL WORK SHALL ALSO BE COORDINATED WITH LOCATION OF DIFFUSERS, SPRINKLERS AND OTHER MECHANICAL WORK.
11. ALL OUTLET BOXES RECEIVING 1–1/4" CONDUIT SHALL BE A MINIMUM OF 2–1/2"DEEP.
12. SUFFICIENTLY LONG WIRE SLACK SHALL BE LEFT IN RUNS TO PERMIT MAKING PROPER FINAL CONNECTIONS. ALL EMPTY CONDUIT SHALL BE PROVIDED WITH #12 AWG STEEL DRAG WIRE.
13. ALL WIRING, POWER, CONDUCTORS, CONDUITS ETC. SHALL MEET THE NYC ELECTRICAL CODE.
14. ALL WORK SHALL BE IN ACCORDANCE WITH THE NYS BUILDING CODE AND NFPA 72.
15. ALL FIRE ALARM EQUIPMENT SHALL BE APPROVED (MEA, BSA OR COA APPROVED).
16. ALL FIRE ALARM CIRCUITS SHALL BE SIZED TO A MAXIMUM OF 80% OF CAPACITY.
17. ALL FIRE ALARM CIRCUITS SHALL BE WIRED NFPA STYLE 4/Y/B (CLASS B) WITH THE EXCEPTION OF THE NETWORK CIRCUIT WHICH SHALL BE NFPA STYLE 7 (CLASS A WITH ISOLATION). DUAL CLASS B NETWORKING IS NOT STYLE 7 AND WILL NOT BE APPROVED. ALL AUDIBLE AND VISUAL CIRCUITS SHALL BE STYLE Y/CLASS B AND SPLIT A/B. SPLIT A/B CIRCUITS SHALL BE WIRED SO THAT EVERY OTHER DEVICE IS WIRED ON AN ALTERNATE CIRCUIT.
18. CONDUITS MAY NOT ENTER THE TOP OF ANY FIRE ALARM EQUIPMENT CABINET.
19. ALL FIRE ALARM EQUIPMENT SHALL BE INSTALLED WITH AESTHETICS IN MIND. CABINETS SHALL BE SEMI FLUSH MOUNTED AND CABLE TRAYS SHALL BE HIDDEN.
20. ALL FIRE ALARM WIRE SHALL BE CLEARLY LABELED IN JUNCTION BOXES AND CABINETS. ALL TERMINALS SHALL BE NUMBERED AND LABELED. ALL CONNECTIONS SHALL BE EITHER SOLDERED, 70DBA APPROVED TERMINAL STRIPS OR SCOTCH LOCKS.
21. ALL LOW VOLTAGE FIRE ALARM CONDUCTORS SHALL BE PROTECTED BY EITHER BUILDING CONSTRUCTION OR CONDUIT TO 8 FEET ABOVE THE FINISHED FLOOR. LOADING DOCKS, GARAGES, SUPPRESSION AND EXTINGUISHING SYSTEM WIRING, MECHANICAL AND ELECTRICAL ROOMS AND OTHER LOCATIONS SUBJECT TO MECHANICAL DAMAGE SHALL BE IN FULL RIGID CONDUIT. IN ALL OTHER AREAS APPROVED WIRE MAY BE RUN WITHOUT CONDUIT ABOVE 8 FT.
ALL WIRING INSTALLATION EXPOSED IN FINISHED AREAS SHALL BE AS FOLLOWS:
A) ON WALLS – IN SINGLE PIECE 1/2" SURFACE MOUNTED STEEL RACEWAY.
B) WHERE CEILING IS NOT ACCESSIBLE – IN SINGLE PIECE SURFACE MOUNTED STEEL RACEWAY.
22. FIRE ALARM CABLES SHALL NOT BE MIXED WITH NON FIRE ALARM CABLING. LOW VOLTAGE FIRE ALARM CABLING SHALL NOT BE MIXED OR WIRED NEAR ANY AC CIRCUIT
23. ALL LOW VOLTAGE WIRING SHALL BE FPLP 150 DEGREE C. ALL NOTIFICATION CIRCUITS SHALL BE A MINIMUM OF 14 AWG AND ALL OTHER LOW VOLTAGE FIRE ALARM CIRCUITS SHALL BE 16 AWG MINIMUM.
24. VERTICAL RISER CABLE FOR ALL SYSTEMS SHALL BE INSTALLED IN A 2 HOUR RATED SHAFT.
25. POLARITY SHALL BE OBSERVED ON ALL CIRCUITS. T–TAPPING SHALL NOT BE ALLOWED ON ANY NOTIFICATION CIRCUITS (HORN, STROBE OR SPEAKER). T–TAPPING SHALL NOT BE PERMITTED ON ADDRESSABLE CIRCUITS.
26. ALL WIRING SHALL BE INSPECTED TO ASSURE THERE ARE NO OPENS, SHORTS OR EARTH GROUNDS.
27. SHIELDED CONDUCTORS OR RUNNING IN SEPARATE RACEWAY SHALL BE AS INSTRUCTED BY THE FIRE ALARM MANUFACTURER'S DOCUMENTATION. ALL NON–POWER LIMITED WIRING SHALL BE RUN IN A SEPARATE RACEWAY.
28. ALL AREA OR DUCT SMOKE DETECTORS SHALL BE PHOTO–ELECTRIC TYPE.
29. SMOKE DETECTORS MUST BE MOUNTED AT LEAST 3 FT AWAY FROM ANY AIR REGISTER.
30. DEVICE LOCATIONS MUST BE READILY ACCESSIBLE TO ALLOW FOR MAINTENANCE AND REPAIR.
31. DUCT MOUNTED SMOKE DETECTORS SHALL BE MOUNTED ON THE DUCTWORK IN STRICT ACCORDANCE WITH THE MANUFACTURERS INSTRUCTIONS. ALL DUCT DETECTORS SHALL BE PROVIDED WITH A REMOTE LED IN AN OBSERVABLE AREA. EACH LED STATION TO BE LABEL PER UNIT AND DEVICE MONITORY.
32. ALL STROBE LIGHTS SHALL BE UL–1971 APPROVED/LISTED. THE MINIMUM CANDELA IS 75 UNLESS OTHERWISE NOTED.
33. NOTIFICATION DEVICES THAT INCLUDE A STROBE SHALL BE MOUNTED 80 INCHES OFF THE FINISHED FLOOR TO THE BOTTOM OF THE STROBE, NOT NECESSARILY THE ELECTRICAL BOX.
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35. OBTAIN APPROVAL OF PLANS BY THE FIRE DEPARTMENT PRIOR TO THE BEGINNING OF ANY WORK.
36. THE CONTRACTOR SHALL BE RESPONSIBLE FOR REMOVING ANY AND ALL ABANDONED FIRE ALARM CABINETS, DEVICES, AND WIRE. PAINT, PATCH AND CLEANUP SHALL ALSO BE INCLUDED.
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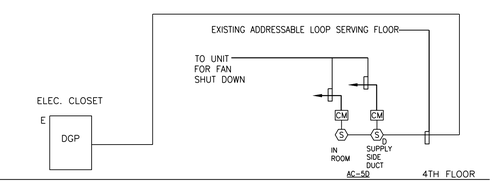

PARTIAL FIRE ALARM RISER
NOT TO SCALE

RISER NOTES:

1. ALL WIRING SHALL BE "TYPE FPLP NEW YORK CITY CERTIFIED FIRE ALARM CABLE" RATED, TEFLON OR EQUIVALENT.
2. ALL SPEAKERS WIRING TO BE TWISTED/SHIELDED PAIR # 16 AWG ON A & B CIRCUITS.
3. ALL STROBE WIRING TO BE TWISTED/SHIELDED PAIR 14 AWG ON A & B CIRCUITS.
4. ALL ADDRESSABLE LOOP WIRING/DATA SHALL BE 2 CONDUCTORS # 14 AWG, TWISTED/SHIELDED PAIR.
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6. ALL POWER WIRING TO BE # 10 GAUGE MINIMUM AND GROUND WIRE MINIMUM OF #10 AWG.
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9. PROVIDE FIRE STOPPING MATERIALS FOR ALL FIRE RATED WALLS PENETRATION OF FIRE ALARM CABLES.
10. COORDINATE WITH HVAC FLOOR PLANS FOR EXACT QUANTITIES OF DEVICES, LOCATIONS AND DIMENSIONS OF HVAC DUCTS TAKE OFF'S AND SMOKE DETECTORS LOCATION.
11. PROVIDE DUCT SMOKE DETECTOR LOCATED IN RETURN DUCT AS SHOWN ON MECHANICAL DRAWINGS TO SHUTDOWN RESPECTIVE FAN SERVING THE FLOOR. COORDINATE WITH MECHANICAL FLOOR PLANS FOR EXACT LOCATION AND QUANTITIES OF DUCT SMOKE, SAMPLING TUBES, INCLUDING FIRE SMOKE DAMPERS LOCATIONS ON FLOOR PLANS.
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NEW YORK CITY ENERGY CONSERVATION CODE

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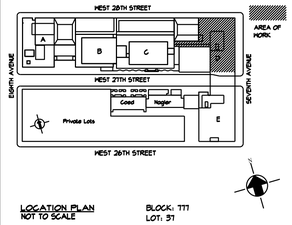
BID SET 06/08/2022

K&L Group
A Division of MG Engineering D.P.C.
healthcare / institutional / higher education

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

rev. no.	date	revisions
	06/08/2022	ISSUED TO BID



LOCATION PLAN
NOT TO SCALE

BLOCK: 777
LOT: 37

Fashion Institute of Technology

300 7th Avenue
New York, NY 10001

MEP Consultants

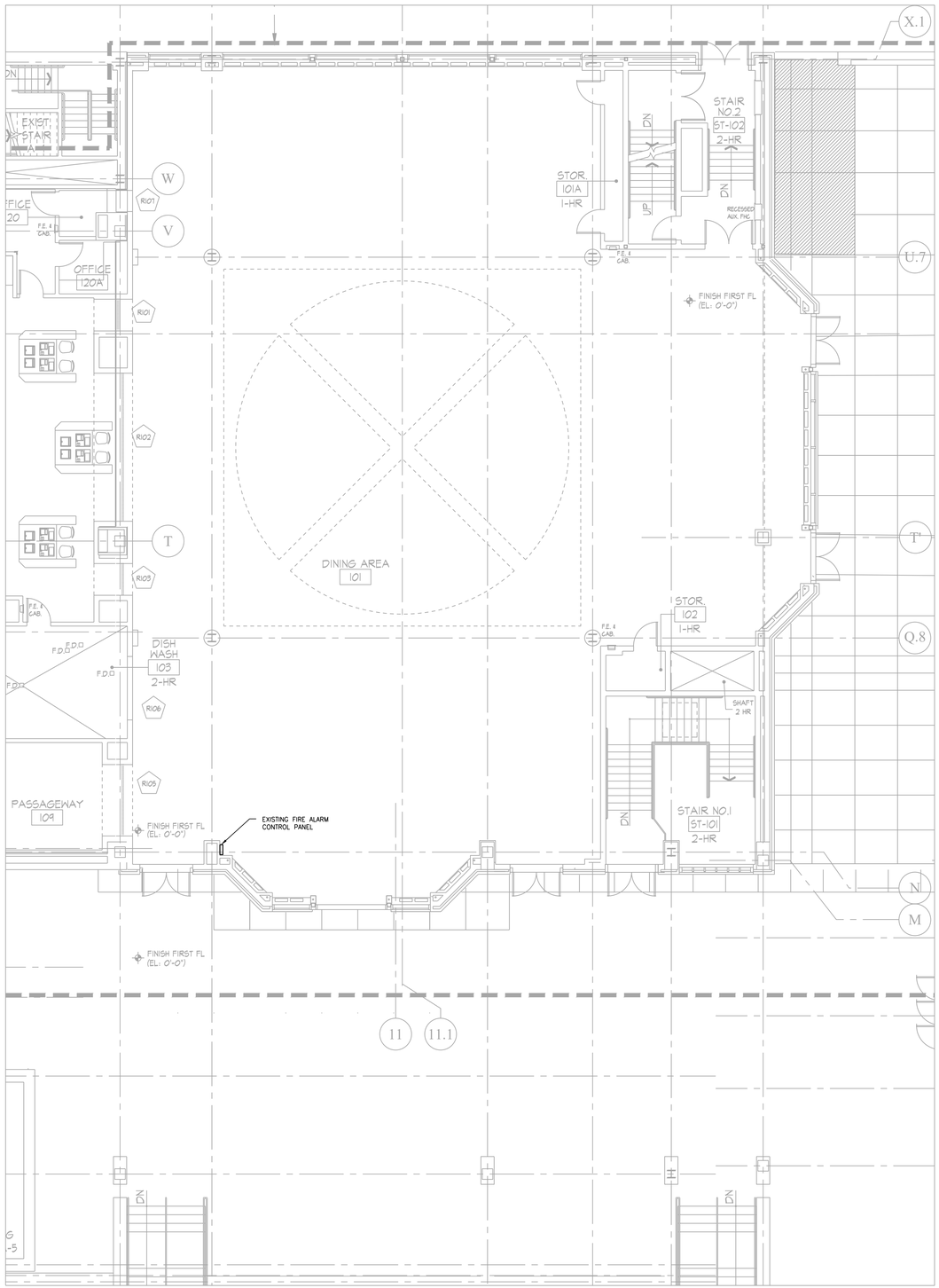
MGE
MG Engineering D.P.C. / we engineer success
116 West 32nd Street, 12th Floor, New York, N.Y. 10001
P.212.643.9055 www.mgedpc.net

PROJECT:
POMERANTZ CENTER
300 7TH AVENUE
AC UNIT REPLACEMENT

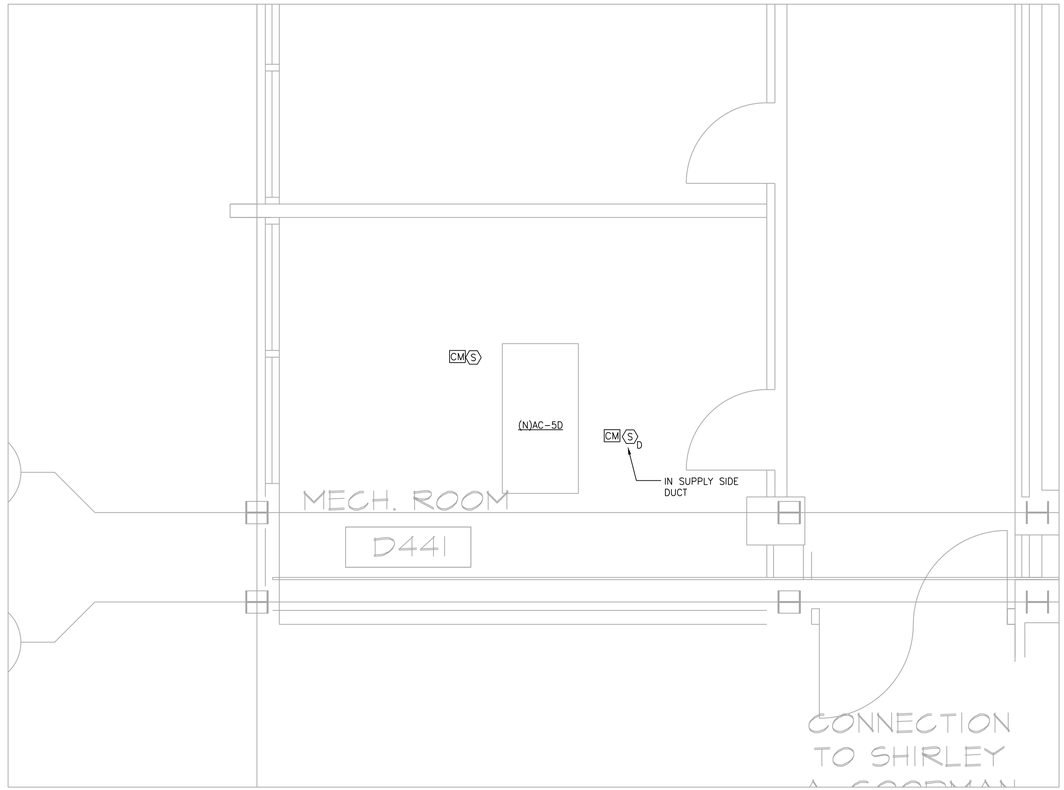
DRAWING TITLE:
FIRE ALARM
SYMBOL LIST, ABBREVIATIONS,
RISER DIAGRAM & MATRIX

SEAL & SIGNATURE:

DATE:	05/31/2022
PROJECT No:	8969.29
DRAWING BY:	KB
CHK BY:	KB
DWG No:	FA-002.00
SCALE: AS NOTED	2 OF 4



①PARTIAL FIRST FLOOR FIRE ALARM PLAN
1/8" = 1'-0"



②PARTIAL 4TH FLOOR FIRE ALARM PLAN
3/8" = 1'-0"

BID SET 06/08/2022

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(NOTE IS APPLICABLE ONLY TO NYC DOB REVIEW PROCESS. CONTRACTOR MUST PROVIDE ALL WORK SHOWN ON PLAN)

NEW YORK CITY BUILDING DEPARTMENT APPROVAL NOTE

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.

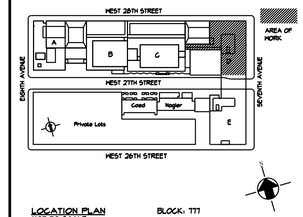
NEW YORK CITY ENERGY CONSERVATION CODE

EXEMPTION WHEN COMPLIANCE WITH FIRE PROTECTION, DETECTION, ALARM AND/OR SUPPRESSION REQUIREMENTS OF TITLE 28 AND/OR THE 2014 NEW YORK CITY CONSTRUCTION CODES CONFLICTS WITH 2020 NYCECC COMPLIANCE, THE TITLE 28 AND/OR 2014 CONSTRUCTION CODES SAFETY PROVISIONS WILL TAKE PRECEDENCE OVER CONFLICTING PROVISIONS IN 2020 NYCECC.

K&L Group
A Division of MG Engineering D.P.C.
healthcare / institutional / higher education

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

rev. no.	date	revisions
	06/08/2022	ISSUED TO BID



LOCATION PLAN
NOT TO SCALE

BLOCK: 777
LOT: 37

Fashion Institute of Technology

300 7th Avenue
New York, NY 10001

MEP Consultants

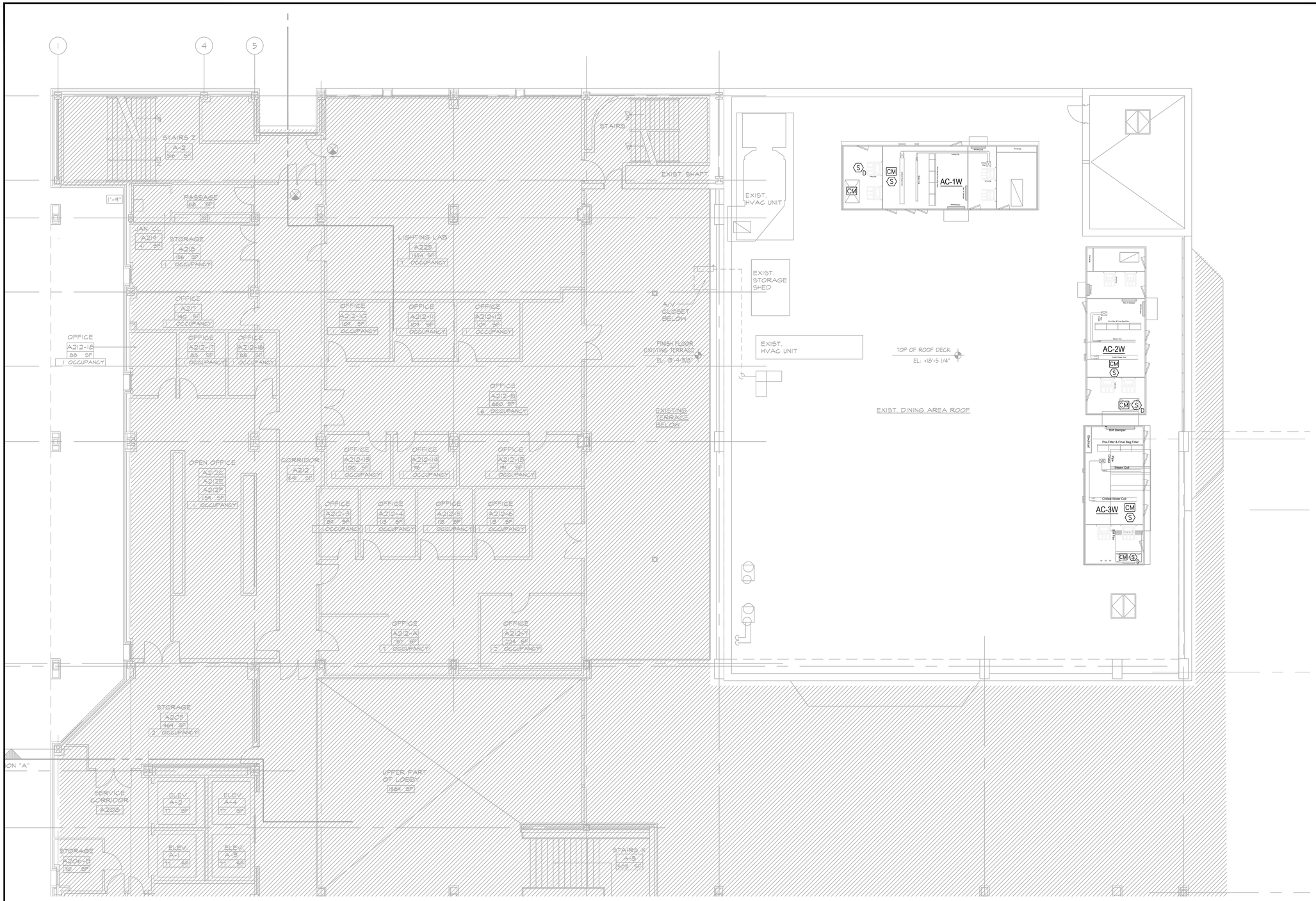
MGE
MG Engineering D.P.C. / we engineer success
116 West 32nd Street, 12th Floor, New York, N.Y. 10001
P.212.643.9055 www.mgedpc.net

PROJECT:
POMERANTZ CENTER
300 7TH AVENUE
AC UNIT REPLACEMENT

DRAWING TITLE:
FIRE ALARM
FIRST AND FOURTH FLOOR
PART PLANS

SEAL & SIGNATURE:

DATE:	05/31/2022
PROJECT No:	8969.29
DRAWING BY:	KB
CHK BY:	KB
DWG No:	FA-100.00
SCALE: AS NOTED	3 OF 4



③ PARTIAL ROOF FIRE ALARM PLAN

1/8" = 1'-0"

BID SET 06/08/2022

NEW YORK CITY BUILDING DEPARTMENT NOTE

THIS PLAN IS FOR ECC SCOPE AND APPROVAL ONLY.

(NOTE IS APPLICABLE ONLY TO NYC DOB REVIEW PROCESS. CONTRACTOR MUST PROVIDE ALL WORK SHOWN ON PLAN)

NEW YORK CITY BUILDING DEPARTMENT APPROVAL NOTE

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NEW YORK CITY ENERGY CONSERVATION CODE

EXEMPTION WHEN COMPLIANCE WITH FIRE PROTECTION, DETECTION, ALARM AND/OR SUPPRESSION REQUIREMENTS OF TITLE 28 AND/OR THE 2014 NEW YORK CITY CONSTRUCTION CODES CONFLICTS WITH 2020 NYCECC COMPLIANCE, THE TITLE 28 AND/OR 2014 CONSTRUCTION CODES SAFETY PROVISIONS WILL TAKE PRECEDENCE OVER CONFLICTING PROVISIONS IN 2020 NYCECC.

K&L Group
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116 West 32nd Street, 12th Floor, New York, N.Y. 10001
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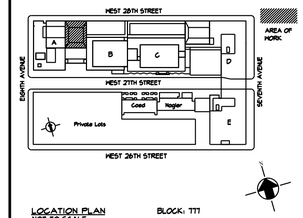
rev. no.	date	revisions
	06/08/2022	ISSUED TO BID



LOCATION PLAN
NOT TO SCALE

BLOCK: 777
LOT: 1

Fashion Institute of Technology

340 8th Avenue
New York, NY 10001

MEP Consultants

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

PROJECT:
WEST COURTYARD
340 8TH AVENUE
AC UNITS REPLACEMENT

DRAWING TITLE:
FIRE ALARM
ROOF
PART PLAN

DOB NOW JOB •

SEAL & SIGNATURE:

DATE:	05/31/2022
PROJECT No:	8969.29
DRAWING BY:	KB
CHK BY:	KB
DWG No:	FA-101.00
SCALE: 1/8"=1'	4 OF 4

EXHIBIT E: EXECUTIVE ORDER 202.16

NEW YORK STATE OF OPPORTUNITY. Department of Health

ANDREW M. CUOMO
Governor

HOWARD A. ZUCKER, M.D., J.D.
Commissioner

SALLY DRESLIN, M.S., R.N.
Executive Deputy Commissioner

Interim Guidance on Executive Order 202.16 Requiring Face Coverings for Public and Private Employees Interacting with the Public During the COVID-19 Outbreak

April 14, 2020

Background:

In December 2019, a new respiratory disease called the novel coronavirus (COVID-19) was detected. COVID-19 is caused by a virus (SARS-CoV-2) that is part of a large family of viruses called coronaviruses. Recently, community-wide transmission of COVID-19 has occurred in the United States, including New York where the number of both confirmed and suspected cases is increasing. To reduce the community-wide transmission of COVID-19, Governor Andrew M. Cuomo has taken aggressive action through Executive Order 202, as amended, to combat the spread of this infectious disease, reducing the density of people in areas of common congregation by closing the in-person operations of non-essential businesses and prohibiting all non-essential gatherings of individuals of any size for any reason.

Executive Order:

Executive Order 202.16, issued on April 12, 2020, provides the following directive:

> *For all essential businesses or entities, any employees who are present in the workplace shall be provided and shall wear face coverings when in direct contact with customers or members of the public. Businesses must provide, at their expense, such face coverings for their employees. This provision may be enforced by local governments or local law enforcement as if it were an order pursuant to section 12 or 12-b of the Public Health Law. This requirement shall be effective Wednesday, April 15 at 8 p.m.*

Guidance:

Essential businesses, as well as state and local government agencies and authorities, must procure, fashion, or otherwise obtain face coverings and provide such coverings to employees who directly interact with the public during the course of their work at no-cost to the employee.

- Businesses are deemed essential by the Empire State Development Corporation (ESD), pursuant to the authority provided in Executive Order 202.6. Please visit the ESD website for specific information on essential businesses. For the purpose of this guidance, essential businesses shall also provide face coverings to contractors, including independent contractors.

- Face coverings include, but are not limited to, cloth (e.g. homemade sewn, quick cut, bandana), surgical masks, N-95 respirators, and face shields. Please visit the Centers for Disease Control and Prevention's "Coronavirus Disease 2019 (COVID-19)" website for information on cloth face covers and other types of personal protective equipment (PPE), as well as instructions on use and cleaning.

- Direct interaction with the public shall be determined by the employer, but, at a minimum, shall include any employee who is routinely within close contact (i.e. six feet or less) with members of the public, including but not limited to customers or clients.

- Employees are allowed to use their own face coverings, but shall not be mandated to do so by their employer. *Further, this guidance shall not prevent employees from wearing more protective coverings (e.g. surgical masks, N-95 respirators, or face shields) if the individual is already in possession of such PPE, or if the employer otherwise requires employees to wear more protective PPE due to the nature of their work (e.g. healthcare).*

- Employees are required to wear face coverings when in direct contact with members of the public, except where doing so would inhibit or otherwise impair the employee's health. *Employers are prohibited from requesting or requiring medical or other documentation from an employee who declines to wear a face covering due to a medical or other health condition that prevents such usage.*

- Employees who are unable to wear face coverings and are susceptible to COVID-19 based on the "Matilda's Law" criteria (i.e. individuals who are 70 years of age or older, individuals with compromised immune systems, and individuals with underlying illnesses) should consult with their employer to consider reasonable accommodations, including but not limited to different PPE, alternate work location, or alternate work assignment with fewer interactions with the public. Employers should work with their employees to see if they can be accommodated to ensure the employee can continue to deliver essential services in the safest manner possible.

- If an employer is unable to procure, fashion, or otherwise obtain face coverings for their employees, they may consult with their local office of emergency management to determine if extra supplies exist within the municipality for this purpose and, if so, they may submit a request for face coverings. Please note that quantites are extremely limited and are prioritized for health care workers and first responders. *Not being able to source face coverings does not relieve an employer's obligation to provide such face coverings to their employees.*

- Nothing in this guidance shall supercede the respiratory protection equipment requirements set forth by the United States Department of Labor's Occupational Safety and Health Administration (OSHA).

Additional Information:
New York State Coronavirus (COVID-19) Website
https://coronavirus.health.ny.gov/

United States Centers for Disease Control and Prevention Coronavirus (COVID-19) Website
https://www.cdc.gov/coronavirus/2019-ncov/index.html

Name of Contractor: _____

Signature: _____ Date: _____

EXHIBIT F: COVID-19 CONTRACTOR GUIDANCE FOR JOBSITES

COVID-19 CONTRACTOR GUIDANCE FOR JOBSITES

In response to the public health emergency for the COVID-19, Governor Andrew Cuomo has declared a State disaster emergency and temporarily suspended or modified laws that would prevent, hinder, or delay action necessary to cope with the disaster or emergency. The Governor has also issued directives to allow for the expansion of certain services including those relating to emergency procurement, and to facilitate the continued work of essential businesses subject to compliance with mandatory directives for safety best practices and social distancing The purpose of this guidance is to set forth the recommended best practices and social distancing requirements for contractors performing work at State University of New York construction sites in the context of the COVID-19 health crisis.

Contractor Responsibilities

Under your contract with the Campus,

- Contractors and their subcontractors are required at all times to guard the safety and health of all persons on and in the vicinity of the work site
- Contractors and their subcontractors are required to comply with all applicable rules, regulations, codes, and bulletins of the New York State Department of Labor and the standards imposed under the Federal Occupational Safety and Health Act of 1970, as amended ("OSHA")
- Contractors and their subcontractors are also required to comply with all contract safety requirements
- Contractors and their subcontractors must comply with all City or State of New York safety requirements for projects within the City or State of New York constructed in accordance with the applicable building code, and contractors are required to provide written safety plans for the site showing how all safety requirements of applicable law will be implemented for the duration of the contract.

Contractors and their subcontractors must also adhere to the following practices to help prevent exposure and spread of COVID-19. The following recommendations are based on what is currently known about COVID-19. Contractors and their subcontractors are advised to stay current and immediately implement the most up-to-date practices to protect the safety and health of your employees, clients, and the general public.

General Responsibilities:

- Contractors and their subcontractors should educate their employees on the symptoms of COVID-19, which include cough, fever, trouble breathing, and pneumonia. Contractors and their subcontractors must instruct any employee who feels they may have any of the

above symptoms to refrain from reporting to the jobsite and immediately contact their health care provider and the local health department in the county in which they reside. Contact information for local health departments can be found at www.health.ny.gov.

- If the employee begins to exhibit these symptoms while in the workplace, steps should be taken to remove the individual from the workplace. Using safe social distancing practices, provide the employee with a surgical mask and instruct them to put it on, self-transport themselves home, and to contact their health care provider and inform the local health department. The Contractor must notify the contracting agency/authority.
- Personnel should be advised to self-quarantine in accordance with the requirements of the New York State and local health department. Contracting agencies/authorities reserve the right to require any employee of the Contractor, and their subcontractors exhibiting symptoms, to be removed from the jobsite
- If an employee is confirmed to have COVID-19 infection, contractors and their subcontractors should inform fellow employees, who have been in contact with this employee, of their possible exposure to COVID-19 in the workplace while maintaining confidentiality as required by applicable New York State and federal law. The fellow employees should then self-monitor for symptoms (i.e., cough, fever, trouble breathing, and pneumonia) and self-quarantine in accordance with the requirements of the New York State and local health department
- If an employee tests positive for COVID-19, Contractors and their subcontractors should direct the employee to self-quarantine and remain quarantined for 14 days, following the guidance of New York State and local health department
    - Contractors and their subcontractors may permit such employee to return to the jobsite when this employee produces a negative COVID-19 test or receives medical clearance to return to work
- If an employee tests negative for COVID-19, contractors and their subcontractors may direct the employee to return to work after recovery from their illness. Any direct contacts on pre-cautionary quarantine may return to the jobsite and resume their work activities.

Social Distancing:

- Do not host large group meetings or congregate in large groups. When meetings are necessary, maintain a distance of 6-feet between people.
- Perform any tool box or other training maintaining the distance of 6-feet between people.
- Perform meetings online or via conference call whenever possible
- Only essential personnel should be permitted on the jobsite
- Discourage handshaking and other contact greetings

General Jobsite Practices

- Procedures and supplies should be in place to encourage proper hand and respiratory hygiene.
    - Hand hygiene:
      Signage with handwashing procedures should be posted in prominent locations promoting hand hygiene
        - Regular handwashing with soap and water for at least 20 seconds should be done:
            - Before and after eating
            - After sneezing, coughing, or nose blowing
            - After using the restroom
            - Before handling food
            - After touching or cleaning surfaces that may be contaminated
            - After using shared equipment and supplies; and also
            - Whenever a contractor or subcontractor believes it is necessary
        - If soap and water are not available, use an alcohol-based hand sanitizer that contains at least 60% alcohol
    - Respiratory Hygiene:
        - Covering coughs and sneezes with tissues or the corner of elbow
        - Disposing of soiled tissues immediately after use
        - Where possible, have disposable masks available to cover an employee's mouth and nose if they develop symptoms on the job to protect others from exposure.
- Practice routine environmental cleaning and disinfecting of all frequently touched surfaces on the jobsite. This includes work stations, project trailers and offices, portable toilets, countertops, handles, doorknobs, gang boxes, tools and equipment. See OSHA Guidance on Preparing Workplaces for COVID-19. www.osha.gov/Publications/OSHA3990.pdf
- Appropriate cleaning agents and directions should be utilized to perform all cleaning. Ensure all workers are trained on the hazards of cleaning chemicals used in the workplace and comply with all OSHA requirements regarding same in accordance with the Hazard Communication (Global Harmonization) Standard. Information about https://coronavirus.health.ny.gov/home
- Do not use a common water bottle
- If using a common water cooler clean dispenser knob after use
- Do not share tools
- Utilize personal protection equipment (PPE) for the job being performed
- Sanitize reusable PPE per manufacturer's recommendation prior to each use
- Do not share PPE
- Ensure used PPE and other trash is disposed of properly

- Utilize disposable gloves where appropriate and instruct workers to wash hands after removing gloves
- Disinfect reusable supplies and equipment
- Don't stack trades, if possible
- Stagger work schedules to minimize the number of people on a job site at any one time.
- Keep one contractor or subcontractor in an area at a time. Indicate an area is occupied with workers with a sign or flag indicating which contractor or subcontractor is in the area at that time. Remove the sign or flag after completion of work in that area to let others know they may then enter into that area to perform their work. The next contractor or subcontractor will then post their sign or flag to notify others that the area is occupied.
- Minimize the number of workers in an area as much as possible by using indicators of an occupied area (signs or flags) scheduling work activities to stagger those required to be in any one time to a minimal number of workers.
- Minimize entryways into a work area so that employees will be able to observe flagging practices described above. Do not reduce the number of emergency exits.
- Avoid cleaning techniques, such as pressurized air or water sprays that may result in generation of bioaerosols

The Campus may request an updated written safety plan for the site to address practices to help prevent exposure and spread of COVID-19 at the jobsite pursuant to New York State, OSHA recommendations and Centers for Disease Control requirements, which include:

- Assessment of potential worker exposure hazards, taking into account the specific recommendations and controls for the four levels of worker exposure risk identified in OSHA's Guidance on Preparing Workplaces for COVID-19 (i.e., very high, high, medium, and lower)
- Evaluation of exposure to risk;
- Selecting, implementing, and ensuring the use of controls (i.e., social distancing appropriate personal protective equipment, hygiene, and cleaning supplies);
- Minimizing the number of workers in an area as much as possible by using indicators of an occupied area (signs or flags) and scheduling work activities to stagger those required to be in any one area to a minimal number of workers.
- Minimize entryways into a work area so that employees will be able to observe flagging practices described above. Do not reduce number of emergency exits; and
- Additional criteria consistent with health and safety practices at the work site.

Project Closure:

- Where work is suspended on a project, contractors are directed to follow any additional project shut-down protocols as provided by the campus.

For additional resources:

OSHA COVID-19 Resources

OSHA Guidance on Preparing Workplaces for COVID-19

DOL COVID-19 Resources

Interim Guidance for Business and Employers

Centers for Disease Control -- https://www.cdc.gov/coronavirus/2019-ncov/index.html

Name of Contractor: _____

Signature: _____ Date: _____

EXHIBIT G: INTERIM GUIDANCE LETTER TO CONTRACTORS

(date)

Project No.
Contract No.
Project Title
Campus

(Contractor address)

Subject: REQUIRED NYS DOH GUIDANCE – COVID-19

Attachment:
1. Interim Guidance for Construction Activities During the COVID-19 Public Health Emergency
2. NYS DOH Safety Plan Template

Dear Contractor,

Please be advised the NYS Department of Health (NYS DOH) issued an "Interim Guidance for Construction Activities During the COVID-19 Public Health Emergency" (Guidance) on May 13th, 2020, which sets forth the minimum requirements applying to all construction entities to help protect against the spread of COVID-19. The Guidance requires all such entities to acknowledge and affirm compliance with the Guidance (Business Affirmation). It also mandates employers to continuously check for updates to the Guidance and take such actions to comply with the updated Guidance. The Guidance supersedes any best practices document previously provided by the State University of New York ("University").

Once your company has reviewed the Guidance, the Business Affirmation can be submitted online at the following website: https://forward.ny.gov/. Under Phase 1 Construction click "Read and Affirm Detailed Guidelines". The attached documents are both available online at the website provided.

Also attached is a NYS DOH Safety Plan Template. Each construction entity employer is required to develop, implement and post a COVID-19 safety plan pursuant to the Guidance. Additionally, the Guidance requires the designation of a safety monitor to implement COVID-19 safety obligations for your company.

The University requires an authorized representative of your company sign and return a copy of this document to the undersigned affirming compliance with the Guidance requirements.

Regards,

Insert Name
Insert Title

Cc: Insert appropriate campus representatives (Business Officer, Project Manager, Other)
Cc: Insert

Contractor Name
Contractor Address

The undersigned authorized representative of _____ hereby affirms that it has submitted the necessary Business Affirmation to NYS; has updated its safety plan to meet the COVID-19 minimum requirements of the Guidance; will check on a regular basis for updates to the Guidance; and will provide the University with the name of its COVID-19 safety monitor and other information requested by the University.

Signature: _____

Print Name and Title: _____

Date: _____

EXHIBIT H. FIT NO DAMAGES FOR DELAY CLAUSE

TO: CONTRACTOR'S NAME

FROM: Fashion Institute of Technology

Project Name: _____

Date: _____

Subject: No Damages for Delay Acknowledgment

In the event the Contractor's performance under this agreement is delayed or interfered with arising out of or connected to the COVID19 pandemic, including but not limited to worker availability, government-mandated suspension of work or any other emergency action associated with protecting the health and safety of the workforce, which leads to a site closure, delay or suspension of the work, Contractor or any subcontractors hereby acknowledge their only remedy under this agreement is to request an extension of time for the performance of the unfinished work as herein provided; under no circumstances will Contractor or any subcontractors or vendors be entitled to any increase in the subcontract price or additional compensation for any alleged costs, expenses or damages as a consequence of such delays or interference, including but not limited to: i) General Condition Costs (e.g.: site clean-up, home and field office expenses, telecommunications equipment or use , and/or supervisory costs including but not limited to Project Manager, Project Engineer, Superintendent and Foremen, etc.), ii) escalation (increases in material costs, transportation charges or any alleged wage or salary increases) or iii) any alleged inefficiencies or loss of productivity. NOTE: The above examples are not intended to be an exhaustive list of all the alleged costs, expenses or damages excluded by this clause. It is offered only as an example of some costs within each category.

Owner shall review the Contractors request for delay and, if acceptable, shall extend the time of performance by Change Order for such reasonable time as the Owner, in its sole discretion, may determine.

By signing below, Contractor acknowledges receipt and acceptance of the terms and conditions herein

FASHION INSTITUTE OF TECNNOLOGY	CONTRACTOR'S NAME
By: _____	By: _____
Title: _____	Title: _____